

#### **SEMI-ANNUAL STATUS REPORT**

First Half 2020 June 18, 2020

Facility No:	Former Standard Oil Bulk Plant No. 302095	Address:	149 and 167 Mainstreet, Morton, Washington
Arcadis Conta	act Person / Phone No.:		Stephen Ahlquist / (503) 785-9308
Arcadis Proje	ct No.:		30045392
Primary Agen	cy/Regulatory ID No.:	South	Washington State Department of Ecology west Regional Office, Toxics Cleanup Program Balaraju / Agreed Order No. DE 03TCPSR-5715

## WORK CONDUCTED THIS PERIOD [First Half 2020]:

- 1. Conducted semi-annual groundwater monitoring and sampling on February 12, 2020.
- 2. Resurveyed monitoring wells on February 12, 2020.
- 3. Prepared the Semi-Annual Status Report, First Half 2020.

#### WORK PROPOSED NEXT PERIOD [Second Half 2020]:

- 1. Conduct semi-annual groundwater monitoring and sampling.
- 2. Prepare the Semi-Annual Status Report, Second Half 2020.

Current Phase of Project:	Monitoring	
Frequency of Monitoring / Sampling:	Semi-Annual (Q1/Q3)	
Is Light Non-Aqueous Phase Liquid (LNAPL) Present On-site:	None	
Cumulative LNAPL Recovered to Date:	None	(gallons)
Approximate Depth to Groundwater:	0.84 to 3.11	(feet below top of casing)
Approximate Groundwater Elevation:	947.18 to 948.35	(feet above NAVD 88)
Groundwater Flow Direction	Southwest	
Groundwater Gradient	0.014	(feet per foot)



Current Remediation Techniques:	None
Permits for Discharge:	Not Applicable
Summary of Unusual Activity:	None
Agency Directive Requirements:	See Attachment C

#### **DISCUSSION**

Arcadis U.S., Inc. (Arcadis) conducted semi-annual groundwater monitoring activities on February 12, 2020. Groundwater monitoring activities were conducted in general accordance with Arcadis' Technical Guidance Instructions for Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells included as **Attachment A**. Additionally, Arcadis oversaw monitoring well survey activities proposed in the Second Half 2019 Semi-Annual Status Report. According to the regulatory directive dated April 24, 2017, seven (7) monitoring wells (MW-7, MW-11, MW-12, MW-15, MW-16, and MW-17) were to be gauged and five (5) monitoring wells (MW-7, MW-11, MW-12, MW-15, and MW-16) were to be purged and sampled. Groundwater monitoring activities were conducted in accordance with the regulatory directive and the additional work activities proposed in the Second Half 2019 Semi-Annual Status Report with the following exception:

Monitoring well MW-18 was inadvertently gauged instead of well MW-13.

The groundwater monitoring field data sheets are included as **Attachment B**. The regulatory directive is included as **Attachment C**.

Groundwater samples were submitted to Pace Analytical in Mount Juliet, Tennessee under standard chain-of-custody protocols. Groundwater gauging and analytical results for the site are presented in **Table 1**. The site location and layout are presented on **Figures 1** and **2**, respectively.

The calculated groundwater flow direction is to the southwest with a hydraulic gradient of 0.014 feet/foot. Historically, groundwater flow direction at the site has been predominately to the southeast. Groundwater elevation contours and flow direction rose diagram are presented on **Figure 3**.

No LNAPL was observed in any of the monitoring wells during this period. Total petroleum hydrocarbons as gasoline was detected in wells MW-15 (379 micrograms per liter [ $\mu$ g/L]) and MW-16 (167  $\mu$ g/L) at concentrations less than the Model Toxics Control Act (MTCA) Method A Cleanup Levels (CULs). Concentrations of total petroleum hydrocarbon as diesel were detected above the MTCA CULs in wells MW-7 (761  $\mu$ g/L) and MW-16 (670  $\mu$ g/L). Concentrations of total petroleum hydrocarbon as heavy range oil were detected less than the MTCA CULs in monitoring wells MW-7 (277  $\mu$ g/L), MW-11 (164  $\mu$ g/L) and



MW-16 (184  $\mu$ g/L). Concentrations of benzene, toluene, ethylbenzene, and total xylenes were not detected in any well. The groundwater analytical map is presented on **Figure 4**. A copy of the laboratory analytical report and chain-of-custody documentation are included as **Attachment D**.

