SECOND QUARTER 2018 ANNUAL
GROUNDWATER MONITORING AND PAH SAMPLING REPORT

SHELL BRANDED WHOLESALE FACILITY
4409 LAKE OTIS PARKWAY
ANCHORAGE, ALASKA

SAP #: 121262
PLANET ID #: 10071287
AGENCY #: 2100.38.542

GES PROJECT #: 3016007

Prepared for:

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June 1, 2018

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ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per Liter
Bgs	Below ground surface
CRA	Conestoga-Rovers & Associates
DEC	Alaska Department of Environmental Conservation
DRO	Diesel Range Organics
EPA	United States Environmental Protection Agency
ESC	ESC Lab Sciences
GAC	Granular Activated Carbon
GES	Groundwater & Environmental Services, Inc.
GRO	Gasoline Range Organics
LCS	Laboratory Control Spike
LCSD	Laboratory Control Spike Duplicate
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PAH	Polycyclic Aromatic Hydrocarbon(s)
PQL	Practical Quantitation Limit
RL	Laboratory Reporting Limit
RPD	Relative Percent Difference
RRO	Residual Range Organics
SOPs	Standard Operating Procedures
SOPUS	Shell Oil Products US
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

Groundwater & Environmental Services, Inc. (GES) is pleased to present this Second Quarter 2018 Annual Groundwater Monitoring Report to the Alaska Department of Environmental Conservation (DEC) on behalf of Shell Oil Products US (SOPUS) summarizing the April 2018 groundwater monitoring and sampling event at Lake Otis Parkway Right-of-Way, north of the East Tudor Road intersection, related to the former service station at 4409 Lake Otis Parkway, Anchorage, Alaska (Figure 1). The site description and background, groundwater monitoring and sampling details, results and findings, data quality, and conclusions are presented below.

1.1 Site Description and Background

Based on previous subsurface investigations, the site is limited to off-property impacts in the eastern right-of-way of Lake Otis Parkway and beneath Lake Otis Parkway. The former service station property at 4409 Lake Otis Parkway, Anchorage, Alaska, is not included in the new site definition. The 4409 Lake Otis Parkway property has been redeveloped as a Walgreens pharmacy.

In June 2014, Conestoga-Rovers & Associates (CRA) conducted a site investigation that included the installation of three monitoring wells. One monitoring well (MW-1A) was installed on the offsite parcel to the west of Lake Otis Parkway to define the lateral extent of impacts to the west. A second monitoring well (MW-2A) was installed to define the extent of groundwater impacts to the north. Groundwater impacts above the DEC's Table C groundwater cleanup levels were only identified at monitoring well MW-3A, which was installed in the center of Lake Otis Parkway near the source area identified during a subsurface investigation in October 2012.

Currently there are three groundwater monitoring wells related to the site, of which, one is located in a parking lot (MW-1A) and two are located in the street (MW-2A and MW-3A). MW-1A is scheduled to be sampled on a semi-annual basis using low flow bladder pump techniques. Per discussions with the Alaska DEC, the wells located in the street were deemed to be in hazardous locations due to vehicular traffic. A work plan to decommission MW-2A and MW-3A was prepared by GES dated March 30, 2018, and was approved by the DEC on April 2, 2018.The wells were properly decommissioned on April 23, 2018. The locations of all site monitoring wells are depicted on Figure 2.

1.2 Site Hydrogeology

Historical groundwater flow direction has been reported to the north-northeast. Historical static groundwater depths at the site have ranged from approximately 15 to 24 feet below ground surface (bgs). Static groundwater depths were measured at 15.7 feet below top of casing (TOC) in MW-1A, at 23.10 feet below TOC in MW-2A and at 20.03 feet below TOC in MW-3A on April 23, 2018. Groundwater flow direction is to the northeast at a gradient of 0.059 foot/foot (Figure 3).

2.0 GROUNDWATER MONITORING AND SAMPLING

GES gauged fluid level in MW-2A and MW-3A and sampled monitoring well MW-3A on April 23, 2018 while MW-1A was gauged and sampled on April 26, 2018, due to an ice plug within the well casing on April 23rd. The wells were sampled using a bladder pump and low flow methodologies consistent with DEC guidance and GES standard operating procedures (SOPs) included in Appendix B.

Samples were collected for analysis of total petroleum hydrocarbons (TPH) as gasoline range organics (GRO), diesel range organics (DRO), residual range organics (RRO), full list Volatile Organic Compounds (VOC) by United States Environmental Protection Agency (EPA) Method 8260B, and polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270 D-SIM. Groundwater samples were submitted under chain of custody to ESC Lab Sciences laboratory (ESC). GES's daily field forms and well sampling forms are presented as Appendix A.

All waste purge water was filtered through a portable granular activated carbon (GAC) filter and discharged in an approved designated location offsite (810 W. Tudor Road). The volume of water treated by the GAC filter during the event was recorded on both the groundwater monitoring and sampling field notes and the Portable GAC Volume Tracking Log, which is kept with the portable GAC bucket at all times. This method of purge water treatment was approved by Robert Weimer on September 29, 2016 via email.

Aqueous samples from MW-3A were collected from the site on April 23, 2018 and MW-1A on April 26, 2018. Well MW-1A was sampled at a later date as the groundwater was inaccessible due to an ice plug in the well approximately three feet below TOC. GES returned to the site on April 26, 2018, where by the ice plug had melted and the groundwater was accessible.

2.1 Groundwater Analytical Methods

Collected groundwater samples were analyzed for DRO and RRO via Alaska Series Method AK 102/103, GRO via Alaska Series Method AK 101, VOCs via EPA Method 8260B (full list), and PAHs via EPA Method 8270 D-SIM.

2.2 Groundwater Analytical Results

The following is a summary of the analytical results from April 2018:

- DRO was detected above the DEC's Table C cleanup level of 1,500 micorgrams per liter (µg/L) in monitoring well MW-1A at a concentration of 1,800 µg/L, in the field duplicate (DUP-1) at a concentration of 1,740 µg/L and MW-3A at a concentration of 2,270 µg/L.
- GRO was detected above the DEC's Table C cleanup level of 2,200 micorgrams per liter (µg/L) in monitoring well MW-3A at a concentration of 8,580 µg/L.
- RRO was detected above the DEC's Table C cleanup level of 1,100 micorgrams per liter (µg/L) in monitoring well MW-1A at a concentration of 4,150 µg/L and 3,260 µg/L in the field duplicate (DUP-1).
- Benzene was detected above the DEC's Table C cleanup level of 4.6 micorgrams per liter (µg/L) in monitoring well MW-3A at a concentration of 336 µg/L.
- Toluene was detected above the DEC's Table C cleanup level of 1,100 micorgrams per liter (µg/L) in monitoring well MW-3A at a concentration of 1,240 µg/L.
- Ethylbenzene was detected above the DEC's Table C cleanup level of 15 micorgrams per liter (µg/L) in monitoring well MW-3A at a concentration of 602 µg/L.
- Total Xylenes was detected above the DEC's Table C cleanup level of 190 micorgrams per liter (µg/L) in monitoring well MW-3A at a concentration of 2,520 µg/L.
- 1,2-Dichloroethane was detected above the DEC's Table C cleanup level of 1.7 micorgrams per liter (µg/L) in monitoring well MW-3A at a concentration of 20.7 µg/L.

- Napthalene was detected above the DEC's Table C cleanup level of 1.7 micorgrams per liter (µg/L) in monitoring well MW-3A at a concentration of 66.3 µg/L.

All other analytical concentrations in the wells were less than the DEC Table C cleanup level and/or laboratory reporting limits (RL). Current and historical groundwater analytical results are summarized in Table 1, PAHs are tabulated in Table 2, and current analytical data is shown on Figure 4. A copy of the laboratory analytical report is presented as Appendix C.

3.0 DATA QUALITY

Groundwater & Environmental Services, Inc. (GES) reviewed the analytical data from the Shell-4409 Lake Otis, Anchorage, AK (site) April 23 and 26, 2018 sampling event in order to determine accuracy and precision for each analysis as well as to determine overall data usability. Organic data were reviewed for holding times, method and field blank results, surrogate or system monitoring compound recoveries, Matrix Spike/Matrix Spike Duplicate (MS/MSD) and LCS recoveries. All data necessary to complete the data review were provided by the laboratory.

The collection of aqueous samples from two locations occurred on April 23 and 26, 2018.

The samples were sent to ESC Lab Sciences laboratory and analyzed by the following methodologies as requested on the Chain of Custody:

- Volatile Organic Compounds (GC) by Method 8021/AK101,
- Volatile Organic Compounds (GC/MS) by Method 8260B,
- Semi-Volatile Organic Compounds (GC) by Method AK102/103,
- Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM.

The analytical results were reviewed using laboratory acceptance criteria and procedures and guidelines contained in the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, revised January 2017.

Data Quality

Data was overall of good quality and usable.

Holding Times

Analytical holding times were met.

Blank Results

There were no analytes reported above the reporting detection limit (RDL).

The included trip blank associated with MW-3A had one detection reported. Acetone recovered at 17.1 ug/L. As concentration in the sample was less than ten times the detection in the blank, according to EPA guidance, the acetone concentration in the sample is considered unreliable. The data is rejected.

Laboratory Control Spike

All laboratory control spike recoveries were within laboratory-specified criteria, with the exception of the MW-3A associated LCS/LCSD recoveries for AK103 RRO C25-C36, which are high outside of criteria. MW-3A results for AK103 RRO C25-C36 are qualified as estimated with a possible high bias. RPDs for acetone, acrolein, acrylonitrile and 2-butanone exceeded the laboratory maximum in the LCS/LCSD associated with MW-1A. The data is qualified.

Preservation

Samples were collected and subsequently stored in amber sample bottles and stored at 4°C ± 2°C until prepared and analyzed. The temperature of the samples upon receipt by the laboratory were recorded. The initial cooler was received below the acceptable range at 1.4°C, the second above the acceptable range at 12.6°C (associated with MW-1A). The first cooler samples were unfrozen, so the below optimal temperature does not affect the data results. Samples were stored in appropriate bottleware, however, preservation pH for MW-3A was high upon laboratory receipt. Preservation is used in conjunction with temperature to limit biodegradation. The pH was adjusted in the laboratory. Because preservation/temperature were out of compliance, all VOC data is qualified as estimated with a possible biased low.

Surrogates Recoveries and Accuracy

The surrogate recoveries were all within laboratory-specified ranges.

Duplicate Analyses and Precision

A field duplicate (DUP-1) from the MW-1A sampling location was collected and submitted blind to the laboratory for analysis. All detections in the sample and the duplicate were below reporting limits, and precision could not be accurately calculated.

Precision is the distribution of a set of reported values about the mean, or the closeness of agreement between individual test results obtained under prescribed and similar conditions. Precision is best expressed in terms of RPD.

Analysis of the laboratory precision employed evaluation of laboratory spike/laboratory spike duplicate (LCS/LCSD) and matrix spike/matrix spike duplicates (MS/MSD) relative percent difference (RPD) precision calculations. There were four compounds that exhibited precision issues. .The overall precision within compliance was 97%.

Accuracy

Accuracy is a measure of the closeness of an observed value to the “true” value, e.g., theoretical or reference value, or population mean. Accuracy includes a combination of random error and systematic error (bias) that result from sampling and analytical operations. Analytical batch accuracy is measured through the analyses of recoveries in LCSs and MS/MSDs. Sample specific accuracy is measured with surrogate recovery. All surrogate recoveries and all recoveries reported in the LCS, and site associated MS/MSD pair were within laboratory-specified criteria. Accuracy for this sampling event and report is 99%.

Sensitivity

Sensitivity is the measure of how low a concentration can be detected/reported. Sensitivity is measured using practical quantitation limits (PQLs) or reporting limits (RLs).

1,2-Dibromoethane and vinyl chloride have both RL and MDL above the minimum DEC clean-up levels. 1,1,2,2-Tetrachloroethane reports with an RL above DEC clean-up levels for groundwater, but the MDLs are below the DEC requirement.

The lack of sensitivity for 1,2-dibromoethane and vinyl chloride disallows comparing non-detected reported results to the DEC clean-up levels. For 1,1,2,2-tetrachloroethane, because the MDL is below regulatory standards, data from these analytes may be used to compare to DEC clean-up standards.

Groundwater analytical data are usable and considered definitive data and suitable for comparison to regulatory standards. The DEC Laboratory Data Review Checklist and Memorandum are presented as Appendix D.

4.0 CONCLUSIONS

During the April 2018 groundwater monitoring event, GRO, DRO, benzene, toluene, ethylbenzene, total xylenes and 1,2-dichloroethane concentrations were greater than DEC's Table C cleanup levels in groundwater sampled from MW-3A. RRO concentrations in MW-1A and DUP-1 exceeded DEC's Table C cleanup levels. In well MW-1A, RRO concentrations have increased since the last event. GES is evaluating whether this well may have been compromised due to its location in a vehicle parking space and may have had surface water runoff infiltration impact the water quality with DRO and RRO constituents (higher concentrations of RRO than MW-3A and no benzene, ethylbenzene or xylenes). As such, Denali Drilling cut down the casing (from frost heave) in MW-1A approximately 4 inches and new well cap was placed to seal the casing. A new well vault lid seal was also installed to mitigate migration of parking lot water runoff into the well vault.

GES plans to continue sampling of MW-1A on an annual basis. Following the next sampling event, another well down gradient of MW-1A will be considered if a reduction of DRO and RRO are not observed.

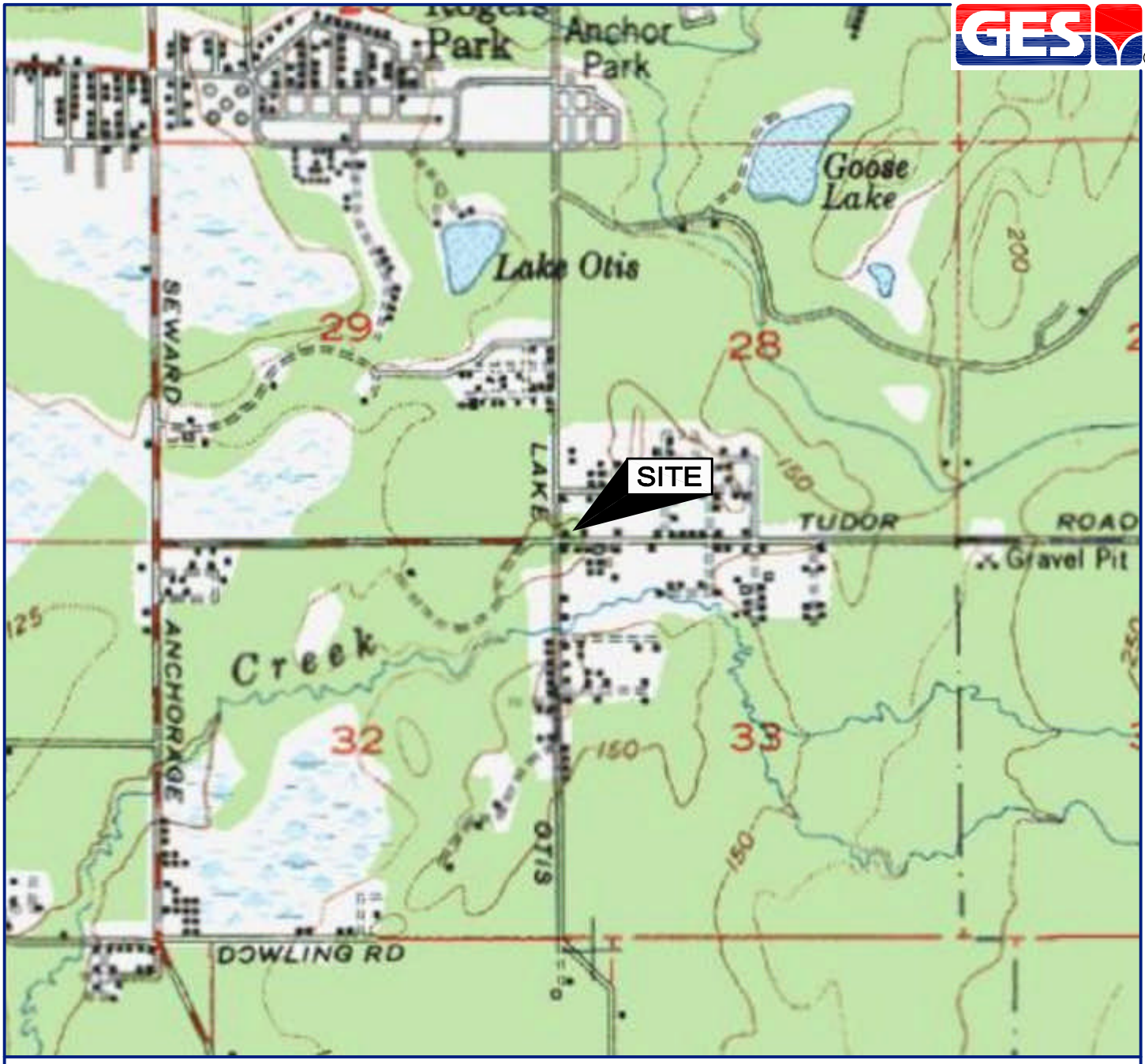
FIGURES

Figure 1: Site Location Map

Figure 2: Site Map

Figure 3: Groundwater Contour Map

Figure 4: Groundwater Analytical Concentrations Map

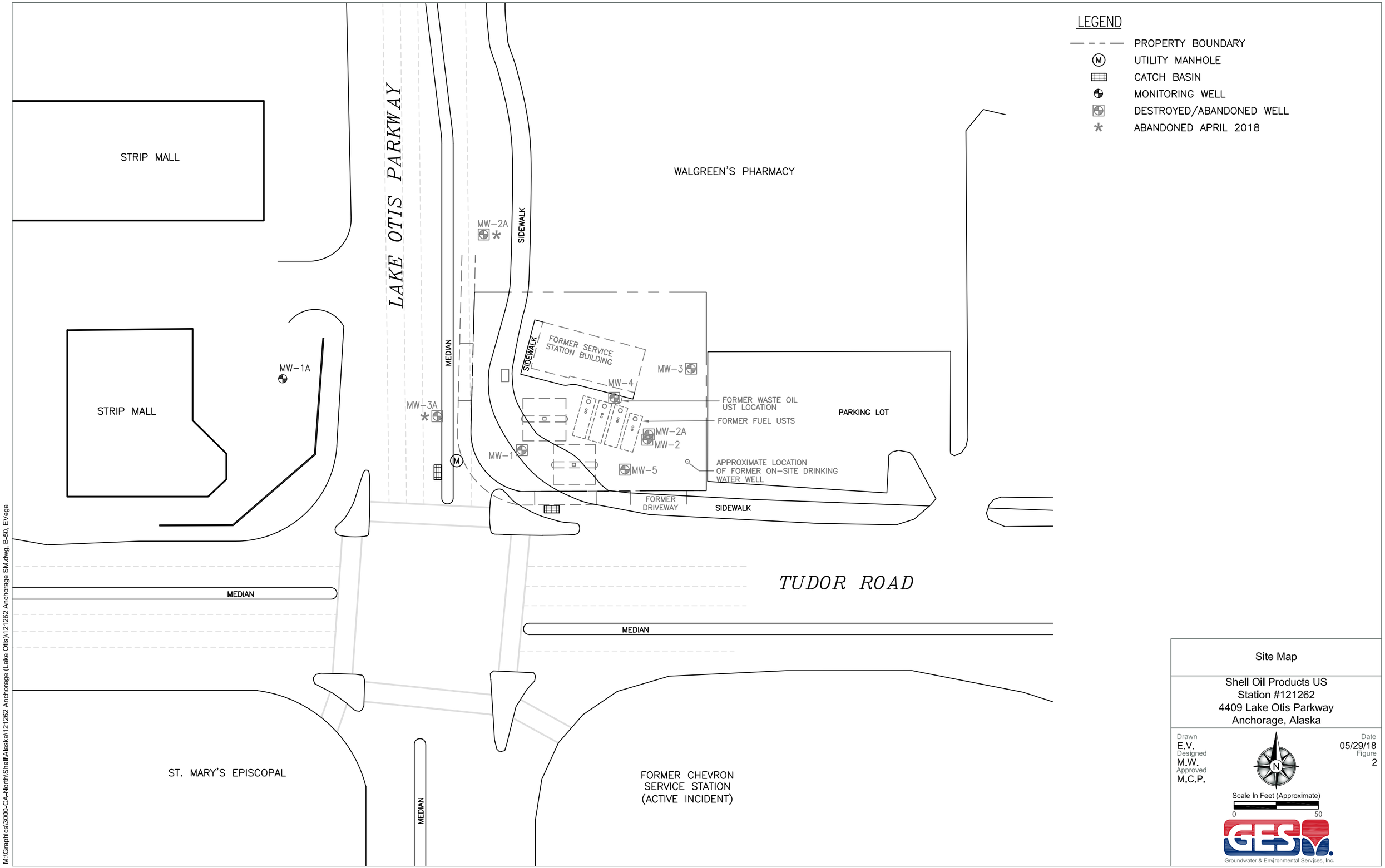


SOURCE: USGS 7.5 MINUTE SERIES
TOPOGRAPHIC QUADRANGLE 1963
ANCHORAGE A–8, ALASKA
CONTOUR INTERVAL = 50'