#### **LIMITATIONS**

This report was prepared in accordance with the scope of work outlined in Arcadis' contract and with generally accepted professional engineering and environmental consulting practices existing at the time this report was prepared and applicable to the location of the site. It was prepared for the exclusive use of Chevron Environmental Management Company for the express purpose stated above. Any re-use of this report for a different purpose or by others not identified above shall be at the user's sole risk without liability to Arcadis. To the extent that this report is based on information provided to Arcadis by third parties, Arcadis may have made efforts to verify this third-party information, but Arcadis cannot guarantee the completeness or accuracy of this information. The opinions expressed and data collected are based on the conditions of the site existing at the time of the field investigation. No other warranties expressed or implied are made by Arcadis.

S. Alelguist	Date:	June 18, 2020
Stephen Ahlquist	_	
Project Manager		
Grayson Chiarello Fish	_ Date: _	June 18, 2020
Grayson Fish, L.G.		

Licensed Geologist



#### ATTACHMENTS:

Table 1	Groundwater Gauging and Analytical Results Fourth Quarter 2004 to Current
Figure 1	Site Location Map
Figure 2	Site Plan
Figure 3	Groundwater Elevation Contour Map, February 12, 2020
Figure 4	Groundwater Analytical Map, February 12, 2020
Attachment A	Technical Guidance Instructions for Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells
Attachment B	Field Data Sheets
Attachment C	Regulatory Directive, April 24, 2017
Attachment D	Laboratory Report and Chain-of-Custody Documentation



# **TABLE**



Well	Date	Screen Interval	Top of Casing (ft)	Depth to Water (ft. bTOC)	Groundwater Elevation (ft. above NAVD 88)	TPH-GRO	TPH-DRO	TPH-HRO	Benzene	Toluene	Ethylbenzene	Total Xylenes	Methyl tert- butyl ether	Dissolved Lead	Total Lead	Naphthalene	Comments
MTCA	Method A CULs	-	-	-	(1.1 above 10.175 00)	800/1,000	500	500	5	1,000	700	1,000	20	15	15	160	
MW-7	10/11/2004	5-20	99.89	3.79	96.10	200	570	<98	<0.5	<0.5	<0.5	<0.5					
MW-7 MW-7	1/25/2005 4/13/2005	5-20 5-20	99.89 99.89	3.27 4.28	96.62 95.61	190 73	1,500 880	220 99	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <1.5	-			-	
MW-7 MW-7	7/11/2005 8/13/2007	5-20 5-20	99.89 99.89	4.02 7.85	95.87 92.04	140 <50	1,100 570	120 210	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	<0.047		-	
MW-7 MW-7	5/27/2008	5-20	99.89 99.90	3.42 3.59	96.47 96.31	<50	750	<97	<0.5	<0.5	<0.5	<0.5	<0.5		-	-	
MW-7	3/18/2009	5-20 5-20	99.90	3.29	96.61	 71	360	<67	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	
MW-7 MW-7	5/26-27/2009 8/3-4/2009	5-20 5-20	99.90 99.90	4.13 8.08	95.77 91.82	73 <50	940 1,500	69 <b>530</b>	<0.5   <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5		-	-	
MW-7 MW-7	12/29/2009 2/4/2010	5-20 5-20	99.90 99.90	3.96 4.17	95.94 95.73	<50 <50	990 890	77 110	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-7	6/1/2010	5-20	99.90	3.23	96.67	91	780	78	< 0.5	< 0.5	<0.5	<1.5	-		-	-	
MW-7 MW-7	8/10/2010 11/18/2010	5-20 5-20	99.90 99.90	7.22 2.43	92.68 97.47	<50 58	<b>830</b> 480	260 400	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-		-	-	
MW-7 MW-7	3/15/2011 6/2/2011	5-20 5-20	99.90 99.90	3.84	96.06 95.82	<50 83	810 10.000	250 870	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-7	8/25/2011	5-20	99.90	7.92	91.98	<50	650	<67	<0.5	<0.5	<0.5	<1.5	-		-	=	
MW-7 MW-7	11/10/2011 2/9/2012	5-20 5-20	99.90 99.90	4.90 4.25	95.00 95.65	<50 <50	380 130	<69 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-		-	-	
MW-7 MW-7	5/31/2012 8/28/2012	5-20 5-20	99.90 99.90	4.90 7.83	95.00 92.07	<50 <50	430 83	<75 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-7	11/21/2012	5-20	99.90	1.84	98.06	<50	160	<70	<0.5	<0.5	<0.5	<1.5	-			-	
MW-7 MW-7	2/8/2013 5/10/2013	5-20 5-20	99.90 99.90	3.29 4.46	96.61 95.44	89 60	310 97	<66 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			=	
MW-7 MW-7	8/8/2013 10/23/2013	5-20 5-20	99.90 99.90	7.23 4.72	92.67 95.18	<50 65	51 100	<66 <66	<0.5 <03	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		=	
MW-7 MW-7	2/25/2014 5/28/2014	5-20 5-20	99.90 99.90	3.23 4.08	96.67 95.82	83	140 210	<67 <66	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-7	8/26/2014	5-20	99.90	7.23	92.67	100 <50	110	<67	< 0.5	< 0.5	<0.5	<1.5	-		-	-	
MW-7 MW-7	11/4/2014 3/23-24/2015	5-20 5-20	99.90 99.90	1.89 4.18	98.01 95.72	<50 <50	190 85	<68 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	_		-	-	
MW-7 MW-7	5/26-27/2015 8/13/2015	5-20 5-20	99.90 99.90	5.68 8.78	94.22 91.12	<50 <50	70 <b>760</b>	<68 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-		-	-	
MW-7	11/16-17/2015	5-20	99.90	3.21	96.69	110	1,200	190	<0.5	< 0.5	<0.5	<1.5	-		-	-	
MW-7 MW-7	2/21-22/2016 5/15-16/2016	5-20 5-20	99.90 99.90	4.22 5.20	95.68 94.70	<50 110	1,800 1,500	380 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-		-	-	
MW-7 MW-7	8/15-16/2016 11/15/2016	5-20 5-20	99.90 99.90	7.08 2.77	92.82 97.13	55 <50	730 930	120 120	<0.2 <0.2	<0.2 <0.2	<0.2 <0.2	<0.2 <0.2	-			-	