QUADRANGLE LOCATION

DRAFTED BY: W.G.S. (N.J.)	SITE LOCATION MAP
CHECKED BY:	SHELL OIL PRODUCTS US STATION #121262 4409 LAKE OTIS PARKWAY ANCHORAGE, ALASKA
REVIEWED BY:	Groundwater & Environmental Services, Inc. 5046 COMMERCIAL CIRCLE, SUITE F, CONCORD, CALIFORNIA 94520
NORTH	SCALE IN FEET: 0 – 2000 / DATE: 4–30–15 / FIGURE: 1

M:\Graphics\3000-CA-North\Shell\Alaska\121262 Anchorage\121262 Anchorage SLM.dwg, Layout1, 4/30/2015 2:08:03 PM, WShea



Site Map

Shell Oil Products US
Station #121262
4409 Lake Otis Parkway
Anchorage, Alaska

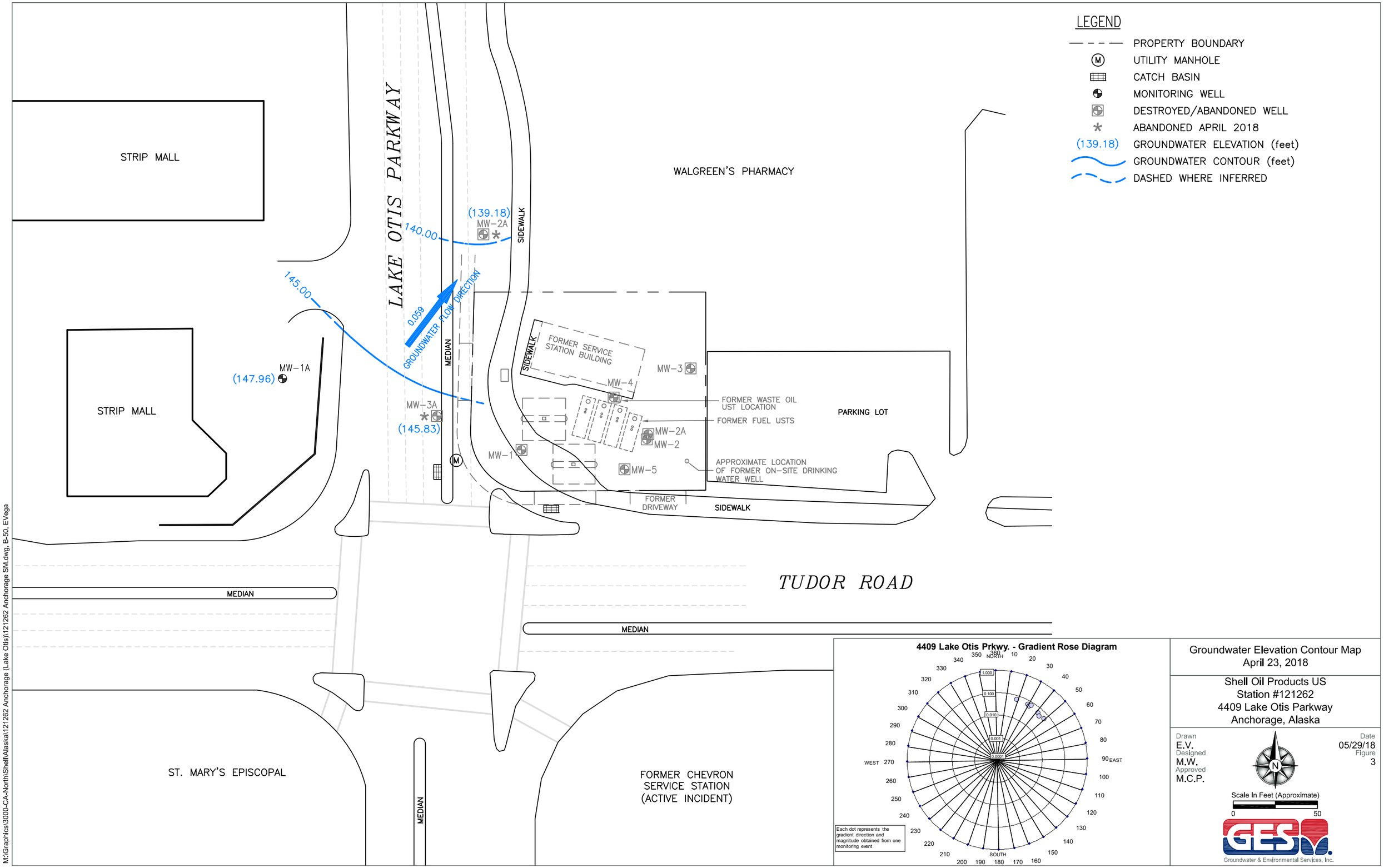
Drawn
E.V.
Designed
M.W.
Approved
M.C.P.

Date
05/29/18
Figure
2

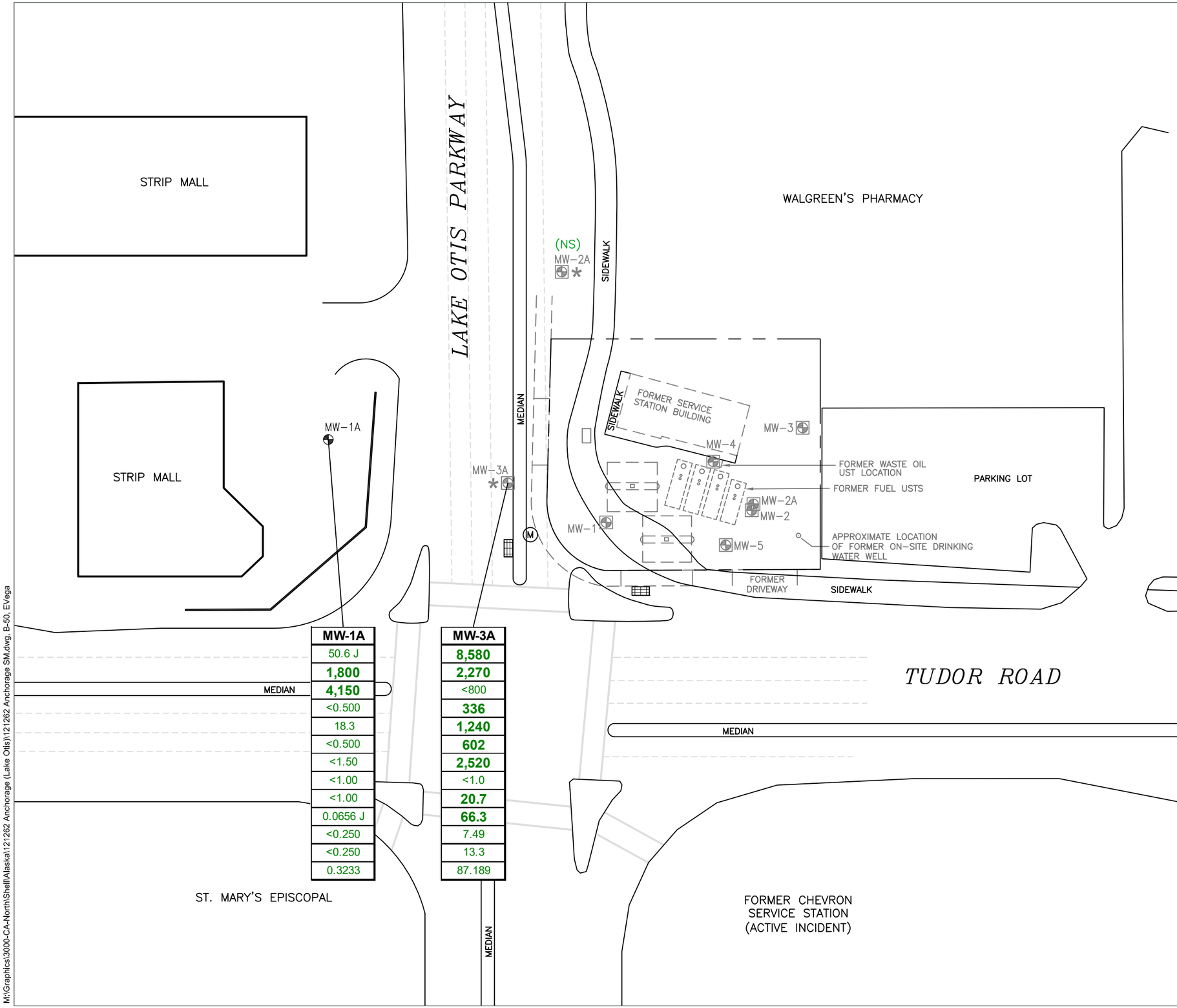
Scale In Feet (Approximate)
0 50

Groundwater & Environmental Services, Inc.

M:\Graphics\3000-CA-North\Shell\Alaska\121262 Anchorage (Lake Otis)\121262 Anchorage SM.dwg, B-50, EVega



M:\Graphics\3000-CA-North\Shell\Alaska\121262 Anchorage (Lake Otis)\121262 Anchorage SM.dwg, B-50, EVega



MW-1A
50.6 J
1,800
4,150
<0.500
18.3
<0.500
<1.50
<1.00
<1.00
0.0656 J
<0.250
<0.250
0.3233

MW-3A
8,580
2,270
<800
336
1,240
602
2,520
<1.0
20.7
66.3
7.49
13.3
87.189

LEGEND

— — —	PROPERTY BOUNDARY
M	UTILITY MANHOLE
	CATCH BASIN
	MONITORING WELL
	DESTROYED/ABANDONED WELL
*	ABANDONED APRIL 2018
MW-1A	WELL IDENTIFICATION
50.6 J	TPH–GRO CONCENTRATION (ug/L)
1,800	TPH–DRO CONCENTRATION (ug/L)
4,150	TPH–RRO CONCENTRATION (ug/L)
<0.500	BENZENE CONCENTRATION (ug/L)
18.3	TOLUENE CONCENTRATION (ug/L)
<0.500	ETHYLBENZENE CONCENTRATION (ug/L)
<1.50	XYLENE CONCENTRATION (ug/L)
<1.00	EDB CONCENTRATION (ug/L)
<1.00	EDC CONCENTRATION (ug/L)
0.0656 J	NAPHTHALENE CONCENTRATION (ug/L)
<0.250	1–MeNaph CONCENTRATION (ug/L)
<0.250	2–MeNaph CONCENTRATION (ug/L)
0.3233	T. PAHs CONCENTRATION (ug/L)
ug/L	MICROGRAMS PER LITER
TPH	TOTAL PETROLEUM HYDROCARBONS
GRO	GASOLINE RANGE ORGANICS
DRO	DIESEL RANGE ORGANICS
RRO	RESIDUAL RANGE ORGANICS
EDB	1,2 DIBROMOETHANE
EDC	1,2 DICHLOROETHANE
1–MeNaph	1–METHYLNAPHTHALENE
2–MeNaph	2–METHYLNAPHTHALENE
T.PAHs	SUM OF TOTAL POLYCYCLIC AROMATIC HYDROCARBONS
<#	WHERE AN ANALYTE IS NOT DETECTED, A REPORTING LIMIT IS GIVEN
ND	NOT DETECTED ABOVE THE MDL or MRL
NS	NOT SAMPLED
J	ESTIMATED VALUE, BETWEEN LABORATORY REPORTING LIMIT AND METHOD DETECTION LIMIT

NOTE:

BOLD VALUE INDICATES RESULT ABOVE DEC TABLE C CLEANUP LEVELS.

Groundwater Analytical Data Map
April 23, 2018

Shell Oil Products US
Station #121262
4409 Lake Otis Parkway
Anchorage, Alaska

Drawn E.V.
Designed M.W.
Approved M.C.P.

Date 05/29/18
Figure 4

Scale In Feet (Approximate)
0 50

Groundwater & Environmental Services, Inc.

M:\Graphics\3000-CA-North\Shell\Alaska\121262 Anchorage (Lake Otis)\121262 Anchorage SM.dwg, B-50, EVega

TABLES

Table 1: Current and Historical Groundwater Analytical Data Summary

Table 2: Analytical Data Summary – PAHs

TABLE 1

SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL DATA
LAKE OTIS PARKWAY RIGHT-OF-WAY,
ANCHORAGE, ALASKA

							HYDROCARBONS			PRIMARY VOCs						OXYGENATES						Metals													
Sample ID		Date	TOC	SPH Thickness	DTW	GWE	TPH-GRO	TPH-DRO	TPH-RRO	B	T	E	X	EDB	EDC	MTBE	DIPE	Ethanol	ETBE	TBA	TAME	Dissolved Arsenic	Total Aresnic	Dissolved Barium	Total Barium	Dissolved Cadmium	Total Cadmium	Dissolved Chromium	Total Chromium	Dissolved Lead	Total Lead	Dissolved Nickel	Total Nickel	Dissolved Vanadium	Total Vanadium
					DEC Cleanup Levels		2,200	1,500	1,100	4.6	1,100	15	190	0.075	1.7	140	NE	NE	NE	NE	NE	0.52	0.52	3,770	3,770	9.21	9.21	22,500	22,500	15	15	392	392	86.4	86.4
MW-1A	d	08/06/14	163.66	---	15.75	147.91	<100	<792	61.3 J	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	---	---	---	---	---	2.98	---	70.2	---	<1.00	---	2.99	---	1.57 J	---	6.49	---	7.39 B	---
MW-1A	d	10/23/14	163.66	---	15.83	147.83	<100	<769	56.7 JB	<1.00	<1.00	<1.00	<2.00	<0.0197	<1.00	<1.00	---	---	---	---	---	---	1.70 J	---	69.8	---	<1.00	---	2.74	---	0.860 J	---	4.93	---	4.94 B
MW-1A	d	06/27/15	163.66	---	16.13	147.53	<50	173	379	<1.0	<1.0	<1.0	<2.0	<0.020	<1.0	<1.0	---	---	---	---	---	2.4	---	63.5	---	<1.0	---	<2.0	---	<1.0	---	2.7	---	<4.0	---
MW-1A	d	08/30/15	163.66	---	15.96	147.70	<50	**2,720**	**3,050**	<1.0	<1.0	<1.0	<2.0	<0.020	<1.0	<1.0	---	---	---	---	---	2.8	---	29.6	---	<1.0	---	2.0	---	1.0	---	5.0	---	<8.0	---
MW-1A	d	10/24/15	163.66	---	15.64	148.02	<50	536	**1,310**	<1.0	<1.0	<1.0	<2.0	<0.019	<1.0	<1.0	---	---	---	---	---	1.8	---	24.6	---	<1.0	---	<2.0	---	<1.0	---	5.4	---	<4.0	---
MW-1A		04/01/16	163.66	---	Unable to gauge		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-1A		10/05/16	163.66	---	16.08	147.58	<100	1,490	**1,100**	<1.0	2.1	<1.0	<3.0	---	<1.0	<1.0	<1.0	<200	<2.0	<20	<2.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-1A		10/02/17	163.66	---	16.03	147.63	<100	884	**2,470**	<0.500	0.784 J	<0.500	<1.50	<1.00	<1.00	<5.00	<1.00	--	--	--	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-1A DUP		10/02/17	163.66	---	16.03	147.63	<100	814	**2,010**	<0.500	0.787 J	<0.500	<1.50	<1.00	<1.00	<5.00	<1.00	--	--	--	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-1A		**04/26/18**	163.66	---	15.70	147.96	50.6J	**1,800**	**4,150**	<0.500	18.3	<0.500	<1.50	<1.00	<1.00	<5.00	<1.00	--	--	--	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-1A-DUP		**04/26/18**	163.66	---	15.70	147.96	49.4J	**1,740**	**3,260**	<0.500	18.3	<0.500	<1.50	<1.00	<1.00	<5.00	<1.00	--	--	--	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-2A	d	08/06/14	162.28	---	23.89	138.39	<100	164 J	113 J	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	---	---	---	---	---	3.57	---	60.0	---	<1.00	---	11.5	---	7.74	---	11.3	---	11.1 B	---
MW-2A	d	10/23/14	162.28	---	23.79	138.49	<100	<766	51.6 JB	<1.00	<1.00	<1.00	<2.00	<0.0198	<1.00	<1.00	---	---	---	---	---	---	1.19 J	---	25.8	---	<1.00	---	5.62	---	0.0453 J	---	3.05	---	3.03 B
MW-2A	d	06/27/15	162.28	---	23.83	138.45	<50	70 J	132 J	<1.0	<1.0	<1.0	<2.0	<0.019	<1.0	<1.0	---	---	---	---	---	1.5	---	22.1	---	<1.0	---	<2.0	---	<1.0	---	<2.0	---	<4.0	---
MW-2A	d	08/30/15	162.28	---	23.73	138.55	<50	175	205 J	<1.0	<1.0	<1.0	<2.0	<0.020	<1.0	<1.0	---	---	---	---	---	1.0	---	20.6	---	<1.0	---	<2.0	---	<1.0	---	2.1	---	<8.0	---
MW-2A	d	10/18/15	162.28	---	22.25	140.03	<50	84.7 J	129 J	<1.0	<1.0	<1.0	<2.0	<0.019	<1.0	<1.0	---	---	---	---	---	<1.0	---	20.9	---	<1.0	---	2.0	---	1.1	---	<2.0	---	5.3	---
MW-2A		04/01/16	162.28	---	23.56	138.72	<50	42.9 J	67.0 J	<1.0	<1.0	<1.0	<2.0	<0.0097	<1.0	<1.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-2A		10/05/16	162.28	---	23.10	139.18	<100	<190	445	<1.0	<1.0	<1.0	<3.0	---	<1.0	<1.0	<1.0	<200	<2.0	<20	<2.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-2A		04/23/18	162.28	---	23.10	139.18	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-3A	d	08/06/14	165.86	---	18.91	146.95	**2,840**	332 J	58.2 J	**72.2**	176	98.0	497	<1.00	<1.00	<1.00	---	---	---	---	---	**50.2**	---	117	---	<1.00	---	14.7	---	5.5	---	16.6	---	11.6 B	---
MW-3A DUP	d	08/06/14	165.86	---	18.91	146.95	**3,300**	368 J	57.3 J	**74.8**	189	107	523	<1.00	<1.00	<1.00	---	---	---	---	---	**47.8**	---	115	---	<1.00	---	7.65	---	5.6	---	17.3	---	14.1 B	---
MW-3A	d	10/23/14	165.86	---	18.74	147.12	**4,810**	395 J	49.7 JB	**92.9**	51.3	180	619	**0.115**	**48.5**	<1.00	---	---	---	---	---	---	**46**	---	110	---	<1.00	---	2.79	---	1.04 J	---	4.81	---	3.30 B
MW-3A DUP	d	10/23/14	165.86	---	18.74	147.12	**4,600**	391 J	66.8 JB	**93.5**	57.4	187	602	**0.123**	**48.9**	<1.00	---	---	---	---	---	---	**47.5**	---	111	---	<1.00	---	1.93 J	---	1.02 J	---	4.84	---	3.36 B
MW-3A	d	06/27/15	165.86	---	19.25	146.61	892	268	<200	**51.8**	1.1	99.1	98.3	0.029	**80.9**	<1.0	---	---	---	---	---	**14.5**	---	80.7	---	<1.0	---	<2.0	---	<1.0	---	<2.0	---	<4.0	---
MW-3A DUP	d	06/27/15	165.86	---	19.25	146.61	1,140	253	<190	**52.9**	1.2	70.1	101	0.028	**83.0**	<1.0	---	---	---	---	---	**18.1**	---	88.5	---	<1.0	---	<2.0	---	<1.0	---	<2.0	---	<4.0	---
MW-3A	d	08/30/15	165.86	---	18.80	147.06	812	410	62.6 J	**80.3**	38.2	131	286	**0.065**	**55.4**	<1.0	---	---	---	---	---	**44.3**	---	136	---	<1.0	---	<2.0	---	<1.0	---	4.4	---	<8.0	---
MW-3A DUP	d	08/30/15	165.86	---	18.80	147.06	283	459	58.0 J	**80.7**	34.4	130	278	**0.064**	**54.9**	<1.0	---	---	---	---	---	**44.6**	---	137	---	<1.0	---	<2.0	---	<1.0	---	4.6	---	<8.0	---
MW-3A	d	10/18/15	165.86	---	18.48	147.38	**1,820**	451	<190	**75.1**	13.8	174	314	**0.063**	**75.2**	<2.0	---	---	---	---	---	**9.4**	---	98.5	---	<1.0	---	<2.0	---	<1.0	---	3.4	---	4.0	---
MW-3A DUP	d	10/18/15	165.86	---	18.48	147.38	**1,820**	512	<190	**72.8**	14.9	174	342	**0.071**	**72.7**	<2.0	---	---	---	---	---	**11.4**	---	104	---	<1.0	---	<2.0	---	<1.0	---	3.2	---	<4.0	---
MW-3A		04/01/16	165.86	---	19.60	146.26	**8,040**	1,270	104	**225**	560	543	1,930	**0.44**	**24.0**	<2.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-3A DUP		04/01/16	165.86	---	19.60	146.26	**7,120**	**1,520**	107	**211**	584	605	2,230	**0.42**	**23.3**	<2.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-3A		10/05/16	165.86	---	19.32	146.54	1,100	535	<380	**64.7**	3.3	**96.8**	122	<2.0	**43.0**	<1.0	<1.0	<200	<2.0	<20	<2.0	---	---	---	---	---	---	---	---	<2.0	---	---	---	---	---
MW-3A DUP		10/05/16	165.86	---	19.32	146.54	786	521	<380	**65.1**	3.3	**88.0**	112	<2.0	**44.4**	<1.0	<1.0	<200	<2.0	<20	<2.0	---	---	---	---	---	---	---	---	<2.0	---	---	---	---	---
MW-3A		**04/23/18**	165.86	---	20.03	145.83	**8,580**	**2,270**	<800	**336**	**1240**	**602**	**2,520**	<1.0	**20.7**	<1.0	<1.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trip blank	d	08/06/14	---	---	---	---	<100	---	---	<1.00	<1.00	<1.00	<3.00			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trip blank	d	06/27/15	---	---	---	---	<50	---	---	<1.0	<1.0	<1.0	<2.0	---	<1.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trip Blank	d	08/30/15	---	---	---	---	<50	---	---	<1.0	<1.0	<1.0	<2.0	---	<1.0	<1.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trip Blank	d	10/18/15	---	---	---	---	<50	---	---	<1.0	<1.0	<1.0	<2.0	---	<1.0	<1.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trip Blank		04/01/16	---	---	---	---	<50	---	---	<1.0	<1.0	<1.0	<2.0	---	<1.0	<1.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trip Blank		10/05/16	---	---	---	---	---	---	---	<1.0	<1.0	<1.0	<3.0	<2.0	<1.0	<1.0	<1.0	<200	<2.0	<20	<2.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trip Blank		10/02/17	---	---	---	---	<100	---	---	<0.500	<1.00	<0.500	<1.50	<1.00	<1.00	<5.00	<1.00	--	--	--	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trip Blank		04/23/18	---	---	---	---	33.5J	---	---	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Notes:
Groundwater results given in µg/L = micrograms per liter
-- = Not analyzed.
NA = Not Applicable
NE = Not Established
< = Constituent was not detected above the indicated laboratory reporting limit.
Concentrations in bold type following third quarter 2016 indicate the analyte was detected above DEC 18AAC75 Table C Cleanup levels (effective November 6, 2016)
DEC = Alaska Department of Environmental Conservation
Dissolved Arsenic, Barium, Cadmium, Chromium, Lead, Nickel, and Vanadium analyzed per EPA Method 6010B.
BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes; analyzed per AK101 Method.
TPH-GRO = Total Petroleum Hydrocarbons (TPH) as Gasoline range orgainics; analyzed per AK101 Method.
DRO = TPH as Diesel Range Organic, per AK102 Method.
RRO = TPH as Residual Range Organics, per AK102 Method.
MTBE = Methyl tert-butyl ether, per EPA Method 8260B.
DIPE = Di-isopropyl ether, per EPA Method 8260B.
ETBE = Ethyl tert-butyl ether, per EPA Method 8260B.
TBA = tert-Butyl alcohol, per EPA Method 8260B.
TAME = tert-Amyl Methyl Ether, per EPA Method 8260B.
VOCs = Volatile Organic Compounds (BTEX, MTBE, DIPE, Ethanol, ETBE, TBA, and TAME)
EDB = 1,2-Dibromoethane
EDC = 1,2-Dichloroethane
a = Sample also analyzed for VOCs per EPA Method 8260B. All other analyte concentrations in groundwater sampled were less than the DEC Table C cleanup levels or laboratory reporting limits.
B = Compound was found in the blank and sample.
c = Total chromium (as trivalent chromium) used as comparison cleanup level. Chromium was speciated in soil at MW-2A and trivalent chromium was present but hexavalent chromium was not. Total chromium in groundwater has not been speciated.
d = Sample also analyzed for tetrachloroethene (PCE). All results were less than the laboratory reporting limits.
J = Analyte detected above the Method detection limit (MDL) but below the laboratory reporting limit.