MW-7	1/10/2019	5-20	99.90	2.82	97.08	<19	710	<100	< 0.5	< 0.5	<0.5	<1.5				-	
MW-7 MW-7	7/21/2019 2/12/2020	5-20 5-20	99.90 951.11	5.03 3.11	94.87 948.00	<19' <100	940 761	<100 277	<0.2 <1.00	<0.2 <1.00	<0.4 <1.00	<1.0 <3.00	-		-	-	WELL RESURVEYED
MW-11	10/11/2004	5-20	97.92	2.92	95.00	<50	<80	<100	<0.5	<0.5	<0.5	<0.5	-				
MW-11 MW-11	1/25/2005 4/13/2005	5-20 5-20	97.92 97.92	2.95 2.21	94.97 95.71	<48 <48	<79 <79	<99 <98	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <1.5				-	
MW-11	7/11/2005	5-20	97.92	3.20	94.72	<48	<93	<120	< 0.5	< 0.5	<0.5	<1.5		0.070		-	
MW-11 MW-11 DUP	8/13/2007 8/13/2007	5-20 5-20	97.92 97.92	6.56 6.56	91.36 91.36	<50 <50	<79 <80	<99 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	0.070	-	-	
MW-11 MW-11	5/27/2008 12/2/2008	5-20 5-20	97.92 97.92	3.98 3.31	93.94 94.61	<50	<76	<95 	<0.5	<0.5	<0.5	<0.5	<0.5			-	
MW-11 MW-11	3/18/2009 5/26-27/2009	5-20 5-20	97.92	2.70	95.22 94.23	<50 <50	85 170	480 <69	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5			-	
MW-11	8/3-4/2009	5-20	97.92 97.92	6.59	91.33	<50	<30	<69	<0.5	<0.5	<0.5	<0.5	<0.5		-	-	
MW-11 MW-11	12/29-30/2009 2/4-5/2010	5-20 5-20	97.92 97.92		TO LOCATE TO LOCATE		-		-		-	-	-		-	-	
MW-11 MW-11	6/1/2010 8/10/2010	5-20 5-20	97.92 97.92	UNABLE	TO LOCATE		-					-	-			-	
MW-11	11/18/2010	5-20	97.92	UNABLE	TO LOCATE		-	-	-		-	-	-		-	=	
MW-11 MW-11	3/15/2011 6/2/2011	5-20 5-20	97.92 97.92	UNABLE	TO LOCATE TO LOCATE		-		-		-	-	-		-	-	
MW-11 MW-11	8/25/2011 11/10/2011	5-20 5-20	97.92 97.92		TO LOCATE TO LOCATE		-		-		-	-	-			-	
MW-11 MW-11	2/10/2012 5/30/2012	5-20	97.92	3.00 3.50	94.92 94.42	<50 <50	<29	<67	<0.5	<0.5 <0.5	<0.5 <0.5	<1.5		-		-	
MW-11	8/27/2012	5-20 5-20	97.92 97.92	6.47	91.45	<50	<31 <28	<72 <66	<0.5 <0.5	< 0.5	<0.5	<1.5 <1.5	-	-		-	
MW-11 MW-11	11/20/2012 2/7/2013	5-20 5-20	97.92 97.92	2.92 2.66	95.00 95.26	<50 <50	<28 <28	<66 <66	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	_			-	
MW-11 MW-11	5/10/2013 8/8/2013	5-20 5-20	97.92 97.92	3.95 6.46	93.97 91.46	<50 <50	<28 <28	<66 <66	<0.5 <0.5	<0.5 <0.5	<05 <0.5	<1.5 <1.5	-	-		-	
MW-11	10/22/2013	5-20	97.92	3.81	94.11	<50	<30	<70	< 0.5	< 0.5	< 0.5	<1.5	-	-	-	-	
MW-11 MW-11	2/24/2014 5/28/2014	5-20 5-20	97.92 97.92	1.88 4.13	96.04 93.79	<50 <50	<29 200	<68 <b>520</b> <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-	-	-	
MW-11 MW-11	8/25/2014 11/3/2014	5-20 5-20	97.92 97.92	5.67 2.93	92.25 94.99	<50 <50	29 <29	<67 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-11	3/23-24/2015	5-20	97.92	2.96	94.96	<50	<29 <28	<67 <66	<0.5 <0.5	<0.5 <0.5	< 0.5	<1.5	-			-	
MW-11 MW-11	5/26-27/2015 8/13/2015	5-20 5-20	97.92 97.92	6.96 6.42	90.96 91.50	<50 <50	81	540	<0.5	< 0.5	<0.5 <0.5	<13 <1.5	-			-	
MW-11 MW-11	11/16-17/2015 2/21-22/2016	5-20 5-20	97.92 97.92	2.34 UNABLE	95.58 E TO ACCESS	<50 	<46 	170	<0.5	<0.5	<0.5	<1.5 	-	-		=	
MW-11 MW-11	5/15-16/2016 8/15-16/2016	5-20 5-20	97.92 97.92	4.19 5.43	93.73 92.49	<50 <50	<47 <46	<100 <100	<0.5 <0.2	<0.5 <0.2	<0.5 <0.2	<1.5 <0.2	-			-	
MW-11	11/15/2016	5-20	97.92	UNABLE	TO ACCESS								-	-	-	_	
MW-11 MW-11	1/10/2019 7/21/2019	5-20 5-20	97.92 97.92	1.69 3.71	92.49 94.21	<19 <19	220 <46	<b>890</b> <100	<0.5 <0.2	<0.5 <0.2	<0.5 <0.4'	<1.5 <1.0'	-	-		-	
MW-11	2/12/2020	5-20	949.22	1.61	947.61	<100	85.1 J	164 J	<1.00	<1.00	<1.00	<3.00	-			-	WELL RESURVEYED



Well	Date	Screen Interval	Top of Casing (ft)	Depth to Water (ft. bTOC)	Groundwater Elevation (ft. above NAVD 88)	TPH-GRO	TPH-DRO	TPH-HRO	Benzene	Toluene	Ethylbenzene	Total Xylenes	Methyl tert- butyl ether	Dissolved Lead	Total Lead	Naphthalene	Comments
MW-12	10/11/2004	5-20	98.25	2.64	95.61	<50	<79	<99	<0.5	<0.5	<0.5	<0.5			-	-	
MW-12 MW-12	1/25/2005 4/13/2005	5-20 5-20	98.25 98.25	2.70 2.34	95.55 95.91	<48 <48	<79 <84	<98 <110	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <1.5			-	-	
MW-12	7/11/2005	5-20	98.25	3.25	95.00	<48	<81	110	< 0.5	< 0.5	<0.5	<1.5	-			-	
MW-12 MW-12	8/13/2007 5/27/2008	5-20 5-20	98.25 98.25	6.06 4.22	92.19 94.03	<50 <50	<89 <82	<110 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 1	<0.5	0.047		-	
MW-12	12/2/2008	5-20	98.25	2.84	95.41									-	-	-	
MW-12 MW-12	3/18/2009 5/26-27/2009	5-20 5-20	98.25 98.25	2.15 3.50	96.10 94.75	<50 <50	<29 <30	<67 <71	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5		-	-	
MW-12	8/3-4/2009	5-20	98.25	6.40	91.85	<50	<30	<70	< 0.5	< 0.5	< 0.5	< 0.5	<0.5	-	-	-	
MW-12 MW-12	12/29-30/2009 2/4-5/2010	5-20 5-20	98.25 98.25	3.00 2.98	95.25 95.27	<50 <50	63 <29	<67 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		-	
MW-12	6/1/2010	5-20	98.25	2.55	95.70	<50	<30	<69	< 0.5	< 0.5	<0.5	<1.5	-			-	
MW-12 MW-12	8/10/2010 11/18/2010	5-20 5-20	98.25 98.25	5.86 1.44	92.39 96.81	<50 <50	<29 <28	<190 <66	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-12	3/15/2011	5-20	98.25	2.08	96.17	<50	<30	250	< 0.5	< 0.5	< 0.5	<1.5	-	-		-	
MW-12 MW-12	8/25/2011 11/10/2011	5-20 5-20	98.25 98.25	6.36 3.40	91.89 94.85	<50 <50	31 <31	<68 <72	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-12	2/10/2011	5-20	98.25	2.25	96.00	<50 <50	39		<0.5	<0.5	<0.5	<1.5 <1.5	-	-		-	
MW-12 MW-12	5/30/2012	5-20	98.25 98.25	3.10 6.51	95.15 91.74	<50 <50	<30 <29	<70 <67	<0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5			-	-	
MW-12	8/27/2012 11/20/2012	5-20 5-20	98.25	2.63	95.62	<50	<29	<68	<0.5 <0.5	<0.5	<0.5	<1.5 <1.5	-	-		-	
MW-12 MW-12	2/7/2013 5/10/2013	5-20 5-20	98.25	2.01	96.24 94.45	<50 <50	<28 <29	<66	<0.5 <0.5	<0.5 <0.5	<0.5	<1.5				-	
MW-12 MW-12	5/10/2013 8/8/2013	5-20 5-20	98.25 98.25	3.80 6.32	94.45 91.93	<50 <50	<29 <30	<67 <70	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		-	
MW-12	10/22/2013	5-20	98.25	3.79	94.46	<50	<29	<67	<0.5	<05	<0.5	<1.5					
MW-12 MW-12	2/24/2014 5/28/2014	5-20 5-20	98.25 98.25	3.40 3.32	94.85 94.93	<50 <50	<29 <29	71 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		-	
MW-12	8/25/2014	5-20	98.25	5.79	92.46	<50	<28	89	< 0.5	< 0.5	< 0.5	<1.5					
MW-12 MW-12	11/3/2014 3/23-24/2015	5-20 5-20	98.25 98.25	2.62 2.71	95.63 95.54	<50 <50	<29 <31	<68 <71	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		-	
MW-12	5/26-27/2015	5-20	98.25	4.88	93.37	<50	<29	<67	<0.5	<0.5	<0.5	<1.5				-	
MW-12 MW-12	8/13/2015 11/16-17/2015	5-20 5-20	98.25 98.25	6.03 2.87	92.22 95.38	<50 <50	<46 <45	<100 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-12	2/21-22/2016	5-20	98.25	2.43	95.82	<50	<47	<100	< 0.5	< 0.5	< 0.5	<1.5				-	
MW-12 MW-12	5/15-16/2016 8/15-16/2016	5-20 5-20	98.25 98.25	4.39 5.44	93.86 92.81	<50 <50	<46 <46	<100 <100	<0.5 <0.2	<0.5 <0.2	<0.5 <0.2	<1.5 <0.2	-			-	
MW-12	11/15/2016	5-20	99.25	2.48	96.77	<50	<45	<100	< 0.2	< 0.2	< 0.2	<0.2				-	
MW-12 MW-12	1/10/2019 7/21/2019	5-20 5-20	98.25 98.25	2.72 4.11	95.53 94.14	<19 <19	<46 <45	<100 <100	<0.5 <0.2	<0.5 <0.2	<0.5 <0.4	<1.5 <1.0'	-		-	-	
MW-12	2/12/2020	5-20	949.53	2.35	947.18	<100	<200	<250	<1.00	<1.00	<1.00	<3.00				-	WELL RESURVEYED
MW-13	12/2/2008	3-18	99.02	3.22	95.80											-	
MW-13	3/18/2009	3-18	99.02	2.24	96.78	<50	180	330	<0.5	<0.5	<0.5	<0.5	<0.5			-	
MW-13 MW-13	5/26-27/2009 8/3-4/2009	3-18 3-18	99.02 99.02	3.88 6.73	95.14 92.29	<50 <50	360 <b>660</b>	<700 700	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5		-	-	
MW-13	12/29-30/2009	3-18	99.02	4.57	94.45	<50	110	<68	<0.5	< 0.5	< 0.5	<1.5				-	
MW-13 MW-13	2/4-5/2010 6/1/2010	3-18 3-18	99.02 99.02	3.68 2.83	95.34 96.19	<50 <50	59 <30	<69 <70	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-13	8/10/2010	3-18	99.02	6.20	92.82	<50	<300	<700	<0.5	<0.5	<0.