TABLE 2
GROUNDWATER ANALYTICAL DATA - PAHs
LAKE OTIS PARKWAY RIGHT-OF-WAY
ANCHORAGE, ALASKA

Well Idenification	Sample Date	EPA Method 8270 (ug/l)																		
		1-Methylnaphthalene	2-Methylnaphthalene	2-Chloronaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
Alaska Screening Criteria																				
Cleanup Levels		**11**	**36**	**746**	**530**	**260**	**43**	**0.300**	**0.25**	**2.5**	**0.26**	**0.80**	**2.0**	**0.250**	**260**	**290**	**0.19**	**1.7**	**170**	**120**
MW-1A	10/5/2016	<0.31	<0.31	--	<0.31	<0.31	<0.19	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.19	<0.19	<0.031	<0.31	<0.19	<0.19
MW-1A	**4/26/2018**	<0.250	<0.250	<0.250	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	0.0293J	0.0483J	<0.0500	0.0224J	<0.0500	0.0417J	<0.0500	0.0150J	0.0656J	0.0234J	0.0776
MW-1A DUP	**4/26/2018**	0.0243J	0.0178J	<0.250	<0.0500	<0.0500	<0.0500	<0.0500	0.0242J	0.0528	0.0717	<0.0500	0.0257J	<0.0500	0.0501J	<0.0500	0.0325J	0.0368J	0.0292J	0.085
MW-2A	10/5/2016	<0.31	<0.31	--	<0.31	<0.31	<0.19	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.19	<0.19	<0.031	<0.31	<0.19	<0.19
MW-3A	10/5/2016	1.2	2.0	--	<0.31	<0.31	<0.19	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.19	<0.19	<0.031	**13.3**	<0.19	<0.19
MW-3A	**4/23/2018**	7.49	13.3	0.0786 J	0.0166 J	<0.0500	<0.0500	<0.0500	<0.0500	0.00374 J	0.00362 J	<0.0500	<0.0500	<0.0500	<0.0500	0.0128 J	<0.0500	**66.3**	<0.0500	<0.0500

Notes:
ug/l = micrograms per liter
EPA = Environmental Protection Agency
Concentrations in bold type indicate the analyte was detected above DEC 18AAC75 Table C Cleanup levels (effective November 6, 2016).
<# = Analyte not detected above the indicated laboratory Method Detection Limit.
J = Indicates an estimated value.
DUP = Duplicate
PAH = Polycyclic aromatic hydrocarbons

APPENDIX A

Field Sheets

Groundwater
& Environmental Services, Inc.

GROUNDWATER MONITORING WELL DATA

Client: SOPUS	Date: 4/23/18
Project No.: 3016007	Site No.: 121262
Site Location/Address: 4409 Lake Otis Pkwy., Anchorage, AK	Field Staff: K. Halpin

Well Number	Depth to Water (BTOC in feet)	Depth to Product (BTOC in feet)	Product Thickness (feet)	Product Removed (Gallons)	Measured Depth to Bottom of Well (BTOC)	Well Completion Depth (BGS)	Casing Diameter (inches)	Screen Interval
MW-1A	15.70				30.95	33	2	18-33
MW-2A	23.10				33.00	33	2	18-33
MW-3A	20.03				31.71	32.8	2	17.8-32.8

SAMPLING EVENT DATASHEET

Project Name: **4409 Lake Otis Pkwy.** Well No: MW-1A Date: 4/26/18

Project No: **3016007** Personnel: K. Halpin

GAUGING DATA

Water Level Measuring Method: WLM / **IP** Measuring Point Description: TOC

WELL PURGE VOLUME CALCULATION	Total Depth (feet)		Depth to Water (feet)		Water Column (feet)		Multiplier for Casing Diameter				Casing Volume (gal)		Total Purge Volume (gal)
							1	2	4	6			
	30.95	-	15.70	=	15.25	X	0.04	0.16	0.64	1.44	2.44	=	2.44

PURGING DATA

Purge Method: WATERRA / BAILER / **SUB** Purge Depth: 1600 Purge Rate: 0.10 (gpm)

Time	1552	1554	1556			
Volume Purge (gal)	0.10	0.30	0.50			
Temperature (C)	7.12	6.67	6.54			
pH	6.79	6.66	6.61			
Spec.Cond.(umhos)	304	304	308			
Turbidity/Color	v. cloudy	v. cloudy	v. cloudy			
Odor (Y/N)	Y	Y	Y			
Dewatered (Y/N)	N	N	N			

Comments/Observations: Sheen on water & odor

SAMPLING DATA

Time Sampled: 1600/1605 Approximate Depth to Water During Sampling: 16.57 (feet)

Comments:

Sample Number	Number of Containers	Container Type	Preservative	Volume Filled (mL or L)	Turbidity/ Color	Analysis Method
MW-1A	10	**VOA**	**HCL**	**40ML**	Y / black	**SEE COC**
DUP-1	10					

Total Purge Volume: 1 (gallons) Disposal: Carbon drum

Weather Conditions: cloudy

Condition of Well Box and Casing at Time of Sampling: Good

Well Head Conditions Requiring Correction: None

Problems Encountered During Purging and Sampling: None

Comments:

BOLTS (Y) / N

CAP & LOCK (Y) / N

GROUT (Y) / N

WELL BOX (Y) / N

SECURED (Y) / N

SAMPLING EVENT DATASHEET

Project Name: **4409 Lake Otis Pkwy.** Well No: MW-34 Date: 4/23/18

Project No: **3016007** Personnel: K. Halpin

GAUGING DATA

Water Level Measuring Method: WLM / **IP** Measuring Point Description: TOC

WELL PURGE VOLUME CALCULATION	Total Depth (feet)		Depth to Water (feet)		Water Column (feet)	Multiplier for Casing Diameter				Casing Volume (gal)		Total Purge Volume (gal)
	31.71	-	20.03	=	11.68	X	1	2	4	6	1.87	=	1.87
							0.04	0.16	0.64	1.44			

PURGING DATA

Purge Method: WATERRA / BAILER / **SUB** Purge Depth: 24.00 Purge Rate: 0.05 (gpm)

Time	1003	1005	1007			
Volume Purge (gal)	0.10	0.20	0.30			
Temperature (C)	5.85	5.80	5.82			
pH	6.47	6.45	6.45			
Spec.Cond.(umhos)	842	842	843			
Turbidity/Color	C/C	C/C	C/C			
Odor (Y/N)	Y	Y	Y			
Dewatered (Y/N)	N	N	N			

Comments/Observations:

SAMPLING DATA

Time Sampled: 1010 Approximate Depth to Water During Sampling: 20.49 (feet)

Comments:

Sample Number	Number of Containers	Container Type	Preservative	Volume Filled (mL or L)	Turbidity/ Color	Analysis Method
MW-34	10	**VOA**	**HCL**	**40ML**	C / C	**SEE COC**

Total Purge Volume: 1.5 (gallons) Disposal: Carbon bucket

Weather Conditions: overcast

Condition of Well Box and Casing at Time of Sampling: good

Well Head Conditions Requiring Correction: none

Problems Encountered During Purging and Sampling: none

Comments:

BOLTS (Y) / N

CAP & LOCK (Y) / N

GROUT (Y) / N

WELL BOX (Y) / N

SECURED (Y) / N

APPENDIX B

Standard Field Procedures for Groundwater Monitoring

TITLE: LOW FLOW GROUNDWATER SAMPLING

PURPOSE / SCOPE

This SOP describes procedures for sampling groundwater using low-flow purging and sampling techniques. The purpose is to obtain samples that are representative of existing groundwater conditions, or samples that retain the physical and chemical properties of the groundwater within an aquifer. Improper sampling and transport procedures may cause compounds of interest to be removed from or added to the sample prior to analysis.

Note: *The importance of proper and consistent field sampling methods, as well as proper documentation,* ***CANNOT BE OVER-EMPHASIZED****.*

This SOP shall be used in conjunction with an approved Health and Safety Plan (HASP). Also, consult the HASP for information on the selection and use of PPE.

REFERENCE

ASTM D5903: Guide for Planning and Preparing for a Groundwater Sampling Event

ASTM D4448: Standard Guide for Sampling Groundwater Wells

ASTM D5979: Guide for Conceptualization and Characterization of Groundwater Systems

EPA, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, (ORD/ OSWER, Washington D.C., 1996) (EPA-540/S-95/504).

EPA Region III, *Recommended Procedure For Low-Flow Purging and Sampling of Groundwater Monitoring Wells.* (Waste and Chemicals Management Division, 1997.)

RESPONSIBILITIES

4.1 Project Manager

The responsibility of the Project Manager (PM) is to ensure that all activities performed by site personnel are performed: safely; in compliance with all pertinent regulations and procedures; and with the necessary equipment and resources to accomplish the tasks described in the Work Plan.

4.2 Local Health and Safety Officer (LHSO)

The Local Health and Safety Officer (LHSO), in consultation with the Corporate HSO and State project representatives, will designate the appropriate level of personnel protective equipment (PPE) for field personnel to safely accomplish their work.

4.3 Case Manager

The Case Manager (CM) is responsible for providing Field Personnel with a sampling or work plan/schedule. In addition, the PM or CM will provide field personnel with enough information to perform the work safely and correctly. This information should include the operational and safety procedures that are applicable to the work being performed.

4.4 Field Personnel

Field personnel are responsible for the safe completion of assigned tasks as described in the SOPs, Health and Safety Plan (HASP) and appropriate site-specific work plans and procedures. They are required to document the work performed and to alert their immediate supervisors of any variances from procedures established in the above documents.

EQUIPMENT / MATERIALS

A basic checklist of suggested equipment and supplies needed to implement this SOP include, but is not limited to:

- Personnel protective equipment as outlined in the site-specific HASP
- Adjustable rate, positive displacement pump (low flow-rate stainless steel submersible pump recommended) or pre-cleaned stainless steel bladder pump
- Electronic, audible (or visual identification) water level meter (0.01 feet accuracy), or interface probe if needed
- Teflon or Teflon-lined polyethylene tubing (3/8 to 1/2 inch, inside diameter)
- Flow measurement supplies (graduated cylinder and stop watch).
- Properly sized generator to operate pump

- In-line flow-through cell capable of measuring pH, specific conductance, and temperature
- Nylon cable-ties
- Decontamination supplies
- Distilled water
- Polyethylene sheeting/cloth/paper towels/garbage bags
- Transportable, purged water storage container
- Well construction log details and historical groundwater gauging data
- Photoionization detector (PID)
- Secondary containment for the flow-through cell
- Field book
- Well Purging Record Form

***Note**: Gas powered equipment at sampling sites require special care to ensure that GES staff handling these units do not contaminate down-hole equipment. Frequent disposable glove changes are required, as well as strict separation of sampling crew tasks (e.g., those handling pumps and hoses do not conduct fueling activities).*

PREPARATION

***Note:** Pre-plan the schedule of sampling activities so that sample collection progresses from "clean" to "dirty" areas to minimize the potential for cross contamination.*

PROCEDURE

Prior to low-flow purging and sampling activities, all measuring devices must be calibrated daily in accordance with equipment vendor recommendations and recorded on a calibration log sheet. Purging and sampling activities should occur in a progression from the "cleanest" to the "dirtiest" well.

7.1 Well Set-Up Activities

The following steps are required to properly set up for sampling:

1. Properly identify and inspect each well.
2. Wear appropriate PPE during set-up activities.

3. Place a sheet of polyethylene adjacent to the well to keep sampling and monitoring equipment from touching the ground.
4. Remove the well cap slowly (positive pressure inside may blow cap off).
5. Measure the VOC concentration at the top of the casing and in the breathing zone using a PID—record reading in field book.
6. Measure and record the depth to water (to within 0.01 feet) using a water level meter or interface probe, if applicable (the water level measurement should be taken from a permanent reference point scribed on top of the well casing).
7. To minimize turbidity in the well, use total well depth information obtained from the well construction logs to calculate one casing volume.[1]
8. Attach and secure Teflon or Teflon-lined polyethylene tubing to low-flow (0.10 to 0.50 L/min) stainless steel submersible pump.
9. Lower the submersible pump slowly and gently into the monitoring well to minimize aquifer agitation and mixing of the stagnant well casing water, and then secure the safety drop cable or nylon rope and tubing together with nylon cable-ties.
10. Place the intake of the submersible pump within the upper 12 inches of the water column. The intake of the pump should be placed at an elevation above dense non-aqueous phase liquid (DNAPL), if applicable.
11. Plumb the in-line flow-through cell to the discharge tubing from the well.
12. Plumb a discharge line from the effluent of the flow-through cell to a transportable, purged water storage container.
13. Position a power source (e.g., a generator) for operation of the submersible pump down gradient of the well to be purged.

1 Multiply the total water column thickness (ft) by the cross-sectional area of the well (ft^2) and record in field book and on Well Purging Record form. One cubic foot (ft^3) is equivalent to 7.48 gallons.

7.2 Low Flow Purging and Sampling

Once you have completed the well set up activities above, follow these steps to purge and sample using low-flow techniques:

1. Put on new nitrile gloves. Change nitrile gloves any time the integrity of the glove is compromised during the purging and sampling activities.
2. Activate the low-flow submersible pump and begin extracting groundwater at a rate between 0.10 and 0.50 L/min.

3. Measure the water level approximately every 10 seconds and adjust extraction rate to obtain minimal drawdown in the well of 0.2 feet, but no more than 0.3 feet maximum.
4. Once drawdown is stabilized, begin monitoring water quality indicators (pH, specific conductance, and temperature) using the in-line flow-through cell. Record observations in field book and on the attached Well Purging Record form. *Note: while purging, the pumping rate and groundwater level are measured and recorded every 10 minutes (or as appropriate).*
5. Monitor the water level and extraction rate, in addition to monitoring water quality indicators, and make periodic adjustments to flow rates to ensure steady flow and minimal drawdown.
6. Water quality readings will be monitored every five minutes (or as appropriate) until stabilization criteria are achieved.
7. Stabilization is achieved when a minimum of three (minimum of four if using temperature as an indicator) successive readings for each parameter, collected 3-5 minutes apart, are within the following criteria:

Water Quality Indicator Parameter	Stabilization Criteria
pH	±0.1 s.u.
Specific Conductance	±3%
Temperature	±3% (minimum of ± 0.2°C)
Oxidation-reaction potential (ORP)	± 10 mV
Turbidity	±10%
Dissolved Oxygen	±10%

***Note**: Stabilization criteria is achieved when the average value of three readings are within each parameter criteria limits.*

8. Collect the necessary samples once purging activities are complete and the groundwater stabilization/clarity is acceptable according to applicable protocol described above.
9. If a well is low yield and purged dry, do not collect a sample until it has recharged to approximately 80% of its pre-purge volume, when practical.
10. Collect samples directly from the pump or bailer into the appropriate sample container under typical circumstances. Take care to avoid handling the interior of the bottle or cap. **Do not** place the bottle cap on the ground or in a pocket to avoid contamination.
11. Fill all sampling containers for each well in a manner that minimizes aeration and turbulence. Put on a new pair of nitrile gloves before filling each container.

12. Disconnect or bypass the flow-through cell prior to obtaining each sample. The first volume of groundwater in the tubing is to be discarded and treated according to the waste management section described below. Place the discharge line in position at the base of the sample bottle. Fill the sample bottle from the bottom to the top, allowing it to overflow before sealing. *Note: do not overflow if the sample bottles contain preservatives.*
13. Place samples immediately on ice and store at 4° C.
14. Obtain final water level and flow rate measurements and enter in field book and on the Well Purging Record form.

7.3 Decontamination Procedures

Clean all equipment that will enter the well or come into contact with groundwater prior to each low-flow purging and sampling activity with a stiff brush and a solution of water and laboratory-grade detergent. All decontamination fluids will be disposed of in accordance with the site's waste management plan.

7.4 Documentation

Document all the events, equipment used, and measurements collected during the sampling activities in the field notes. Make all entries in black indelible ink and strike out any corrections with a single line. Initial and date corrections.

Record all manually-measured data and procedural descriptions in a field notebook and on well purging forms (**Attachment 1**). Maintain detailed notes regarding field calibration events, purging or PID anomalies, and volumes of extracted groundwater.

7.5 Waste Management

Transfer all purged water to the hazardous waste accumulation area were it will be pumped through a 20 and 50 micron filter prior to transfer into 6,000-gallon wastewater storage tank. A record of the total gallons will be maintained in the field book.

Porous materials (PPE, rags, etc.) contaminated with groundwater and non-porous materials that cannot be decontaminated will be managed as hazardous waste. Porous and non-porous materials not contaminated with groundwater will be disposed of as residual waste.

RECORDS

1.0 TITLE: FLUID LEVEL GAUGING

2.0 PURPOSE / SCOPE

The purpose of this SOP is to provide general instructions to all GES personnel concerning fluid level gauging activities. The measurement of fluid levels (groundwater or phase-separated compounds) in monitor wells, piezometers, extraction wells, and/or boreholes is required in geotechnical, hydrogeologic, and waste management investigations to determine the presence and condition of the groundwater, or the presence and thickness of phase-separated compounds. Water level measurements (hydraulic head) are used to determine: hydraulic gradients and the direction of groundwater flow; the effectiveness of groundwater extraction systems; and the volume of water required for well purging prior to groundwater sampling. The measurement of the thickness of phase-separated compounds provides a qualitative (not quantitative) monitoring of this form of contamination.

In order to provide reliable data, water levels must be determined over the shortest period of time possible. Barometric pressure can affect groundwater levels and, therefore, observation of significant weather changes during the period of water level measurements must be noted. Tidal fluctuations, navigation controls on rivers, rainfall events and groundwater pumping can also affect groundwater level measurements. Personnel collecting water level data must note if any of these controls are in effect during the groundwater level collection period. Due to possible changes during the groundwater level determination period, it is imperative that the time of data collection at each station be accurately recorded.

In conjunction with groundwater level measurements, surface water (e.g., ponds, lakes, rivers, and lagoons) must be monitored as well. This information is critical in understanding the hydrogeologic setting of the site and, most importantly, how contaminants may move beneath the site.

Note: *The importance of proper and consistent field methods, as well as proper documentation,* ***CANNOT BE OVER-EMPHASIZED****.*

This SOP shall be used in conjunction with an approved Health and Safety Plan (HASP). Also, consult the HASP for information on the selection and use of PPE.

3.0 REFERENCE

ASTM 4750 —Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)

ASTM D6000 —Guide for Presentation of Water-Level Information from Ground-Water Sites

U.S. EPA (1986), RCRA Ground water Monitoring Technical Enforcement Guidance Document, Washington, D.C.

U.S. EPA (1992), RCRA Ground water Monitoring: Draft Technical Guidance, Washington, D.C. (EPA/530-R-93-001).

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manger (PM) is responsible to ensure that all activities performed by site personnel are performed safely, in compliance with all pertinent regulations and procedures, and provide the necessary equipment and resources to accomplish the tasks described in this procedure.

4.2 Local Health and Safety Officer (LHSO)

The Local Health and Safety Officer (LHSO), in consultation with the Corporate HSO and State project representatives, will designate the appropriate level of personnel protective equipment (PPE) for field personnel to safely accomplish their work.

4.3 Case Manager

The Case Manager (CM) is responsible for providing field personnel with a comprehensive fluid level gauging work plan/schedule. In addition, the PM or CM will provide field personnel with enough information to perform the work safely and correctly. This information should include the operational and safety procedures that are applicable to the work being performed.

4.4 Field Personnel

Field personnel are responsible for the safe completion of assigned tasks as described in the SOPs, Health and Safety Plan (HASP) and appropriate site-specific work plans and procedures. They are required to document the work

performed and to alert their immediate supervisors of any variances from procedures established in the above documents.

5.0 EQUIPMENT / MATERIALS

A number of devices are used by GES to collect water level measurements. Typical devices used are:

- Calibrated electronic water level indicators (e.g., solinst or slope indicator)
- Tape/ploppers
- Pressure transducers and dataloggers (generally for pumping tests and long-term monitoring)
- Stevens recorders for long-term monitoring

Devices typically used by GES to measure phase-separated compounds are:

- Electronic audible interface probe
- Clear bottom-loading bailers
- Weighted cotton string or cord

The pressure transducers, Stevens recorders, and oil/water interface probes have manuals which describe their use. This procedure will focus on an overview of this equipment and other methods which have more widespread use in fluid level measurement.

***Note**: Since many decisions concerning the distribution, transport, and remediation of groundwater contamination will be made on the basis of fluid level monitoring, the accuracy of the measurements made at an appropriate level of precision is very important.*

Typically, the precision required is +/-0.01 foot (+/-1 mm); the majority of GES' measuring devices are graduated to this precision level. To ensure accuracy, double check all fluid level readings; it is very easy to misread a tape or transpose figures when recording the data.

6.0 PREPARATION

Review and perform preparation activities per SOP FM 1.5, *General Instructions for Field Personnel.*

If the water-level data are being collected for the entire site, the Water-Level Measurement Field Sheet, obtained from the PM/CM, should be used (Attachment A). If the data are being collected during low flow ground water sampling, SOP FM 8.5, *Low Flow Groundwater Sampling Procedures* should be followed. If gauging activities are associated with other Site investigation activities the appropriate SOP will be reference accordingly.

Obtain a copy of previous water levels from the PM or CM.

The device used to measure water levels should attain an accuracy of 0.01 ft. A steel tape or an electric sounder can be used to measure water levels, but this SOP only concerns the use of an electric sounder.

When practical, the same portable water-level measurement device should be used for all measurements. However, in order to prevent cross contamination between monitor wells, the water-level indicators must be decontaminated according to SOP FM 14.1, *Decontamination of Dedicated Sampling Equipment*. If an indicator is dedicated to a particular section of the site, or a particular well, it should be marked accordingly.

Obtain and complete the Equipment Checklist (SOP FM 1.5, Attachment A) to confirm that all the necessary materials are available before proceeding.

Make sure water-level measuring equipment is in good operating condition.

Whenever possible, start at those wells that are the least contaminated and work towards more contaminated areas as indicated by the PM or CM.

Clean all equipment per SOP FM 14.1 before the initial and between each use.

7.0 PROCEDURE

Water-Level Measurement Procedure

Once the prior planning and preparation activities are completed, fluid level measurements can proceed. The typical series of events which will take place are:

- Well identification/inspection
- Air monitoring
- Reference point determination
- Level measurements
- Equipment decontamination

- Field note completion, review, and checking
- Equipment return
- Documentation submitted to appropriate staff and files

***Note**: Similar to sampling sequence, fluid level measurements should follow a logical order from the least known or suspected level of contamination to the greatest. This will minimize the potential for cross-contamination between wells/monitoring locations.*

Well Identification/Inspection

Once at the site and prior to fluid level measurements, confirm that the well to be measured has been correctly identified and located. Frequently sites under evaluation have numerous wells, or wells located in clusters such that identification errors can easily occur. The monitoring personnel should be alert to potential cap switching, mislabeled locations or unlabeled wells.

Proper well locations can be determined by comparison of the well log details to measured well details (i.e., total well depth, casing diameter, casing stick-up or stick-down distances), field ties and site plans.

Once the correct monitor well is identified, a thorough inspection shall be completed, and recorded in the field book. Determine if the cap and lock are secure or if they have been tampered with. If the well is unlocked, replace the lock. Any cracks in the protective casing and/or surface seal should be noted, as well as any subsidence or surface water ponding in the vicinity of the well.

Note the results of the well inspection (even if the well is in perfect condition) and inform the Project Coordinator of any well repairs required. Arrange to have any unmarked wells permanently stamped for proper identification. (A temporary marking at the time of monitoring should also be performed.)

Air Monitoring

Unlock and open the protective casing. Remove the well casing cap and monitor the breathing zone directly above the open cap with an organic vapor meter (SOP FM 16.4). Record vapor readings on the Water Level Measurement Field Sheet (Attachment A). Refer to the site-specific HASP if vapor readings are detected above 1.0 parts per million for more than a five minute period. Recording of extended air monitoring activities shall be conducted with the Air Monitoring Record, Real-Time Monitoring sheet (SOP FM 16.4).

Reference Point Determination

Use the top of the reference point as imprinted on the top of the well casing as the measuring reference point. If a reference point is not present, the north side of the well casing will be used as the reference point and marked on the well casing in a manner that can be referred to during future monitoring events (e.g., notch piping or write with permanent marker). This will be the point of measure (POM) to be used when obtaining water-level measurements. Any deviation from this measuring point must be documented on the Water-Level Measurement Field Sheet (Attachment A) and reported to PM or CM.

Level measurements

Measure the distance from the water surface to the POM by placing a steel indicator reference bar (or something comparatively straight and rigid) over the top of the well casing, then lower an electronic water-level indicator or equivalent (i.e., steel tape) into the sounding port as marked. When water is encountered, a light (usually red) will shine on the reel of the water-level indicator, and an intermittent beeping sound will be heard. Slowly move the line up and down along the side of the reference bar until the exact point at which the buzz is heard is located. A continuous beeping sound indicates a phase layer is confirmed. Using the bottom of the reference bar as the measuring point, obtain the depth-to-water measurement and phase layer measurement, if encountered, by referencing the markings on the water-level indicator line to the buzzing tone, red indicator light, or audible beeping sound. Note the reading. Compare the new measurement to previously measured water levels.

***Note**: Beware of watertight caps which provide an airtight seal on the casing end and the water level is positioned within the casing area (i.e., not within the screened interval). Often if this condition exists, a vacuum or pressurized zone is created within the casing section which supports or depresses the water column within the well casing, creating an artificially high or low water column. This effect can cause a few inches or feet of error in the static water level. Two or three water level measurements will confirm water level stability or changing conditions. Once the water level has stabilized (i.e., static) the proper measurement may be taken.*

Equipment decontamination

The water level indicator may then be removed and decontaminated in accordance to the Work Plan requirements.

Field note completion, review, and checking

Record measurement, date, and any notes next to the previous month's water level on the Water-Level Measurement Field Sheet (Attachment A). If the water-

level measurement seems suspect or if there is a 0.5 ft difference from the last reading, then re-check water-level measurement. Place a check mark next to the well ID on the Water-Level Measurement Field Sheet to indicate that the measurement was verified.

Report any measurement anomalies to the PM or CM. Secure well cap and lock the protective casing or cap.

Equipment return

After all equipment has been thoroughly cleaned and decontaminated, return to proper location and complete any necessary equipment forms.

Store water-level indicator in a clean, protected area during transport to the next well and after work is completed.

Documentation submitted to appropriate staff and files

Forward original Water-Level Measurement Field Sheet to PM or CM.

8.0 RECORDS

Field Notes

The field notes must document all the events, equipment used, and measurements collected during the sampling activities. The field notes must be legible and concise so that the entire sample event can be reconstructed later for future reference.

Record field notes in a standard bound survey-type field book issued for general note taking/field records and available from all GES equipment administrators. Make all field book entries black ink and make any changes/corrections with a single strikethrough line. Initial and date to indicate who made the change/ correction and when it was made.

Complete and submit a Water-Level Measurement Field Sheet.

9.0 FOLLOW-UP ACTIVITIES

Perform the following once field activities are complete.

APPENDIX C

Laboratory Reports

ANALYTICAL REPORT

May 07, 2018

GES, Inc. - Concord, CA

Sample Delivery Group:	L988695
Samples Received:	04/25/2018
Project Number:	3016007-800008-206□□
Description:	GWM 2Q18
Site:	4409 LAKE OTIS PKWY
Report To:	Kevin Halpin 5046 Commercial Circle, Ste. F Concord, CA 94520

Entire Report Reviewed By:

Brian Ford

Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

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MW-3A L988695-01 GW

			Collected by	Collected date/time	Received date/time
			K. Halpin	04/23/18 10:10	04/25/18 08:45

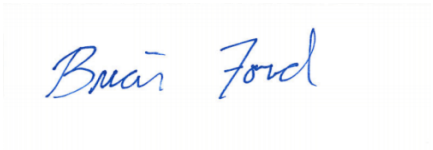
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8021/AK101	WG1103245	5	04/26/18 15:23	04/26/18 15:23	JHH
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1103382	1	04/27/18 00:54	04/27/18 00:54	ACE
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1103382	50	04/28/18 13:08	04/28/18 13:08	BMB
Semi-Volatile Organic Compounds (GC) by Method AK102/103	WG1103773	1	05/01/18 07:45	05/03/18 21:00	TH
Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM	WG1103656	1	04/27/18 07:28	04/27/18 15:17	DMG

TRIP BLANK L988695-02 GW

			Collected by	Collected date/time	Received date/time
			K. Halpin	04/23/18 00:00	04/25/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8021/AK101	WG1103245	1	04/26/18 13:58	04/26/18 13:58	JHH
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1103382	1	04/26/18 20:53	04/26/18 20:53	ACE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Brian Ford
Technical Service Representative

Volatile Organic Compounds (GC) by Method 8021/AK101

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
TPHGAK C6 to C10	8580		50.0	500	5	04/26/2018 15:23	WG1103245
(S) a,a,a-Trifluorotoluene(FID)	*167*	J1		*50.0-150*		*04/26/2018 15:23*	WG1103245

Sample Narrative:

L988695-01 WG1103245: Surrogate failure due to matrix interference.

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Acetone	121		10.0	50.0	1	04/27/2018 00:54	WG1103382
Acrolein	U		8.87	50.0	1	04/27/2018 00:54	WG1103382
Acrylonitrile	U		1.87	10.0	1	04/27/2018 00:54	WG1103382
Benzene	336		16.6	50.0	50	04/28/2018 13:08	WG1103382
Bromobenzene	U		0.352	1.00	1	04/27/2018 00:54	WG1103382
Bromodichloromethane	U		0.380	1.00	1	04/27/2018 00:54	WG1103382
Bromoform	U		0.469	1.00	1	04/27/2018 00:54	WG1103382
Bromomethane	U		0.866	5.00	1	04/27/2018 00:54	WG1103382
n-Butylbenzene	9.15		0.361	1.00	1	04/27/2018 00:54	WG1103382
sec-Butylbenzene	6.42		0.365	1.00	1	04/27/2018 00:54	WG1103382
tert-Butylbenzene	U		0.399	1.00	1	04/27/2018 00:54	WG1103382
Carbon tetrachloride	U		0.379	1.00	1	04/27/2018 00:54	WG1103382
Chlorobenzene	U		0.348	1.00	1	04/27/2018 00:54	WG1103382
Chlorodibromomethane	U		0.327	1.00	1	04/27/2018 00:54	WG1103382
Chloroethane	U		0.453	5.00	1	04/27/2018 00:54	WG1103382
Chloroform	U		0.324	5.00	1	04/27/2018 00:54	WG1103382
Chloromethane	0.316	J	0.276	2.50	1	04/27/2018 00:54	WG1103382
2-Chlorotoluene	U		0.375	1.00	1	04/27/2018 00:54	WG1103382
4-Chlorotoluene	U		0.351	1.00	1	04/27/2018 00:54	WG1103382
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/27/2018 00:54	WG1103382
1,2-Dibromoethane	U		0.381	1.00	1	04/27/2018 00:54	WG1103382
Dibromomethane	U		0.346	1.00	1	04/27/2018 00:54	WG1103382
1,2-Dichlorobenzene	U		0.349	1.00	1	04/27/2018 00:54	WG1103382
1,3-Dichlorobenzene	U		0.220	1.00	1	04/27/2018 00:54	WG1103382
1,4-Dichlorobenzene	U		0.274	1.00	1	04/27/2018 00:54	WG1103382
Dichlorodifluoromethane	U		0.551	5.00	1	04/27/2018 00:54	WG1103382
1,1-Dichloroethane	U		0.259	1.00	1	04/27/2018 00:54	WG1103382
1,2-Dichloroethane	20.7		0.361	1.00	1	04/27/2018 00:54	WG1103382
1,1-Dichloroethene	U		0.398	1.00	1	04/27/2018 00:54	WG1103382
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/27/2018 00:54	WG1103382
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/27/2018 00:54	WG1103382
1,2-Dichloropropane	U		0.306	1.00	1	04/27/2018 00:54	WG1103382
1,1-Dichloropropene	U		0.352	1.00	1	04/27/2018 00:54	WG1103382
1,3-Dichloropropane	U		0.366	1.00	1	04/27/2018 00:54	WG1103382
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/27/2018 00:54	WG1103382
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/27/2018 00:54	WG1103382
2,2-Dichloropropane	U		0.321	1.00	1	04/27/2018 00:54	WG1103382
Di-isopropyl ether	U		0.320	1.00	1	04/27/2018 00:54	WG1103382
Ethylbenzene	602		19.2	50.0	50	04/28/2018 13:08	WG1103382
Hexachloro-1,3-butadiene	U		0.256	1.00	1	04/27/2018 00:54	WG1103382
Isopropylbenzene	38.0		0.326	1.00	1	04/27/2018 00:54	WG1103382
p-Isopropyltoluene	12.2		0.350	1.00	1	04/27/2018 00:54	WG1103382
2-Butanone (MEK)	4.94	J	3.93	10.0	1	04/27/2018 00:54	WG1103382
Methylene Chloride	U		1.00	5.00	1	04/27/2018 00:54	WG1103382
4-Methyl-2-pentanone (MIBK)	2.17	J	2.14	10.0	1	04/27/2018 00:54	WG1103382
Methyl tert-butyl ether	U		0.367	1.00	1	04/27/2018 00:54	WG1103382

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Naphthalene	119		1.00	5.00	1	04/27/2018 00:54	WG1103382
n-Propylbenzene	112		0.349	1.00	1	04/27/2018 00:54	WG1103382
Styrene	U		0.307	1.00	1	04/27/2018 00:54	WG1103382
1,1,1,2-Tetrachloroethane	U		0.385	1.00	1	04/27/2018 00:54	WG1103382
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/27/2018 00:54	WG1103382
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/27/2018 00:54	WG1103382
Tetrachloroethene	0.832	J	0.372	1.00	1	04/27/2018 00:54	WG1103382
Toluene	1240		20.6	50.0	50	04/28/2018 13:08	WG1103382
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/27/2018 00:54	WG1103382
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/27/2018 00:54	WG1103382
1,1,1-Trichloroethane	U		0.319	1.00	1	04/27/2018 00:54	WG1103382
1,1,2-Trichloroethane	U		0.383	1.00	1	04/27/2018 00:54	WG1103382
Trichloroethene	U		0.398	1.00	1	04/27/2018 00:54	WG1103382
Trichlorofluoromethane	U		1.20	5.00	1	04/27/2018 00:54	WG1103382
1,2,3-Trichloropropane	U		0.807	2.50	1	04/27/2018 00:54	WG1103382
1,2,4-Trimethylbenzene	668		18.6	50.0	50	04/28/2018 13:08	WG1103382
1,2,3-Trimethylbenzene	109		0.321	1.00	1	04/27/2018 00:54	WG1103382
1,3,5-Trimethylbenzene	237		19.4	50.0	50	04/28/2018 13:08	WG1103382
Vinyl chloride	U		0.259	1.00	1	04/27/2018 00:54	WG1103382
Xylenes, Total	2520		53.0	150	50	04/28/2018 13:08	WG1103382
(S) Toluene-d8	*102*			*80.0-120*		*04/28/2018 13:08*	WG1103382
(S) Toluene-d8	*105*			*80.0-120*		*04/27/2018 00:54*	WG1103382
(S) Dibromofluoromethane	*109*			*76.0-123*		*04/28/2018 13:08*	WG1103382
(S) Dibromofluoromethane	*94.3*			*76.0-123*		*04/27/2018 00:54*	WG1103382
(S) 4-Bromofluorobenzene	*98.7*			*80.0-120*		*04/27/2018 00:54*	WG1103382
(S) 4-Bromofluorobenzene	*100*			*80.0-120*		*04/28/2018 13:08*	WG1103382

Semi-Volatile Organic Compounds (GC) by Method AK102/103

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
AK102 DRO C10-C25	2270		170	800	1	05/03/2018 21:00	WG1103773
AK103 RRO C25-C36	U	J4	460	800	1	05/03/2018 21:00	WG1103773
(S) o-Terphenyl	*102*			*50.0-150*		*05/03/2018 21:00*	WG1103773
(S) n-Triacontane d62	*60.5*			*50.0-150*		*05/03/2018 21:00*	WG1103773

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Anthracene	U		0.00800	0.0500	1	04/27/2018 15:17	WG1103656
Acenaphthene	0.0166	J	0.0100	0.0500	1	04/27/2018 15:17	WG1103656
Acenaphthylene	U		0.00700	0.0500	1	04/27/2018 15:17	WG1103656
Benzo(a)anthracene	U		0.00830	0.0500	1	04/27/2018 15:17	WG1103656
Benzo(a)pyrene	U		0.0158	0.0500	1	04/27/2018 15:17	WG1103656
Benzo(b)fluoranthene	0.00374	B J	0.00212	0.0500	1	04/27/2018 15:17	WG1103656
Benzo(g,h,i)perylene	0.00362	B J	0.00227	0.0500	1	04/27/2018 15:17	WG1103656
Benzo(k)fluoranthene	U	J3	0.0255	0.0500	1	04/27/2018 15:17	WG1103656
Chrysene	U		0.0144	0.0500	1	04/27/2018 15:17	WG1103656
Dibenz(a,h)anthracene	U		0.00454	0.0500	1	04/27/2018 15:17	WG1103656
Fluoranthene	U		0.0165	0.0500	1	04/27/2018 15:17	WG1103656
Fluorene	0.0128	J	0.00898	0.0500	1	04/27/2018 15:17	WG1103656
Indeno(1,2,3-cd)pyrene	U		0.00739	0.0500	1	04/27/2018 15:17	WG1103656
Naphthalene	66.3		0.0123	0.250	1	04/27/2018 15:17	WG1103656
Phenanthrene	U		0.0184	0.0500	1	04/27/2018 15:17	WG1103656
Pyrene	U		0.0155	0.0500	1	04/27/2018 15:17	WG1103656
1-Methylnaphthalene	7.49		0.0189	0.250	1	04/27/2018 15:17	WG1103656

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
2-Methylnaphthalene	13.3		0.0155	0.250	1	04/27/2018 15:17	WG1103656
2-Chloronaphthalene	0.0786	J	0.0165	0.250	1	04/27/2018 15:17	WG1103656
(S) Nitrobenzene-d5	*93.5*			*11.0-135*		*04/27/2018 15:17*	WG1103656
(S) 2-Fluorobiphenyl	*80.5*			*32.0-120*		*04/27/2018 15:17*	WG1103656
(S) p-Terphenyl-d14	*62.8*			*23.0-122*		*04/27/2018 15:17*	WG1103656

Volatile Organic Compounds (GC) by Method 8021/AK101

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
TPHGAK C6 to C10	33.5	B J	10.0	100	1	04/26/2018 13:58	WG1103245
(S) a,a,a-Trifluorotoluene(FID)	*104*			*50.0-150*		*04/26/2018 13:58*	WG1103245

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Acetone	17.1	J	10.0	50.0	1	04/26/2018 20:53	WG1103382
Acrolein	U		8.87	50.0	1	04/26/2018 20:53	WG1103382
Acrylonitrile	U		1.87	10.0	1	04/26/2018 20:53	WG1103382
Benzene	U		0.331	1.00	1	04/26/2018 20:53	WG1103382
Bromobenzene	U		0.352	1.00	1	04/26/2018 20:53	WG1103382
Bromodichloromethane	U		0.380	1.00	1	04/26/2018 20:53	WG1103382
Bromoform	U		0.469	1.00	1	04/26/2018 20:53	WG1103382
Bromomethane	U		0.866	5.00	1	04/26/2018 20:53	WG1103382
n-Butylbenzene	U		0.361	1.00	1	04/26/2018 20:53	WG1103382
sec-Butylbenzene	U		0.365	1.00	1	04/26/2018 20:53	WG1103382
tert-Butylbenzene	U		0.399	1.00	1	04/26/2018 20:53	WG1103382
Carbon tetrachloride	U		0.379	1.00	1	04/26/2018 20:53	WG1103382
Chlorobenzene	U		0.348	1.00	1	04/26/2018 20:53	WG1103382
Chlorodibromomethane	U		0.327	1.00	1	04/26/2018 20:53	WG1103382
Chloroethane	U		0.453	5.00	1	04/26/2018 20:53	WG1103382
Chloroform	U		0.324	5.00	1	04/26/2018 20:53	WG1103382
Chloromethane	U		0.276	2.50	1	04/26/2018 20:53	WG1103382
2-Chlorotoluene	U		0.375	1.00	1	04/26/2018 20:53	WG1103382
4-Chlorotoluene	U		0.351	1.00	1	04/26/2018 20:53	WG1103382
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/26/2018 20:53	WG1103382
1,2-Dibromoethane	U		0.381	1.00	1	04/26/2018 20:53	WG1103382
Dibromomethane	U		0.346	1.00	1	04/26/2018 20:53	WG1103382
1,2-Dichlorobenzene	U		0.349	1.00	1	04/26/2018 20:53	WG1103382
1,3-Dichlorobenzene	U		0.220	1.00	1	04/26/2018 20:53	WG1103382
1,4-Dichlorobenzene	U		0.274	1.00	1	04/26/2018 20:53	WG1103382
Dichlorodifluoromethane	U		0.551	5.00	1	04/26/2018 20:53	WG1103382
1,1-Dichloroethane	U		0.259	1.00	1	04/26/2018 20:53	WG1103382
1,2-Dichloroethane	U		0.361	1.00	1	04/26/2018 20:53	WG1103382
1,1-Dichloroethene	U		0.398	1.00	1	04/26/2018 20:53	WG1103382
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/26/2018 20:53	WG1103382
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/26/2018 20:53	WG1103382
1,2-Dichloropropane	U		0.306	1.00	1	04/26/2018 20:53	WG1103382
1,1-Dichloropropene	U		0.352	1.00	1	04/26/2018 20:53	WG1103382
1,3-Dichloropropane	U		0.366	1.00	1	04/26/2018 20:53	WG1103382
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/26/2018 20:53	WG1103382
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/26/2018 20:53	WG1103382
2,2-Dichloropropane	U		0.321	1.00	1	04/26/2018 20:53	WG1103382
Di-isopropyl ether	U		0.320	1.00	1	04/26/2018 20:53	WG1103382
Ethylbenzene	U		0.384	1.00	1	04/26/2018 20:53	WG1103382
Hexachloro-1,3-butadiene	U		0.256	1.00	1	04/26/2018 20:53	WG1103382
Isopropylbenzene	U		0.326	1.00	1	04/26/2018 20:53	WG1103382
p-Isopropyltoluene	U		0.350	1.00	1	04/26/2018 20:53	WG1103382
2-Butanone (MEK)	U		3.93	10.0	1	04/26/2018 20:53	WG1103382
Methylene Chloride	U		1.00	5.00	1	04/26/2018 20:53	WG1103382
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0	1	04/26/2018 20:53	WG1103382
Methyl tert-butyl ether	U		0.367	1.00	1	04/26/2018 20:53	WG1103382
Naphthalene	U		1.00	5.00	1	04/26/2018 20:53	WG1103382
n-Propylbenzene	U		0.349	1.00	1	04/26/2018 20:53	WG1103382
Styrene	U		0.307	1.00	1	04/26/2018 20:53	WG1103382

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
1,1,1,2-Tetrachloroethane	U		0.385	1.00	1	04/26/2018 20:53	WG1103382
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/26/2018 20:53	WG1103382
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/26/2018 20:53	WG1103382
Tetrachloroethene	U		0.372	1.00	1	04/26/2018 20:53	WG1103382
Toluene	U		0.412	1.00	1	04/26/2018 20:53	WG1103382
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/26/2018 20:53	WG1103382
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/26/2018 20:53	WG1103382
1,1,1-Trichloroethane	U		0.319	1.00	1	04/26/2018 20:53	WG1103382
1,1,2-Trichloroethane	U		0.383	1.00	1	04/26/2018 20:53	WG1103382
Trichloroethene	U		0.398	1.00	1	04/26/2018 20:53	WG1103382
Trichlorofluoromethane	U		1.20	5.00	1	04/26/2018 20:53	WG1103382
1,2,3-Trichloropropane	U		0.807	2.50	1	04/26/2018 20:53	WG1103382
1,2,4-Trimethylbenzene	U		0.373	1.00	1	04/26/2018 20:53	WG1103382
1,2,3-Trimethylbenzene	U		0.321	1.00	1	04/26/2018 20:53	WG1103382
1,3,5-Trimethylbenzene	U		0.387	1.00	1	04/26/2018 20:53	WG1103382
Vinyl chloride	U		0.259	1.00	1	04/26/2018 20:53	WG1103382
Xylenes, Total	U		1.06	3.00	1	04/26/2018 20:53	WG1103382
(S) Toluene-d8	*100*			*80.0-120*		*04/26/2018 20:53*	WG1103382
(S) Dibromofluoromethane	*106*			*76.0-123*		*04/26/2018 20:53*	WG1103382
(S) 4-Bromofluorobenzene	*102*			*80.0-120*		*04/26/2018 20:53*	WG1103382

Method Blank (MB)

(MB) R3306062-3 04/26/18 12:03

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
TPHGAK C6 to C10	28.3	J	10.0	100
(S) a,a,a-Trifluorotoluene(FID)	*104*			*50.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3306062-2 04/26/18 11:16 • (LCSD) R3306062-5 04/26/18 16:57

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TPHGAK C6 to C10	400	381	356	95.2	89.0	60.0-120			6.82	20
(S) a,a,a-Trifluorotoluene(FID)				*103*	*104*	*50.0-150*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3305436-3 04/26/18 19:53

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Acetone	U		10.0	50.0
Acrolein	U		8.87	50.0
Acrylonitrile	U		1.87	10.0
Benzene	U		0.331	1.00
Bromobenzene	U		0.352	1.00
Bromodichloromethane	U		0.380	1.00
Bromoform	U		0.469	1.00
Bromomethane	U		0.866	5.00
n-Butylbenzene	U		0.361	1.00
sec-Butylbenzene	U		0.365	1.00
tert-Butylbenzene	U		0.399	1.00
Carbon tetrachloride	U		0.379	1.00
Chlorobenzene	U		0.348	1.00
Chlorodibromomethane	U		0.327	1.00
Chloroethane	U		0.453	5.00
Chloroform	U		0.324	5.00
Chloromethane	U		0.276	2.50
2-Chlorotoluene	U		0.375	1.00
4-Chlorotoluene	U		0.351	1.00
1,2-Dibromo-3-Chloropropane	U		1.33	5.00
1,2-Dibromoethane	U		0.381	1.00
Dibromomethane	U		0.346	1.00
1,2-Dichlorobenzene	U		0.349	1.00
1,3-Dichlorobenzene	U		0.220	1.00
1,4-Dichlorobenzene	U		0.274	1.00
Dichlorodifluoromethane	U		0.551	5.00
1,1-Dichloroethane	U		0.259	1.00
1,2-Dichloroethane	U		0.361	1.00
1,1-Dichloroethene	U		0.398	1.00
cis-1,2-Dichloroethene	U		0.260	1.00
trans-1,2-Dichloroethene	U		0.396	1.00
1,2-Dichloropropane	U		0.306	1.00
1,1-Dichloropropene	U		0.352	1.00
1,3-Dichloropropane	U		0.366	1.00
cis-1,3-Dichloropropene	U		0.418	1.00
trans-1,3-Dichloropropene	U		0.419	1.00
2,2-Dichloropropane	U		0.321	1.00
Di-isopropyl ether	U		0.320	1.00
Ethylbenzene	U		0.384	1.00
Hexachloro-1,3-butadiene	0.395	J	0.256	1.00

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3305436-3 04/26/18 19:53

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Isopropylbenzene	U		0.326	1.00
p-Isopropyltoluene	U		0.350	1.00
2-Butanone (MEK)	U		3.93	10.0
Methylene Chloride	U		1.00	5.00
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0
Methyl tert-butyl ether	U		0.367	1.00
Naphthalene	U		1.00	5.00
n-Propylbenzene	U		0.349	1.00
Styrene	U		0.307	1.00
1,1,1,2-Tetrachloroethane	U		0.385	1.00
1,1,2,2-Tetrachloroethane	U		0.130	1.00
Tetrachloroethene	U		0.372	1.00
Toluene	U		0.412	1.00
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00
1,2,3-Trichlorobenzene	U		0.230	1.00
1,2,4-Trichlorobenzene	U		0.355	1.00
1,1,1-Trichloroethane	U		0.319	1.00
1,1,2-Trichloroethane	U		0.383	1.00
Trichloroethene	U		0.398	1.00
Trichlorofluoromethane	U		1.20	5.00
1,2,3-Trichloropropane	U		0.807	2.50
1,2,3-Trimethylbenzene	U		0.321	1.00
1,2,4-Trimethylbenzene	U		0.373	1.00
1,3,5-Trimethylbenzene	U		0.387	1.00
Vinyl chloride	U		0.259	1.00
Xylenes, Total	U		1.06	3.00
(S) Toluene-d8	*98.9*			*80.0-120*
(S) Dibromofluoromethane	*107*			*76.0-123*
(S) 4-Bromofluorobenzene	*105*			*80.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3305436-1 04/26/18 18:53 • (LCSD) R3305436-2 04/26/18 19:13

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	125	165	158	132	126	10.0-160			4.31	23
Acrolein	125	105	106	84.4	84.4	10.0-160			0.101	20
Acrylonitrile	125	141	137	113	110	60.0-142			2.68	20
Benzene	25.0	25.0	23.7	99.8	94.6	69.0-123			5.37	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3305436-1 04/26/18 18:53 • (LCSD) R3305436-2 04/26/18 19:13

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Bromobenzene	25.0	22.3	22.2	89.3	88.7	79.0-120			0.687	20
Bromodichloromethane	25.0	25.1	24.3	100	97.4	76.0-120			2.94	20
Bromoform	25.0	25.4	25.6	102	103	67.0-132			1.02	20
Bromomethane	25.0	31.3	28.9	125	116	18.0-160			7.95	20
n-Butylbenzene	25.0	23.8	22.7	95.3	90.7	72.0-126			4.90	20
sec-Butylbenzene	25.0	24.6	23.5	98.3	93.9	74.0-121			4.53	20
tert-Butylbenzene	25.0	24.2	23.4	96.9	93.6	75.0-122			3.49	20
Carbon tetrachloride	25.0	25.4	22.7	102	90.8	63.0-122			11.3	20
Chlorobenzene	25.0	23.1	22.5	92.4	89.8	79.0-121			2.76	20
Chlorodibromomethane	25.0	24.1	24.0	96.3	95.9	75.0-125			0.380	20
Chloroethane	25.0	30.3	28.3	121	113	47.0-152			6.83	20
Chloroform	25.0	24.3	22.7	97.4	90.9	72.0-121			6.80	20
Chloromethane	25.0	25.7	23.8	103	95.1	48.0-139			7.61	20
2-Chlorotoluene	25.0	23.5	22.9	94.0	91.5	74.0-122			2.66	20
4-Chlorotoluene	25.0	23.7	23.5	94.8	93.8	79.0-120			1.00	20
1,2-Dibromo-3-Chloropropane	25.0	23.9	23.4	95.4	93.8	64.0-127			1.71	20
1,2-Dibromoethane	25.0	23.6	23.7	94.4	94.8	77.0-123			0.343	20
Dibromomethane	25.0	25.2	24.4	101	97.6	78.0-120			3.23	20
1,2-Dichlorobenzene	25.0	23.3	22.6	93.1	90.2	80.0-120			3.20	20
1,3-Dichlorobenzene	25.0	23.6	23.1	94.6	92.3	72.0-123			2.45	20
1,4-Dichlorobenzene	25.0	22.6	22.2	90.5	88.9	77.0-120			1.88	20
Dichlorodifluoromethane	25.0	24.8	22.6	99.1	90.4	49.0-155			9.20	20
1,1-Dichloroethane	25.0	24.8	23.2	99.2	92.6	70.0-126			6.85	20
1,2-Dichloroethane	25.0	24.3	23.5	97.3	94.1	67.0-126			3.34	20
1,1-Dichloroethene	25.0	25.4	23.0	102	92.0	64.0-129			9.95	20
cis-1,2-Dichloroethene	25.0	24.3	22.7	97.0	90.6	73.0-120			6.81	20
trans-1,2-Dichloroethene	25.0	24.3	22.0	97.2	87.9	71.0-121			10.1	20
1,2-Dichloropropane	25.0	23.9	23.0	95.5	91.9	75.0-125			3.86	20
1,1-Dichloropropene	25.0	25.0	23.7	100	94.9	71.0-129			5.30	20
1,3-Dichloropropane	25.0	23.1	23.6	92.4	94.3	80.0-121			2.08	20
cis-1,3-Dichloropropene	25.0	23.8	23.7	95.0	94.9	79.0-123			0.142	20
trans-1,3-Dichloropropene	25.0	23.7	24.0	94.8	95.9	74.0-127			1.18	20
2,2-Dichloropropane	25.0	25.3	23.1	101	92.3	60.0-125			9.36	20
Di-isopropyl ether	25.0	26.2	25.6	105	102	59.0-133			2.51	20
Ethylbenzene	25.0	22.9	22.1	91.8	88.4	77.0-120			3.75	20
Hexachloro-1,3-butadiene	25.0	19.8	20.7	79.4	82.9	64.0-131			4.38	20
Isopropylbenzene	25.0	24.6	24.0	98.4	96.1	75.0-120			2.38	20
p-Isopropyltoluene	25.0	25.1	23.6	101	94.3	74.0-126			6.42	20
2-Butanone (MEK)	125	146	149	117	119	37.0-158			1.87	20
Methylene Chloride	25.0	25.7	24.4	103	97.5	66.0-121			5.46	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3305436-1 04/26/18 18:53 • (LCSD) R3305436-2 04/26/18 19:13

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
4-Methyl-2-pentanone (MIBK)	125	139	138	111	110	59.0-143			0.694	20
Methyl tert-butyl ether	25.0	25.6	24.8	102	99.2	64.0-123			3.08	20
Naphthalene	25.0	19.5	21.0	77.8	83.9	62.0-128			7.49	20
n-Propylbenzene	25.0	24.1	23.5	96.6	94.0	79.0-120			2.70	20
Styrene	25.0	24.4	24.1	97.7	96.4	78.0-124			1.38	20
1,1,1,2-Tetrachloroethane	25.0	24.0	23.4	96.2	93.4	75.0-122			2.94	20
1,1,2,2-Tetrachloroethane	25.0	23.8	24.0	95.0	95.8	71.0-122			0.839	20
Tetrachloroethene	25.0	23.7	22.9	94.9	91.5	70.0-127			3.66	20
Toluene	25.0	24.0	23.0	95.8	92.0	77.0-120			4.05	20
1,1,2-Trichlorotrifluoroethane	25.0	25.2	23.0	101	92.1	61.0-136			9.15	20
1,2,3-Trichlorobenzene	25.0	19.5	20.2	78.1	80.8	61.0-133			3.39	20
1,2,4-Trichlorobenzene	25.0	19.4	21.0	77.5	84.0	69.0-129			8.07	20
1,1,1-Trichloroethane	25.0	25.1	23.0	100	92.1	68.0-122			8.62	20
1,1,2-Trichloroethane	25.0	23.6	23.6	94.4	94.5	78.0-120			0.117	20
Trichloroethene	25.0	23.8	22.7	95.3	90.9	78.0-120			4.73	20
Trichlorofluoromethane	25.0	26.6	24.3	106	97.3	56.0-137			9.04	20
1,2,3-Trichloropropane	25.0	23.3	24.1	93.2	96.5	72.0-124			3.54	20
1,2,3-Trimethylbenzene	25.0	23.3	22.9	93.3	91.7	75.0-120			1.75	20
1,2,4-Trimethylbenzene	25.0	24.5	23.9	98.2	95.6	75.0-120			2.65	20
1,3,5-Trimethylbenzene	25.0	24.4	23.9	97.6	95.5	75.0-120			2.20	20
Vinyl chloride	25.0	26.0	23.6	104	94.4	64.0-133			9.83	20
Xylenes, Total	75.0	71.5	68.2	95.3	90.9	77.0-120			4.72	20
(S) Toluene-d8				*100*	*99.1*	*80.0-120*				
(S) Dibromofluoromethane				*102*	*98.1*	*76.0-123*				
(S) 4-Bromofluorobenzene				*97.3*	*99.9*	*80.0-120*				

Method Blank (MB)

(MB) R3307016-1 05/03/18 19:19

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
AK102 DRO C10-C25	U		170	800
AK103 RRO C25-C36	U		460	800
(S) n-Triacontane d62	*67.2*			*50.0-150*
(S) o-Terphenyl	*96.4*			*50.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3307016-2 05/03/18 19:39 • (LCSD) R3307016-4 05/03/18 20:20

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
AK102 DRO C10-C25	3000	2800	2860	93.3	95.2	75.0-125			2.04	20
(S) o-Terphenyl				*88.4*	*93.9*	*50.0-150*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3307016-3 05/03/18 20:00 • (LCSD) R3307016-5 05/03/18 20:40

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
AK103 RRO C25-C36	3000	3890	4080	130	136	60.0-120	J4	J4	4.69	20
(S) n-Triacontane d62				*47.9*	*47.1*	*50.0-150*	J2	J2		

Method Blank (MB)

(MB) R3305487-3 04/27/18 14:34

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Anthracene	U		0.00800	0.0500
Acenaphthene	U		0.0100	0.0500
Acenaphthylene	U		0.00700	0.0500
Benzo(a)anthracene	U		0.00830	0.0500
Benzo(a)pyrene	U		0.0158	0.0500
Benzo(b)fluoranthene	0.00276	J	0.00212	0.0500
Benzo(g,h,i)perylene	0.00268	J	0.00227	0.0500
Benzo(k)fluoranthene	U		0.0255	0.0500
Chrysene	U		0.0144	0.0500
Dibenz(a,h)anthracene	U		0.00454	0.0500
Fluoranthene	U		0.0165	0.0500
Fluorene	U		0.00898	0.0500
Indeno(1,2,3-cd)pyrene	U		0.00739	0.0500
Naphthalene	0.0226	J	0.0123	0.250
Phenanthrene	U		0.0184	0.0500
Pyrene	U		0.0155	0.0500
1-Methylnaphthalene	U		0.0189	0.250
2-Methylnaphthalene	U		0.0155	0.250
2-Chloronaphthalene	U		0.0165	0.250
(S) Nitrobenzene-d5	*82.6*			*11.0-135*
(S) 2-Fluorobiphenyl	*82.0*			*32.0-120*
(S) p-Terphenyl-d14	*88.6*			*23.0-122*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3305487-1 04/27/18 13:28 • (LCSD) R3305487-2 04/27/18 13:50

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Anthracene	2.00	1.54	1.83	76.8	91.7	51.0-120			17.7	20
Acenaphthene	2.00	1.43	1.71	71.7	85.5	50.0-120			17.5	20
Acenaphthylene	2.00	1.56	1.86	77.8	93.1	49.0-120			18.0	20
Benzo(a)anthracene	2.00	1.52	1.81	75.8	90.5	49.0-120			17.7	20
Benzo(a)pyrene	2.00	1.53	1.83	76.4	91.3	50.0-122			17.7	20
Benzo(b)fluoranthene	2.00	1.53	1.71	76.3	85.4	48.0-120			11.3	22
Benzo(g,h,i)perylene	2.00	1.46	1.66	73.1	82.8	38.0-126			12.4	22
Benzo(k)fluoranthene	2.00	1.45	1.85	72.6	92.5	48.0-120		J3	24.1	22
Chrysene	2.00	1.46	1.75	73.1	87.5	51.0-120			18.0	20
Dibenz(a,h)anthracene	2.00	1.50	1.67	75.2	83.3	30.0-130			10.3	26
Fluoranthene	2.00	1.53	1.81	76.7	90.4	50.0-121			16.4	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3305487-1 04/27/18 13:28 • (LCSD) R3305487-2 04/27/18 13:50

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Fluorene	2.00	1.48	1.76	74.0	88.2	48.0-120			17.5	20
Indeno(1,2,3-cd)pyrene	2.00	1.53	1.75	76.6	87.7	39.0-125			13.5	21
Naphthalene	2.00	1.37	1.62	68.3	80.9	46.0-120			16.9	20
Phenanthrene	2.00	1.45	1.76	72.4	88.2	50.0-120			19.6	20
Pyrene	2.00	1.49	1.78	74.3	89.0	49.0-127			18.0	20
1-Methylnaphthalene	2.00	1.41	1.68	70.7	83.9	50.0-120			17.0	20
2-Methylnaphthalene	2.00	1.32	1.58	66.1	79.1	49.0-120			17.9	20
2-Chloronaphthalene	2.00	1.38	1.66	69.2	83.1	46.0-120			18.2	20
(S) Nitrobenzene-d5				*78.9*	*96.1*	*11.0-135*				
(S) 2-Fluorobiphenyl				*72.0*	*88.4*	*32.0-120*				
(S) p-Terphenyl-d14				*80.0*	*94.9*	*23.0-122*				

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
B	The same analyte is found in the associated blank.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.

ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by ESC Lab Sciences.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T 104704245-17-14
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

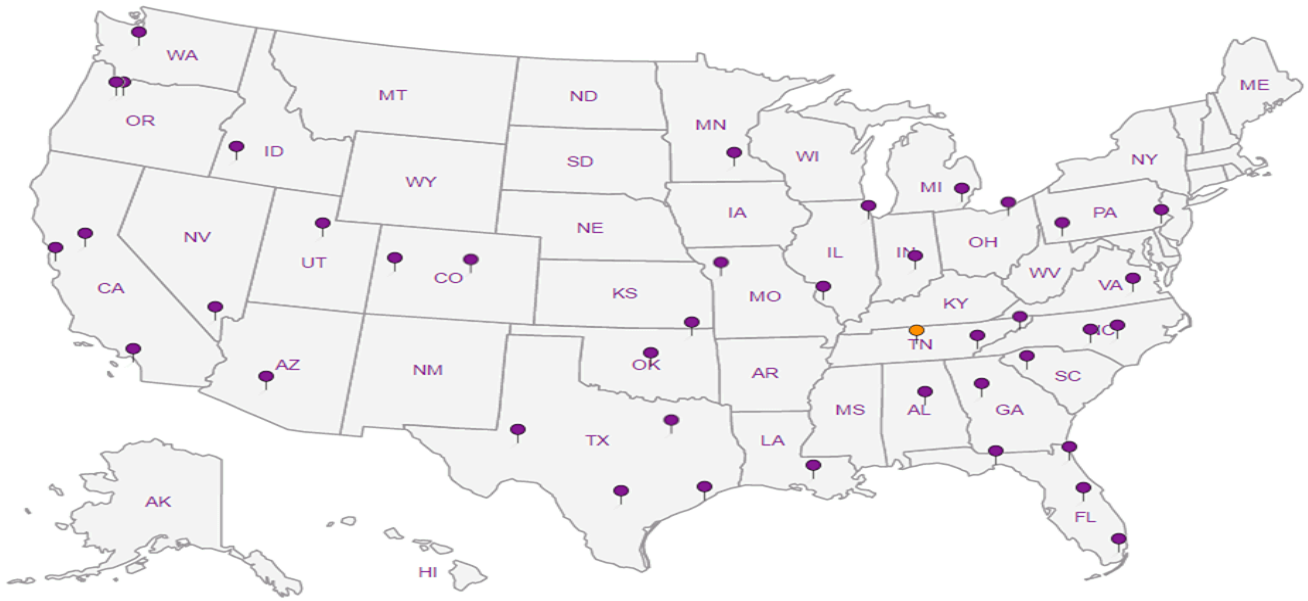
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. ESC Lab Sciences performs all testing at our central laboratory.



GES, Inc. - Concord, CA

5046 Commercial Circle, Ste. F
Concord, CA 94520

Billing Information:
GES Accounts Payable
440 Creamery Way
Ste. 500
Exton, PA 19341

Report to: Kevin Halpin

Email To: khalpin@gesonline.com; mpeterson@gesonline.com

Project Description: GWM 2018

City/State Collected: Anchorage, AK

Phone: 866-507-1411
Fax: 925-825-2021

Client Project # 3016007-800008-206

Lab Project # GESCCA-ANCHORAGE

Collected by (print): K. Halpin

Site/Facility ID # 4409 LAKE OTIS PKWY

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	8270PAHSIMD PAH 100ml Amb-NoPres	AK101 40mlAmb HCl	AK102/103 100ml Amb HCl	V8260 VOCs 40mlAmb-HCl	trip blk AK101 40mlAmb-HCl-Blk	trip blk V8260 VOCs 40mlAmb-HCl-Blk					Remarks	Sample # (lab only)
MW-1A		GW				10	X	X	X	X								
MW-3A	G	GW		4/23/18	1010	10	X	X	X	X								-01
DUP-1		GW				10	X	X	X	X								
		GW				10	X	X	X	X								
TRIP BLANK		GW				2					X	X						-02

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking # 4386 6862 9463

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	4/23/18	1700	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)
			801

Trip Blank Received: Yes / No
2 HCL / MeoH
TBR

Temp: 1.4 °C Bottles Received: 10

Date: 4/25/18 Time: 8:45

If preservation required by Login: Date/Time
pH adj. in lab @ 1824 on 4/25

Hold:

Condition: NCF / OK

Sample Receipt Checklist
COC Seal Present/Intact: NP ✓Y __N
COC Signed/Accurate: ✓Y __N
Bottles arrive intact: ✓Y __N
Correct bottles used: ✓Y __N
Sufficient volume sent: ✓Y __N
If Applicable
VOA Zero Headspace: ✓Y __N
Preservation Correct/Checked: ✓Y __N

Chain of Custody Page 1 of 1

ESC LABORATORY SCIENCES
a subsidiary of Pace Analytical

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# L988695
D099

Acctnum: GESCCA
Template: T135050
Prelogin: P648609
TSR: 110 - Brian Ford
PB: JB 4-16-18
Shipped Via: FedEx 2nd Day

ANALYTICAL REPORT

May 15, 2018

GES, Inc. - Concord, CA

Sample Delivery Group:	L989743
Samples Received:	04/28/2018
Project Number:	3016007-800008-206
Description:	2018 GWM
Site:	4409 LAKE OTIS PKWAY
Report To:	Kevin Halpin 5046 Commercial Circle, Ste. F Concord, CA 94520

Entire Report Reviewed By:

Jason Romer
Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

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MW-1A L989743-01 GW

			Collected by	Collected date/time	Received date/time
			K. Halpin	04/26/18 16:00	04/28/18 08:45
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8021/AK101	WG1105157	1	05/01/18 18:12	05/01/18 18:12	BMB
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1104815	1	04/30/18 17:18	04/30/18 17:18	JCP
Semi-Volatile Organic Compounds (GC) by Method AK102/103	WG1105542	1	05/07/18 07:43	05/14/18 21:54	MTJ
Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM	WG1104916	1	05/03/18 02:11	05/03/18 16:07	KM

DUP-1 L989743-02 GW

			Collected by	Collected date/time	Received date/time
			K. Halpin	04/26/18 16:05	04/28/18 08:45
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8021/AK101	WG1105157	1	05/01/18 18:36	05/01/18 18:36	BMB
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1104815	1	04/30/18 17:39	04/30/18 17:39	JCP
Semi-Volatile Organic Compounds (GC) by Method AK102/103	WG1105542	1	05/07/18 07:43	05/14/18 22:15	MTJ
Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM	WG1104916	1	05/03/18 02:11	05/03/18 16:28	KM

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jason Romer
Technical Service Representative

Volatile Organic Compounds (GC) by Method 8021/AK101

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
TPHGAK C6 to C10	50.6	B J	10.0	100	1	05/01/2018 18:12	WG1105157
Benzene	U		0.190	0.500	1	05/01/2018 18:12	WG1105157
Toluene	18.3		0.412	1.00	1	05/01/2018 18:12	WG1105157
Ethylbenzene	U		0.160	0.500	1	05/01/2018 18:12	WG1105157
Total Xylene	U		0.510	1.50	1	05/01/2018 18:12	WG1105157
Methyl tert-butyl ether	U		0.340	5.00	1	05/01/2018 18:12	WG1105157
(S) a,a,a-Trifluorotoluene(FID)	*98.5*			*50.0-150*		*05/01/2018 18:12*	WG1105157
(S) a,a,a-Trifluorotoluene(PID)	*101*			*80.0-121*		*05/01/2018 18:12*	WG1105157

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Acetone	U	J3	10.0	50.0	1	04/30/2018 17:18	WG1104815
Acrolein	U	J3	8.87	50.0	1	04/30/2018 17:18	WG1104815
Acrylonitrile	U	J3	1.87	10.0	1	04/30/2018 17:18	WG1104815
Benzene	U		0.331	1.00	1	04/30/2018 17:18	WG1104815
Bromobenzene	U		0.352	1.00	1	04/30/2018 17:18	WG1104815
Bromodichloromethane	U		0.380	1.00	1	04/30/2018 17:18	WG1104815
Bromoform	U		0.469	1.00	1	04/30/2018 17:18	WG1104815
Bromomethane	U		0.866	5.00	1	04/30/2018 17:18	WG1104815
n-Butylbenzene	U		0.361	1.00	1	04/30/2018 17:18	WG1104815
sec-Butylbenzene	U		0.365	1.00	1	04/30/2018 17:18	WG1104815
tert-Butylbenzene	U		0.399	1.00	1	04/30/2018 17:18	WG1104815
Carbon tetrachloride	U		0.379	1.00	1	04/30/2018 17:18	WG1104815
Chlorobenzene	U		0.348	1.00	1	04/30/2018 17:18	WG1104815
Chlorodibromomethane	U		0.327	1.00	1	04/30/2018 17:18	WG1104815
Chloroethane	U		0.453	5.00	1	04/30/2018 17:18	WG1104815
Chloroform	U		0.324	5.00	1	04/30/2018 17:18	WG1104815
Chloromethane	U		0.276	2.50	1	04/30/2018 17:18	WG1104815
2-Chlorotoluene	U		0.375	1.00	1	04/30/2018 17:18	WG1104815
4-Chlorotoluene	U		0.351	1.00	1	04/30/2018 17:18	WG1104815
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/30/2018 17:18	WG1104815
1,2-Dibromoethane	U		0.381	1.00	1	04/30/2018 17:18	WG1104815
Dibromomethane	U		0.346	1.00	1	04/30/2018 17:18	WG1104815
1,2-Dichlorobenzene	U		0.349	1.00	1	04/30/2018 17:18	WG1104815
1,3-Dichlorobenzene	U		0.220	1.00	1	04/30/2018 17:18	WG1104815
1,4-Dichlorobenzene	U		0.274	1.00	1	04/30/2018 17:18	WG1104815
Dichlorodifluoromethane	U		0.551	5.00	1	04/30/2018 17:18	WG1104815
1,1-Dichloroethane	U		0.259	1.00	1	04/30/2018 17:18	WG1104815
1,2-Dichloroethane	U		0.361	1.00	1	04/30/2018 17:18	WG1104815
1,1-Dichloroethene	U		0.398	1.00	1	04/30/2018 17:18	WG1104815
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/30/2018 17:18	WG1104815
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/30/2018 17:18	WG1104815
1,2-Dichloropropane	U		0.306	1.00	1	04/30/2018 17:18	WG1104815
1,1-Dichloropropene	U		0.352	1.00	1	04/30/2018 17:18	WG1104815
1,3-Dichloropropane	U		0.366	1.00	1	04/30/2018 17:18	WG1104815
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/30/2018 17:18	WG1104815
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/30/2018 17:18	WG1104815
2,2-Dichloropropane	U		0.321	1.00	1	04/30/2018 17:18	WG1104815
Di-isopropyl ether	U		0.320	1.00	1	04/30/2018 17:18	WG1104815
Ethylbenzene	U		0.384	1.00	1	04/30/2018 17:18	WG1104815
Hexachloro-1,3-butadiene	U		0.256	1.00	1	04/30/2018 17:18	WG1104815
Isopropylbenzene	U		0.326	1.00	1	04/30/2018 17:18	WG1104815
p-Isopropyltoluene	U		0.350	1.00	1	04/30/2018 17:18	WG1104815

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
2-Butanone (MEK)	U	J3	3.93	10.0	1	04/30/2018 17:18	WG1104815
Methylene Chloride	U		1.00	5.00	1	04/30/2018 17:18	WG1104815
4-Methyl-2-pentanone (MIBK)	2.42	J	2.14	10.0	1	04/30/2018 17:18	WG1104815
Methyl tert-butyl ether	U		0.367	1.00	1	04/30/2018 17:18	WG1104815
Naphthalene	U		1.00	5.00	1	04/30/2018 17:18	WG1104815
n-Propylbenzene	U		0.349	1.00	1	04/30/2018 17:18	WG1104815
Styrene	U		0.307	1.00	1	04/30/2018 17:18	WG1104815
1,1,1,2-Tetrachloroethane	U		0.385	1.00	1	04/30/2018 17:18	WG1104815
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/30/2018 17:18	WG1104815
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/30/2018 17:18	WG1104815
Tetrachloroethene	U		0.372	1.00	1	04/30/2018 17:18	WG1104815
Toluene	21.8		0.412	1.00	1	04/30/2018 17:18	WG1104815
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/30/2018 17:18	WG1104815
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/30/2018 17:18	WG1104815
1,1,1-Trichloroethane	U		0.319	1.00	1	04/30/2018 17:18	WG1104815
1,1,2-Trichloroethane	U		0.383	1.00	1	04/30/2018 17:18	WG1104815
Trichloroethene	U		0.398	1.00	1	04/30/2018 17:18	WG1104815
Trichlorofluoromethane	U		1.20	5.00	1	04/30/2018 17:18	WG1104815
1,2,3-Trichloropropane	U		0.807	2.50	1	04/30/2018 17:18	WG1104815
1,2,4-Trimethylbenzene	U		0.373	1.00	1	04/30/2018 17:18	WG1104815
1,2,3-Trimethylbenzene	U		0.321	1.00	1	04/30/2018 17:18	WG1104815
1,3,5-Trimethylbenzene	U		0.387	1.00	1	04/30/2018 17:18	WG1104815
Vinyl chloride	U		0.259	1.00	1	04/30/2018 17:18	WG1104815
Xylenes, Total	U		1.06	3.00	1	04/30/2018 17:18	WG1104815
(S) Toluene-d8	*104*			*80.0-120*		*04/30/2018 17:18*	WG1104815
(S) Dibromofluoromethane	*114*			*76.0-123*		*04/30/2018 17:18*	WG1104815
(S) 4-Bromofluorobenzene	*108*			*80.0-120*		*04/30/2018 17:18*	WG1104815

Semi-Volatile Organic Compounds (GC) by Method AK102/103

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
AK102 DRO C10-C25	1800		170	800	1	05/14/2018 21:54	WG1105542
AK103 RRO C25-C36	4150		460	800	1	05/14/2018 21:54	WG1105542
(S) o-Terphenyl	*95.1*			*50.0-150*		*05/14/2018 21:54*	WG1105542
(S) n-Triacontane d62	*73.5*			*50.0-150*		*05/14/2018 21:54*	WG1105542

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Anthracene	U		0.00800	0.0500	1	05/03/2018 16:07	WG1104916
Acenaphthene	U		0.0100	0.0500	1	05/03/2018 16:07	WG1104916
Acenaphthylene	U		0.00700	0.0500	1	05/03/2018 16:07	WG1104916
Benzo(a)anthracene	U		0.00830	0.0500	1	05/03/2018 16:07	WG1104916
Benzo(a)pyrene	U		0.0158	0.0500	1	05/03/2018 16:07	WG1104916
Benzo(b)fluoranthene	0.0293	B J	0.00212	0.0500	1	05/03/2018 16:07	WG1104916
Benzo(g,h,i)perylene	0.0483	B J	0.00227	0.0500	1	05/03/2018 16:07	WG1104916
Benzo(k)fluoranthene	U		0.0255	0.0500	1	05/03/2018 16:07	WG1104916
Chrysene	0.0224	J	0.0144	0.0500	1	05/03/2018 16:07	WG1104916
Dibenz(a,h)anthracene	U		0.00454	0.0500	1	05/03/2018 16:07	WG1104916
Fluoranthene	0.0417	J	0.0165	0.0500	1	05/03/2018 16:07	WG1104916
Fluorene	U		0.00898	0.0500	1	05/03/2018 16:07	WG1104916
Indeno(1,2,3-cd)pyrene	0.0150	B J	0.00739	0.0500	1	05/03/2018 16:07	WG1104916
Naphthalene	0.0656	J	0.0123	0.250	1	05/03/2018 16:07	WG1104916
Phenanthrene	0.0234	J	0.0184	0.0500	1	05/03/2018 16:07	WG1104916
Pyrene	0.0776		0.0155	0.0500	1	05/03/2018 16:07	WG1104916

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
1-Methylnaphthalene	U		0.0189	0.250	1	05/03/2018 16:07	WG1104916
2-Methylnaphthalene	U		0.0155	0.250	1	05/03/2018 16:07	WG1104916
2-Chloronaphthalene	U		0.0165	0.250	1	05/03/2018 16:07	WG1104916
(S) Nitrobenzene-d5	*73.0*			*11.0-135*		*05/03/2018 16:07*	WG1104916
(S) 2-Fluorobiphenyl	*67.4*			*32.0-120*		*05/03/2018 16:07*	WG1104916
(S) p-Terphenyl-d14	*79.3*			*23.0-122*		*05/03/2018 16:07*	WG1104916

Volatile Organic Compounds (GC) by Method 8021/AK101

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
TPHGAK C6 to C10	49.4	B J	10.0	100	1	05/01/2018 18:36	WG1105157
Benzene	U		0.190	0.500	1	05/01/2018 18:36	WG1105157
Toluene	18.3		0.412	1.00	1	05/01/2018 18:36	WG1105157
Ethylbenzene	U		0.160	0.500	1	05/01/2018 18:36	WG1105157
Total Xylene	U		0.510	1.50	1	05/01/2018 18:36	WG1105157
Methyl tert-butyl ether	U		0.340	5.00	1	05/01/2018 18:36	WG1105157
(S) a,a,a-Trifluorotoluene(FID)	*97.9*			*50.0-150*		*05/01/2018 18:36*	WG1105157
(S) a,a,a-Trifluorotoluene(PID)	*101*			*80.0-121*		*05/01/2018 18:36*	WG1105157

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Acetone	U	J3	10.0	50.0	1	04/30/2018 17:39	WG1104815
Acrolein	U	J3	8.87	50.0	1	04/30/2018 17:39	WG1104815
Acrylonitrile	U	J3	1.87	10.0	1	04/30/2018 17:39	WG1104815
Benzene	U		0.331	1.00	1	04/30/2018 17:39	WG1104815
Bromobenzene	U		0.352	1.00	1	04/30/2018 17:39	WG1104815
Bromodichloromethane	U		0.380	1.00	1	04/30/2018 17:39	WG1104815
Bromoform	U		0.469	1.00	1	04/30/2018 17:39	WG1104815
Bromomethane	U		0.866	5.00	1	04/30/2018 17:39	WG1104815
n-Butylbenzene	U		0.361	1.00	1	04/30/2018 17:39	WG1104815
sec-Butylbenzene	U		0.365	1.00	1	04/30/2018 17:39	WG1104815
tert-Butylbenzene	U		0.399	1.00	1	04/30/2018 17:39	WG1104815
Carbon tetrachloride	U		0.379	1.00	1	04/30/2018 17:39	WG1104815
Chlorobenzene	U		0.348	1.00	1	04/30/2018 17:39	WG1104815
Chlorodibromomethane	U		0.327	1.00	1	04/30/2018 17:39	WG1104815
Chloroethane	U		0.453	5.00	1	04/30/2018 17:39	WG1104815
Chloroform	U		0.324	5.00	1	04/30/2018 17:39	WG1104815
Chloromethane	U		0.276	2.50	1	04/30/2018 17:39	WG1104815
2-Chlorotoluene	U		0.375	1.00	1	04/30/2018 17:39	WG1104815
4-Chlorotoluene	U		0.351	1.00	1	04/30/2018 17:39	WG1104815
1,2-Dibromo-3-Chloropropane	U		1.33	5.00	1	04/30/2018 17:39	WG1104815
1,2-Dibromoethane	U		0.381	1.00	1	04/30/2018 17:39	WG1104815
Dibromomethane	U		0.346	1.00	1	04/30/2018 17:39	WG1104815
1,2-Dichlorobenzene	U		0.349	1.00	1	04/30/2018 17:39	WG1104815
1,3-Dichlorobenzene	U		0.220	1.00	1	04/30/2018 17:39	WG1104815
1,4-Dichlorobenzene	U		0.274	1.00	1	04/30/2018 17:39	WG1104815
Dichlorodifluoromethane	U		0.551	5.00	1	04/30/2018 17:39	WG1104815
1,1-Dichloroethane	U		0.259	1.00	1	04/30/2018 17:39	WG1104815
1,2-Dichloroethane	U		0.361	1.00	1	04/30/2018 17:39	WG1104815
1,1-Dichloroethene	U		0.398	1.00	1	04/30/2018 17:39	WG1104815
cis-1,2-Dichloroethene	U		0.260	1.00	1	04/30/2018 17:39	WG1104815
trans-1,2-Dichloroethene	U		0.396	1.00	1	04/30/2018 17:39	WG1104815
1,2-Dichloropropane	U		0.306	1.00	1	04/30/2018 17:39	WG1104815
1,1-Dichloropropene	U		0.352	1.00	1	04/30/2018 17:39	WG1104815
1,3-Dichloropropane	U		0.366	1.00	1	04/30/2018 17:39	WG1104815
cis-1,3-Dichloropropene	U		0.418	1.00	1	04/30/2018 17:39	WG1104815
trans-1,3-Dichloropropene	U		0.419	1.00	1	04/30/2018 17:39	WG1104815
2,2-Dichloropropane	U		0.321	1.00	1	04/30/2018 17:39	WG1104815
Di-isopropyl ether	U		0.320	1.00	1	04/30/2018 17:39	WG1104815
Ethylbenzene	U		0.384	1.00	1	04/30/2018 17:39	WG1104815
Hexachloro-1,3-butadiene	U		0.256	1.00	1	04/30/2018 17:39	WG1104815
Isopropylbenzene	U		0.326	1.00	1	04/30/2018 17:39	WG1104815
p-Isopropyltoluene	U		0.350	1.00	1	04/30/2018 17:39	WG1104815

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
2-Butanone (MEK)	U	J3	3.93	10.0	1	04/30/2018 17:39	WG1104815
Methylene Chloride	U		1.00	5.00	1	04/30/2018 17:39	WG1104815
4-Methyl-2-pentanone (MIBK)	2.43	J	2.14	10.0	1	04/30/2018 17:39	WG1104815
Methyl tert-butyl ether	U		0.367	1.00	1	04/30/2018 17:39	WG1104815
Naphthalene	U		1.00	5.00	1	04/30/2018 17:39	WG1104815
n-Propylbenzene	U		0.349	1.00	1	04/30/2018 17:39	WG1104815
Styrene	U		0.307	1.00	1	04/30/2018 17:39	WG1104815
1,1,1,2-Tetrachloroethane	U		0.385	1.00	1	04/30/2018 17:39	WG1104815
1,1,2,2-Tetrachloroethane	U		0.130	1.00	1	04/30/2018 17:39	WG1104815
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00	1	04/30/2018 17:39	WG1104815
Tetrachloroethene	U		0.372	1.00	1	04/30/2018 17:39	WG1104815
Toluene	20.9		0.412	1.00	1	04/30/2018 17:39	WG1104815
1,2,3-Trichlorobenzene	U		0.230	1.00	1	04/30/2018 17:39	WG1104815
1,2,4-Trichlorobenzene	U		0.355	1.00	1	04/30/2018 17:39	WG1104815
1,1,1-Trichloroethane	U		0.319	1.00	1	04/30/2018 17:39	WG1104815
1,1,2-Trichloroethane	U		0.383	1.00	1	04/30/2018 17:39	WG1104815
Trichloroethene	U		0.398	1.00	1	04/30/2018 17:39	WG1104815
Trichlorofluoromethane	U		1.20	5.00	1	04/30/2018 17:39	WG1104815
1,2,3-Trichloropropane	U		0.807	2.50	1	04/30/2018 17:39	WG1104815
1,2,4-Trimethylbenzene	U		0.373	1.00	1	04/30/2018 17:39	WG1104815
1,2,3-Trimethylbenzene	U		0.321	1.00	1	04/30/2018 17:39	WG1104815
1,3,5-Trimethylbenzene	U		0.387	1.00	1	04/30/2018 17:39	WG1104815
Vinyl chloride	U		0.259	1.00	1	04/30/2018 17:39	WG1104815
Xylenes, Total	U		1.06	3.00	1	04/30/2018 17:39	WG1104815
(S) Toluene-d8	*102*			*80.0-120*		*04/30/2018 17:39*	WG1104815
(S) Dibromofluoromethane	*113*			*76.0-123*		*04/30/2018 17:39*	WG1104815
(S) 4-Bromofluorobenzene	*110*			*80.0-120*		*04/30/2018 17:39*	WG1104815

Semi-Volatile Organic Compounds (GC) by Method AK102/103

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
AK102 DRO C10-C25	1740		170	800	1	05/14/2018 22:15	WG1105542
AK103 RRO C25-C36	3260		460	800	1	05/14/2018 22:15	WG1105542
(S) o-Terphenyl	*99.0*			*50.0-150*		*05/14/2018 22:15*	WG1105542
(S) n-Triacontane d62	*78.8*			*50.0-150*		*05/14/2018 22:15*	WG1105542

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Anthracene	U		0.00800	0.0500	1	05/03/2018 16:28	WG1104916
Acenaphthene	U		0.0100	0.0500	1	05/03/2018 16:28	WG1104916
Acenaphthylene	U		0.00700	0.0500	1	05/03/2018 16:28	WG1104916
Benzo(a)anthracene	U		0.00830	0.0500	1	05/03/2018 16:28	WG1104916
Benzo(a)pyrene	0.0242	J	0.0158	0.0500	1	05/03/2018 16:28	WG1104916
Benzo(b)fluoranthene	0.0528	B	0.00212	0.0500	1	05/03/2018 16:28	WG1104916
Benzo(g,h,i)perylene	0.0717	B	0.00227	0.0500	1	05/03/2018 16:28	WG1104916
Benzo(k)fluoranthene	U		0.0255	0.0500	1	05/03/2018 16:28	WG1104916
Chrysene	0.0257	J	0.0144	0.0500	1	05/03/2018 16:28	WG1104916
Dibenz(a,h)anthracene	U		0.00454	0.0500	1	05/03/2018 16:28	WG1104916
Fluoranthene	0.0501		0.0165	0.0500	1	05/03/2018 16:28	WG1104916
Fluorene	U		0.00898	0.0500	1	05/03/2018 16:28	WG1104916
Indeno(1,2,3-cd)pyrene	0.0325	B J	0.00739	0.0500	1	05/03/2018 16:28	WG1104916
Naphthalene	0.0368	J	0.0123	0.250	1	05/03/2018 16:28	WG1104916
Phenanthrene	0.0292	J	0.0184	0.0500	1	05/03/2018 16:28	WG1104916
Pyrene	0.0850		0.0155	0.0500	1	05/03/2018 16:28	WG1104916

Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
1-Methylnaphthalene	0.0243	J	0.0189	0.250	1	05/03/2018 16:28	WG1104916
2-Methylnaphthalene	0.0178	J	0.0155	0.250	1	05/03/2018 16:28	WG1104916
2-Chloronaphthalene	U		0.0165	0.250	1	05/03/2018 16:28	WG1104916
(S) Nitrobenzene-d5	*84.4*			*11.0-135*		*05/03/2018 16:28*	WG1104916
(S) 2-Fluorobiphenyl	*78.9*			*32.0-120*		*05/03/2018 16:28*	WG1104916
(S) p-Terphenyl-d14	*94.3*			*23.0-122*		*05/03/2018 16:28*	WG1104916

Method Blank (MB)

(MB) R3306209-3 05/01/18 15:55

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Benzene	U		0.190	0.500
Toluene	U		0.412	1.00
Ethylbenzene	U		0.160	0.500
Total Xylene	U		0.510	1.50
Methyl tert-butyl ether	U		0.340	5.00
TPHGAK C6 to C10	30.6	J	10.0	100
(S) a,a,a-Trifluorotoluene(PID)	*99.2*			*80.0-121*
(S) a,a,a-Trifluorotoluene(FID)	*98.1*			*50.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3306209-1 05/01/18 14:57 • (LCSD) R3306209-8 05/01/18 22:16

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Benzene	50.0	50.3	44.0	101	88.1	71.0-121			13.2	20
Toluene	50.0	49.9	43.2	99.8	86.4	72.0-120			14.3	20
Ethylbenzene	50.0	50.5	44.2	101	88.4	75.0-122			13.3	20
Total Xylene	150	145	128	96.3	85.6	74.0-124			11.8	20
Methyl tert-butyl ether	50.0	43.1	38.7	86.2	77.4	63.0-126			10.8	21
(S) a,a,a-Trifluorotoluene(PID)				*97.5*	*97.0*	*80.0-121*				
(S) a,a,a-Trifluorotoluene(FID)				*97.9*	*98.1*	*50.0-150*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3306209-2 05/01/18 14:57 • (LCSD) R3306209-9 05/01/18 22:16

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TPHGAK C6 to C10	400	391	345	97.7	86.3	60.0-120			12.4	20
(S) a,a,a-Trifluorotoluene(PID)				*97.5*	*97.0*	*80.0-121*				
(S) a,a,a-Trifluorotoluene(FID)				*97.9*	*98.1*	*50.0-150*				

L989743-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L989743-01 05/01/18 18:12 • (MS) R3306209-4 05/01/18 20:33 • (MSD) R3306209-6 05/01/18 20:57

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Benzene	50.0	U	42.6	48.5	85.2	97.0	1	29.0-146			13.0	20
Toluene	50.0	18.3	57.8	63.2	78.8	89.8	1	35.0-140			9.07	20
Ethylbenzene	50.0	U	42.4	48.5	84.7	97.0	1	39.0-143			13.5	20
Total Xylene	150	U	125	141	83.2	94.2	1	42.0-142			12.4	20
Methyl tert-butyl ether	50.0	U	39.9	44.8	79.8	89.5	1	41.0-138			11.5	20
(S) a,a,a-Trifluorotoluene(PID)					*99.4*	*99.8*		*80.0-121*				
(S) a,a,a-Trifluorotoluene(FID)					*98.2*	*98.2*		*50.0-150*				

L989743-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L989743-01 05/01/18 18:12 • (MS) R3306209-5 05/01/18 20:33 • (MSD) R3306209-7 05/01/18 20:57

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TPHGAK C6 to C10	400	50.6	352	395	75.4	86.1	1	70.0-130			11.5	20
(S) a,a,a-Trifluorotoluene(PID)					*99.4*	*99.8*		*80.0-121*				
(S) a,a,a-Trifluorotoluene(FID)					*98.2*	*98.2*		*50.0-150*				

Method Blank (MB)

(MB) R3307232-3 04/30/18 10:22

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Acetone	U		10.0	50.0
Acrolein	U		8.87	50.0
Acrylonitrile	U		1.87	10.0
Benzene	U		0.331	1.00
Bromobenzene	U		0.352	1.00
Bromodichloromethane	U		0.380	1.00
Bromoform	U		0.469	1.00
Bromomethane	U		0.866	5.00
n-Butylbenzene	U		0.361	1.00
sec-Butylbenzene	U		0.365	1.00
tert-Butylbenzene	U		0.399	1.00
Carbon tetrachloride	U		0.379	1.00
Chlorobenzene	U		0.348	1.00
Chlorodibromomethane	U		0.327	1.00
Chloroethane	U		0.453	5.00
Chloroform	U		0.324	5.00
Chloromethane	U		0.276	2.50
2-Chlorotoluene	U		0.375	1.00
4-Chlorotoluene	U		0.351	1.00
1,2-Dibromo-3-Chloropropane	U		1.33	5.00
1,2-Dibromoethane	U		0.381	1.00
Dibromomethane	U		0.346	1.00
1,2-Dichlorobenzene	U		0.349	1.00
1,3-Dichlorobenzene	U		0.220	1.00
1,4-Dichlorobenzene	U		0.274	1.00
Dichlorodifluoromethane	U		0.551	5.00
1,1-Dichloroethane	U		0.259	1.00
1,2-Dichloroethane	U		0.361	1.00
1,1-Dichloroethene	U		0.398	1.00
cis-1,2-Dichloroethene	U		0.260	1.00
trans-1,2-Dichloroethene	U		0.396	1.00
1,2-Dichloropropane	U		0.306	1.00
1,1-Dichloropropene	U		0.352	1.00
1,3-Dichloropropane	U		0.366	1.00
cis-1,3-Dichloropropene	U		0.418	1.00
trans-1,3-Dichloropropene	U		0.419	1.00
2,2-Dichloropropane	U		0.321	1.00
Di-isopropyl ether	U		0.320	1.00
Ethylbenzene	U		0.384	1.00
Hexachloro-1,3-butadiene	0.312	J	0.256	1.00

Method Blank (MB)

(MB) R3307232-3 04/30/18 10:22

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Isopropylbenzene	U		0.326	1.00
p-Isopropyltoluene	U		0.350	1.00
2-Butanone (MEK)	U		3.93	10.0
Methylene Chloride	U		1.00	5.00
4-Methyl-2-pentanone (MIBK)	U		2.14	10.0
Methyl tert-butyl ether	U		0.367	1.00
Naphthalene	U		1.00	5.00
n-Propylbenzene	U		0.349	1.00
Styrene	U		0.307	1.00
1,1,1,2-Tetrachloroethane	U		0.385	1.00
1,1,2,2-Tetrachloroethane	U		0.130	1.00
Tetrachloroethene	U		0.372	1.00
Toluene	U		0.412	1.00
1,1,2-Trichlorotrifluoroethane	U		0.303	1.00
1,2,3-Trichlorobenzene	U		0.230	1.00
1,2,4-Trichlorobenzene	U		0.355	1.00
1,1,1-Trichloroethane	U		0.319	1.00
1,1,2-Trichloroethane	U		0.383	1.00
Trichloroethene	U		0.398	1.00
Trichlorofluoromethane	U		1.20	5.00
1,2,3-Trichloropropane	U		0.807	2.50
1,2,3-Trimethylbenzene	U		0.321	1.00
1,2,4-Trimethylbenzene	U		0.373	1.00
1,3,5-Trimethylbenzene	U		0.387	1.00
Vinyl chloride	U		0.259	1.00
Xylenes, Total	U		1.06	3.00
(S) Toluene-d8	*105*			*80.0-120*
(S) Dibromofluoromethane	*105*			*76.0-123*
(S) 4-Bromofluorobenzene	*110*			*80.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3307232-1 04/30/18 09:22 • (LCSD) R3307232-2 04/30/18 09:42

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	125	93.8	164	75.0	131	10.0-160		J3	54.5	23
Acrolein	125	19.7	31.2	15.8	25.0	10.0-160		J3	45.4	20
Acrylonitrile	125	98.9	132	79.1	106	60.0-142		J3	28.9	20
Benzene	25.0	23.4	23.5	93.6	93.9	69.0-123			0.373	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3307232-1 04/30/18 09:22 • (LCSD) R3307232-2 04/30/18 09:42

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Bromobenzene	25.0	24.1	22.8	96.5	91.1	79.0-120			5.76	20
Bromodichloromethane	25.0	22.7	22.7	90.8	91.0	76.0-120			0.138	20
Bromoform	25.0	25.7	25.4	103	101	67.0-132			1.26	20
Bromomethane	25.0	28.1	27.9	113	112	18.0-160			0.879	20
n-Butylbenzene	25.0	24.5	24.5	97.9	98.1	72.0-126			0.177	20
sec-Butylbenzene	25.0	25.9	25.1	104	100	74.0-121			3.39	20
tert-Butylbenzene	25.0	25.1	24.5	100	97.9	75.0-122			2.49	20
Carbon tetrachloride	25.0	22.8	23.0	91.2	91.9	63.0-122			0.803	20
Chlorobenzene	25.0	23.0	22.7	92.2	90.7	79.0-121			1.66	20
Chlorodibromomethane	25.0	23.3	23.2	93.1	92.7	75.0-125			0.506	20
Chloroethane	25.0	27.9	26.9	112	107	47.0-152			3.82	20
Chloroform	25.0	22.2	22.4	88.9	89.4	72.0-121			0.632	20
Chloromethane	25.0	26.6	25.8	106	103	48.0-139			3.05	20
2-Chlorotoluene	25.0	25.7	24.5	103	97.8	74.0-122			4.79	20
4-Chlorotoluene	25.0	25.0	24.1	99.9	96.5	79.0-120			3.52	20
1,2-Dibromo-3-Chloropropane	25.0	23.7	24.9	95.0	99.6	64.0-127			4.79	20
1,2-Dibromoethane	25.0	22.9	23.4	91.5	93.6	77.0-123			2.24	20
Dibromomethane	25.0	22.3	22.9	89.0	91.7	78.0-120			2.98	20
1,2-Dichlorobenzene	25.0	23.2	23.7	92.9	94.9	80.0-120			2.20	20
1,3-Dichlorobenzene	25.0	24.6	24.1	98.3	96.5	72.0-123			1.84	20
1,4-Dichlorobenzene	25.0	23.6	23.5	94.3	94.0	77.0-120			0.307	20
Dichlorodifluoromethane	25.0	24.4	24.0	97.8	95.9	49.0-155			1.90	20
1,1-Dichloroethane	25.0	22.8	22.9	91.4	91.4	70.0-126			0.0927	20
1,2-Dichloroethane	25.0	22.0	22.6	88.1	90.5	67.0-126			2.71	20
1,1-Dichloroethene	25.0	22.6	22.6	90.5	90.6	64.0-129			0.0910	20
cis-1,2-Dichloroethene	25.0	22.9	22.8	91.7	91.2	73.0-120			0.640	20
trans-1,2-Dichloroethene	25.0	22.1	22.3	88.6	89.3	71.0-121			0.894	20
1,2-Dichloropropane	25.0	22.6	22.2	90.4	88.8	75.0-125			1.75	20
1,1-Dichloropropene	25.0	23.6	23.5	94.2	94.1	71.0-129			0.139	20
1,3-Dichloropropane	25.0	23.2	23.1	93.0	92.3	80.0-121			0.681	20
cis-1,3-Dichloropropene	25.0	23.9	23.9	95.4	95.4	79.0-123			0.00750	20
trans-1,3-Dichloropropene	25.0	24.4	24.4	97.6	97.8	74.0-127			0.108	20
2,2-Dichloropropane	25.0	25.5	25.3	102	101	60.0-125			0.680	20
Di-isopropyl ether	25.0	24.4	24.8	97.7	99.1	59.0-133			1.45	20
Ethylbenzene	25.0	23.2	22.8	92.7	91.3	77.0-120			1.55	20
Hexachloro-1,3-butadiene	25.0	20.8	20.2	83.0	80.9	64.0-131			2.62	20
Isopropylbenzene	25.0	26.6	25.0	106	100	75.0-120			5.96	20
p-Isopropyltoluene	25.0	25.9	25.3	104	101	74.0-126			2.43	20
2-Butanone (MEK)	125	118	147	94.0	118	37.0-158		J3	22.6	20
Methylene Chloride	25.0	23.1	23.6	92.5	94.5	66.0-121			2.12	20

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3307232-1 04/30/18 09:22 • (LCSD) R3307232-2 04/30/18 09:42

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
4-Methyl-2-pentanone (MIBK)	125	126	139	101	111	59.0-143			10.1	20
Methyl tert-butyl ether	25.0	22.3	23.2	89.4	92.8	64.0-123			3.78	20
Naphthalene	25.0	19.9	20.8	79.7	83.2	62.0-128			4.32	20
n-Propylbenzene	25.0	26.4	25.4	105	102	79.0-120			3.78	20
Styrene	25.0	26.6	24.9	106	99.6	78.0-124			6.40	20
1,1,1,2-Tetrachloroethane	25.0	23.0	23.6	92.1	94.3	75.0-122			2.34	20
1,1,2,2-Tetrachloroethane	25.0	28.1	28.0	112	112	71.0-122			0.208	20
Tetrachloroethene	25.0	23.7	23.3	94.9	93.2	70.0-127			1.74	20
Toluene	25.0	24.1	23.3	96.4	93.4	77.0-120			3.15	20
1,1,2-Trichlorotrifluoroethane	25.0	23.1	22.6	92.4	90.2	61.0-136			2.37	20
1,2,3-Trichlorobenzene	25.0	19.6	18.9	78.4	75.5	61.0-133			3.77	20
1,2,4-Trichlorobenzene	25.0	20.1	20.3	80.6	81.1	69.0-129			0.637	20
1,1,1-Trichloroethane	25.0	22.8	23.1	91.3	92.2	68.0-122			1.05	20
1,1,2-Trichloroethane	25.0	23.1	23.0	92.3	91.9	78.0-120			0.405	20
Trichloroethene	25.0	21.0	21.0	84.0	83.9	78.0-120			0.0398	20
Trichlorofluoromethane	25.0	24.4	23.8	97.6	95.4	56.0-137			2.27	20
1,2,3-Trichloropropane	25.0	23.6	23.2	94.5	92.9	72.0-124			1.68	20
1,2,3-Trimethylbenzene	25.0	24.0	23.5	96.0	94.2	75.0-120			1.89	20
1,2,4-Trimethylbenzene	25.0	25.4	24.5	102	98.0	75.0-120			3.68	20
1,3,5-Trimethylbenzene	25.0	26.3	24.9	105	99.7	75.0-120			5.38	20
Vinyl chloride	25.0	23.9	23.0	95.7	92.0	64.0-133			3.94	20
Xylenes, Total	75.0	69.8	71.3	93.1	95.1	77.0-120			2.13	20
(S) Toluene-d8				*105*	*103*	*80.0-120*				
(S) Dibromofluoromethane				*98.2*	*103*	*76.0-123*				
(S) 4-Bromofluorobenzene				*103*	*98.4*	*80.0-120*				

Method Blank (MB)

(MB) R3309645-1 05/14/18 12:45

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
AK102 DRO C10-C25	U		170	800
AK103 RRO C25-C36	U		460	800
(S) n-Triacontane d62	*75.0*			*50.0-150*
(S) o-Terphenyl	*78.3*			*50.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3309645-2 05/14/18 13:05 • (LCSD) R3309645-3 05/14/18 13:25

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
AK102 DRO C10-C25	3000	2510	2470	83.8	82.5	75.0-125			1.54	20
(S) n-Triacontane d62				*0.000*	*0.000*	*50.0-150*	J2	J2		
(S) o-Terphenyl				*79.9*	*82.1*	*50.0-150*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3309645-4 05/14/18 13:45 • (LCSD) R3309645-5 05/14/18 14:06

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
AK103 RRO C25-C36	3000	2770	2880	92.4	96.0	60.0-120			3.77	20
(S) n-Triacontane d62				*78.6*	*75.1*	*50.0-150*				
(S) o-Terphenyl				*0.000*	*0.000*	*50.0-150*	J2	J2		

Method Blank (MB)

(MB) R3306770-3 05/03/18 12:51

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Anthracene	U		0.00800	0.0500
Acenaphthene	U		0.0100	0.0500
Acenaphthylene	U		0.00700	0.0500
Benzo(a)anthracene	U		0.00830	0.0500
Benzo(a)pyrene	U		0.0158	0.0500
Benzo(b)fluoranthene	0.00965	J	0.00212	0.0500
Benzo(g,h,i)perylene	0.0108	J	0.00227	0.0500
Benzo(k)fluoranthene	U		0.0255	0.0500
Chrysene	U		0.0144	0.0500
Dibenz(a,h)anthracene	0.0207	J	0.00454	0.0500
Fluoranthene	U		0.0165	0.0500
Fluorene	U		0.00898	0.0500
Indeno(1,2,3-cd)pyrene	0.0120	J	0.00739	0.0500
Naphthalene	U		0.0123	0.250
Phenanthrene	U		0.0184	0.0500
Pyrene	U		0.0155	0.0500
1-Methylnaphthalene	U		0.0189	0.250
2-Methylnaphthalene	U		0.0155	0.250
2-Chloronaphthalene	U		0.0165	0.250
(S) Nitrobenzene-d5	*97.2*			*11.0-135*
(S) 2-Fluorobiphenyl	*94.2*			*32.0-120*
(S) p-Terphenyl-d14	*92.9*			*23.0-122*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3306770-1 05/03/18 10:26 • (LCSD) R3306770-2 05/03/18 10:48

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Anthracene	2.00	1.92	1.87	96.2	93.7	51.0-120			2.70	20
Acenaphthene	2.00	1.87	1.84	93.4	92.1	50.0-120			1.38	20
Acenaphthylene	2.00	1.89	1.87	94.5	93.7	49.0-120			0.775	20
Benzo(a)anthracene	2.00	1.85	1.84	92.6	92.0	49.0-120			0.694	20
Benzo(a)pyrene	2.00	1.88	1.86	94.0	92.9	50.0-122			1.25	20
Benzo(b)fluoranthene	2.00	1.94	1.91	97.0	95.4	48.0-120			1.66	22
Benzo(g,h,i)perylene	2.00	1.96	1.93	98.1	96.5	38.0-126			1.68	22
Benzo(k)fluoranthene	2.00	1.78	1.76	89.1	87.9	48.0-120			1.34	22
Chrysene	2.00	1.90	1.87	95.1	93.7	51.0-120			1.49	20
Dibenz(a,h)anthracene	2.00	1.99	1.97	99.4	98.4	30.0-130			1.06	26
Fluoranthene	2.00	1.90	1.90	95.2	94.8	50.0-121			0.484	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3306770-1 05/03/18 10:26 • (LCSD) R3306770-2 05/03/18 10:48

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Fluorene	2.00	1.82	1.81	90.8	90.4	48.0-120			0.485	20
Indeno(1,2,3-cd)pyrene	2.00	1.98	1.95	99.1	97.3	39.0-125			1.81	21
Naphthalene	2.00	1.88	1.87	93.9	93.4	46.0-120			0.510	20
Phenanthrene	2.00	1.85	1.82	92.6	91.0	50.0-120			1.75	20
Pyrene	2.00	1.84	1.83	91.9	91.3	49.0-127			0.746	20
1-Methylnaphthalene	2.00	1.84	1.83	92.0	91.4	50.0-120			0.640	20
2-Methylnaphthalene	2.00	1.79	1.78	89.3	88.9	49.0-120			0.467	20
2-Chloronaphthalene	2.00	1.88	1.86	93.8	93.2	46.0-120			0.617	20
(S) Nitrobenzene-d5				*102*	*99.9*	*11.0-135*				
(S) 2-Fluorobiphenyl				*99.7*	*97.7*	*32.0-120*				
(S) p-Terphenyl-d14				*98.5*	*95.3*	*23.0-122*				

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
B	The same analyte is found in the associated blank.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J3	The associated batch QC was outside the established quality control range for precision.

ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by ESC Lab Sciences.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T 104704245-17-14
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

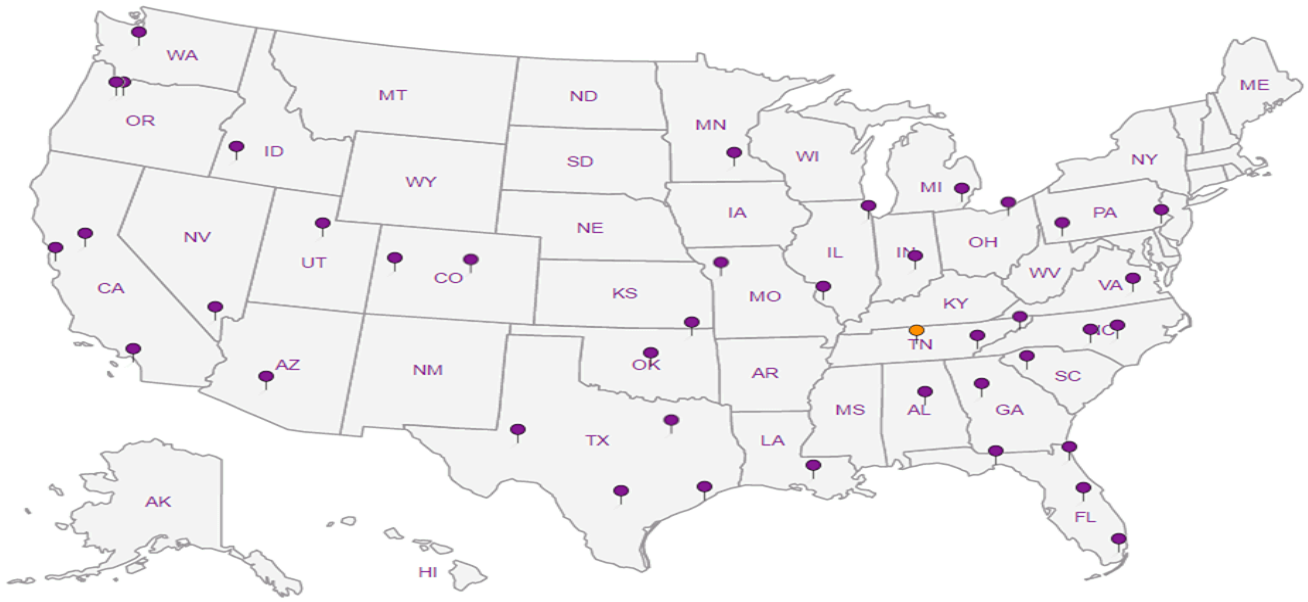
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. ESC Lab Sciences performs all testing at our central laboratory.



GES, Inc. – Concord, CA
5046 Commercial Circle, Ste. F
Concord, CA 94520

Billing Information:
GES Accounts Payable
440 Creamery Way
Ste. 500
Exton, PA 19341

Report to: Kevin Halpin

Email To: MPeterson@GESonline.com
KHalpin@GESonline.com

Project Description: 2018 GWM

City/State Collected: Anchorage, AK

Phone: 866-507-1411
Fax:

Client Project # 301 6007-800008-206

Lab Project #

Collected by (print): K. Halpin

Site/Facility ID # 4409 Lake Otis Pkwy

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Date Results Needed

Quote #

Pres Chk

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	8270 PAH SIM D PAH 100ml Amb	AK101 40ml Amb HCl	AK101/103 100ml Amb HCl	VOCs 40ml Amb-HCl								
MW-1A	G	GW		4/26/18	1600	10	X	X	X	X								-01
DUP-1	G	GW		↓	1605	10	X	X	X	X								-02

Chain of Custody Page 1 of 1

ESC LAB SCIENCES
a subsidiary of Pace Analytical

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# 989743

H168

Acctnum:
Template:
Prelogin:
TSR:
PB:
Shipped Via:

Remarks | Sample # (lab only)

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__UPS X FedEx __Courier

Tracking # 4380 6862 9474

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	4/26/18	1700	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes (No) HCL / MeoH TBR

Temp: 12.6 °C Bottles Received: 20

Date: 4/28/18 Time: 0845

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

APPENDIX D

DEC Laboratory Data Review Checklist

MEMORANDUM

TO: **Mark C. Peterson, Project Manager**
Kevin Halpin

FROM: **Bonnie Janowiak, Ph.D.**

RE: **Data Evaluation Narrative**
Project: Shell-4409 Lake Otis, Anchorage, AK
Groundwater and Environmental Services
Matrix: Groundwater –Sampled April 23 and 26, 2018
ESC Lab Sciences SDG Number: L988695, L989743

Review completed May 21, 2018

1. Data Review Criteria

Groundwater & Environmental Services, Inc. (GES) reviewed the analytical data from the **Shell-4409 Lake Otis, Anchorage, AK** (site) April 23 and 26, 2018 sampling event in order to determine accuracy and precision for each analysis as well as to determine overall data usability. Organic data were reviewed for holding times, method and field blank results, surrogate or system monitoring compound recoveries, Matrix Spike/Matrix Spike Duplicate (MS/MSD) and LCS recoveries. All data necessary to complete the data review were provided by the laboratory.

The collection of aqueous samples from two locations occurred on April 23 and 26, 2018.

The samples were sent to ESC Lab Sciences laboratory and analyzed by the following methodologies as requested on the Chain of Custody:

- Volatile Organic Compounds (GC) by Method 8021/AK101,
- Volatile Organic Compounds (GC/MS) by Method 8260B,
- Semi-Volatile Organic Compounds (GC) by Method AK102/103,
- Semi Volatile Organic Compounds (GC/MS) by Method 8270 D-SIM.

The analytical results were reviewed using laboratory acceptance criteria and procedures and guidelines contained in the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, revised January 2017.

2. Data Qualifiers Assigned

Table 1. Qualified Analytical Data

Field Identification	Analyte	Qualification	Reason for Qualification
MW-3A	AK103 RRO C25-C36	J+	Recovery in LCS/LCSD high
MW-3A	Acetone	R	Positive Blank

MW-3A	VOCs	J-/UJ-	Insufficient field preservation
MW-1A	VOCs	J-	Temperature exceedance at laboratory receipt
MW-1A	Acetone, Acrolein, Acrylonitrile, 2-Butanone	UJ	RPD exceeds criteria

J+ = Estimated value, possible high bias

3. Data Quality

Data was overall of good quality and usable.

3.1. Holding Times

Analytical holding times were met.

3.2. Blank Results

There were no analytes reported above the reporting detection limit (RDL).

The included trip blank associated with MW-3A had one detection reported. Acetone recovered at 17.1 ug/L. As concentration in the sample was less than ten times the detection in the blank, according to EPA guidance, the acetone concentration in the sample is considered unreliable. The data is rejected.

3.3. Laboratory Control Spike

All laboratory control spike recoveries were within laboratory-specified criteria, with the exception of the MW-3A associated LCS/LCSD recoveries for AK103 RRO C25-C36, which are high outside of criteria. MW-3A results for AK103 RRO C25-C36 are qualified as estimated with a possible high bias. RPDs for acetone, acrolein, acrylonitrile and 2-butanone exceeded the laboratory maximum in the LCS/LCSD associated with MW-1A. The data is qualified.

3.4. Preservation

Samples were collected and subsequently stored in amber sample bottles and stored at 4°C ± 2°C until prepared and analyzed. The temperature of the samples upon receipt by the laboratory were recorded. The initial cooler was received below the acceptable range at 1.4°C, the second above the acceptable range at 12.6°C (associated with MW-1A). The first cooler samples were unfrozen, so the below optimal temperature does not affect the data results. Samples were stored in appropriate bottleware, however, preservation pH for MW-3A was high upon laboratory receipt. Preservation is used in conjunction with temperature to limit biodegradation. The pH was adjusted in the laboratory. Because preservation/temperature were out of compliance, all VOC data is qualified as estimated with a possible biased low.

3.5. Surrogates Recoveries and Accuracy

The surrogate recoveries were all within laboratory-specified ranges.

3.6. Duplicate Analyses and Precision

A field duplicate (DUP-1) from the MW-1A sampling location was collected and submitted blind to the laboratory for analysis. All detections in the sample and the duplicate were below reporting limits, and precision could not be accurately calculated.

Precision is the distribution of a set of reported values about the mean, or the closeness of agreement between individual test results obtained under prescribed and similar conditions. Precision is best expressed

in terms of RPD.

Analysis of the laboratory precision employed evaluation of laboratory spike/laboratory spike duplicate (LCS/LCSD) and matrix spike/matrix spike duplicates (MS/MSD) relative percent difference (RPD) precision calculations. There were four compounds that exhibited precision issues. .The overall precision within compliance was 97%.

3.7. Accuracy

Accuracy is a measure of the closeness of an observed value to the "true" value, e.g., theoretical or reference value, or population mean. Accuracy includes a combination of random error and systematic error (bias) that result from sampling and analytical operations. Analytical batch accuracy is measured through the analyses of recoveries in LCSs and MS/MSDs. Sample specific accuracy is measured with surrogate recovery. All surrogate recoveries and all recoveries reported in the LCS, and site associated MS/MSD pair were within laboratory-specified criteria. Accuracy for this sampling event and report is 99%.

3.8. Sensitivity

Sensitivity is the measure of how low a concentration can be detected/reported. Sensitivity is measured using practical quantitation limits (PQLs) or reporting limits (RLs).

1,2-Dibromoethane and vinyl chloride have both RL and MDL above the minimum DEC clean-up levels. 1,1,2,2-Tetrachloroethane reports with an RL above DEC clean-up levels for groundwater, but the MDLs are below the DEC requirement.

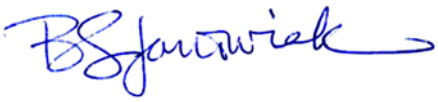
The lack of sensitivity for 1,2-dibromoethane and vinyl chloride disallows comparing non-detected reported results to the DEC clean-up levels. For 1,1,2,2-tetrachloroethane, because the MDL is below regulatory standards, data from these analytes may be used to compare to DEC clean-up standards.

3.9. Summary

Groundwater analytical data are usable and considered definitive data and suitable for comparison to regulatory standards.

Please do not hesitate to contact me if you have comments or questions.

Sincerely,



Bonnie Janowiak, Ph.D.
Project Chemist
708 North Main, Suite 201
Blacksburg, VA 24060

Laboratory Data Review Checklist

Completed by:	Bonnie Janowiak, Ph.D.		
Title:	Project Chemist	Date:	May 21, 2018
CS Report Name:	Second Quarter 2018 Annual Groundwater Monitoring and PAH Sampling Report	Report Date:	May 31, 2018
Consultant Firm:	Groundwater & Environmental Services		
Laboratory Name:	ESC Lab Sciences	Laboratory Report Number:	L986695
ADEC File Number:	2100.38.542	ADEC RecKey Number:	N/A

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

(•) Yes ( ) No ( ) NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

( ) Yes (•) No ( ) NA (Please explain) Comments:

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

b. Correct analyses requested?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

( ) Yes (•) No ( ) NA (Please explain) Comments:

1.4°C (low but not frozen - no qualification)

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

○ Yes ◉ No ○ NA (Please explain) Comments:

Preservation pH was high upon laboratory receipt. pH adjusted in laboratory. VOC data qualified as possibly biased low.

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain) Comments:

Improper preservation was documented on ESC non-conformance form. COC indicated pH adjustment by laboratory on date of receipt.

e. Data quality or usability affected? (Please explain)

Comments:

4. Case Narrative

a. Present and understandable?

◉ Yes ○ No ○ NA (Please explain) Comments:

Case narrative was very general. No specifics listed for the analyses performed.

b. Discrepancies, errors or QC failures identified by the lab?

○ Yes ◉ No ○ NA (Please explain) Comments:

The case narrative did not include sample or method specific comments.

c. Were all corrective actions documented?

○ Yes ◉ No ○ NA (Please explain) Comments:

No corrective actions or issues were documented in the case narrative.

d. What is the effect on data quality/usability according to the case narrative?

Comments:

The case narrative included is not useful to understanding the quality of the data reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

b. All applicable holding times met?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

c. All soils reported on a dry weight basis?

( ) Yes ( ) No (•) NA (Please explain) Comments:

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

( ) Yes (•) No ( ) NA (Please explain) Comments:

1,2-Dibromoethane and vinyl chloride have both RL and MDL above the minimum DEC clean-up levels.1,1,2,2-Tetrachloroethane reports with an RL above the DEC clean-up levels for groundwater, but the MDLs are below the DEC requirements

e. Data quality or usability affected? (Please explain) Comments:

The lack of sensitivity for 1,2-Dibromoethane and vinyl chloride disallows comparing non-detected reported results to the DEC clean-up levels. For 1,1,2,2-tetrachloroethane, because the MDL is below regulatory standards, data from these analytes may be used to compare to DEC clean-up standards.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

ii. All method blank results less than PQL?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

iii. If above PQL, what samples are affected? Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain) Comments:

v. Data quality or usability affected? (Please explain) Comments:

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

○ Yes ○ No ◉ NA (Please explain) Comments:

No metals reported.

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

○ Yes ◉ No ○ NA (Please explain) Comments:

LCS/LCSD recoveries for AK103 RRO C25-C36 are high outside of criteria.

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

MW-3A is qualified for possible high bias in AK103 RRO C25-C36.

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

vii. Data quality or usability affected? (Please explain) Comments:

MW-3A sample results for AK103 RRO C25-C36 are qualified as estimated with a possible high bias.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

( ) Yes (•) No ( ) NA (Please explain) Comments:

LCS/LCSD for AK103 RRO C25-C36 recoveries are high out of specification.

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

iv. Data quality or usability affected? (Use the comment box to explain.). Comments:

MW-3A sample results for AK103 RRO C25-C36 are qualified as estimated with a possible high bias.

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

(•) Yes ( ) No ( ) NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

(•) Yes ( ) No ( ) NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Acetone recovered at 17.1 ug/L.

iv. If above PQL, what samples are affected?

Comments:

MW-3A

v. Data quality or usability affected? (Please explain.)

Comments:

Acetone concentration in the sample is considered unreliable. The data is rejected.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

○ Yes ○ No ◉ NA (Please explain) Comments:

Only one sample.

ii. Submitted blind to lab?

○ Yes ○ No ◉ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs?
(Recommended: 30% water, 50% soil)

$$\text{RPD (\%)} = \text{Absolute Value of: } \frac{(R_1 - R_2)}{((R_1 + R_2)/2)} \times 100$$

Where R_1 = Sample Concentration

R_2 = Field Duplicate Concentration

○ Yes ○ No ◉ NA (Please explain) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain) Comments:

f. Decontamination or Equipment Blank (if applicable)

○ Yes ◉ No ○ NA (Please explain) Comments:

i. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain) Comments:

ii. If above PQL, what samples are affected?

Comments:

iii. Data quality or usability affected? (Please explain.)

Comments:

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain) Comments:

Laboratory Data Review Checklist

Completed by:	Bonnie Janowiak, Ph.D.		
Title:	Project Chemist	Date:	May 21, 2018
CS Report Name:	Second Quarter 2018 Annual Groundwater Monitoring and PAH Sampling Report	Report Date:	May 31, 2018
Consultant Firm:	Groundwater & Environmental Services		
Laboratory Name:	ESC Lab Sciences	Laboratory Report Number:	L989743
ADEC File Number:	2100.38.542	ADEC RecKey Number:	N/A

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

(•) Yes ( ) No ( ) NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

( ) Yes (•) No ( ) NA (Please explain) Comments:

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

b. Correct analyses requested?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

( ) Yes (•) No ( ) NA (Please explain) Comments:

12.6°C

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

( ) Yes (•) No ( ) NA (Please explain) Comments:

Not noted as non-compliance in the report - the samples were above temperature.

e. Data quality or usability affected? (Please explain)

Comments:

VOCs for MW-1A are qualified as estimated with a possible low bias.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

Case narrative was very general. No specifics listed for the analyses performed.

b. Discrepancies, errors or QC failures identified by the lab?

( ) Yes (•) No ( ) NA (Please explain) Comments:

The case narrative did not include sample or method specific comments.

c. Were all corrective actions documented?

( ) Yes (•) No ( ) NA (Please explain) Comments:

No corrective actions or issues were documented in the case narrative.

d. What is the effect on data quality/usability according to the case narrative?

Comments:

The case narrative included is not useful to understanding the quality of the data reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

b. All applicable holding times met?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

c. All soils reported on a dry weight basis?

( ) Yes ( ) No (•) NA (Please explain) Comments:

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

( ) Yes (•) No ( ) NA (Please explain) Comments:

1,2-Dibromoethane and vinyl chloride have both RL and MDL above the minimum DEC clean-up levels.1,1,2,2-Tetrachloroethane reports with an RL above the DEC clean-up levels for groundwater, but the MDLs are below the DEC requirements.

e. Data quality or usability affected? (Please explain) Comments:

The lack of sensitivity for 1,2-Dibromoethane and vinyl chloride disallows comparing non-detected reported results to the DEC clean-up levels. For 1,1,2,2-tetrachloroethane, because the MDL is below regulatory standards, data from these analytes may be used to compare to DEC clean-up standards.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

ii. All method blank results less than PQL?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

iii. If above PQL, what samples are affected? Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain) Comments:

v. Data quality or usability affected? (Please explain) Comments:

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

○ Yes ◉ No ○ NA (Please explain) Comments:

Acetone, Acrolein, Acrylonitrile and 2-Butanone have RPDs that exceed laboratory criteria.

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

vii. Data quality or usability affected? (Please explain) Comments:

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

(•) Yes ( ) No ( ) NA (Please explain) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

(•) Yes ( ) No ( ) NA (Please explain) Comments:

iv. Data quality or usability affected? (Use the comment box to explain.). Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

( ) Yes ( ) No (•) NA (Please explain.) Comments:

No trip blank was analyzed.

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

( ) Yes ( ) No (•) NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs?
(Recommended: 30% water, 50% soil)

$$\text{RPD (\%)} = \text{Absolute Value of: } \frac{(R_1 - R_2)}{((R_1 + R_2)/2)} \times 100$$

Where R_1 = Sample Concentration

R_2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain) Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ◉ No ○ NA (Please explain) Comments:

f. Decontamination or Equipment Blank (if applicable)

○ Yes ◉ No ○ NA (Please explain) Comments:

i. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain) Comments:

ii. If above PQL, what samples are affected?

Comments:

iii. Data quality or usability affected? (Please explain.)

Comments:

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain) Comments: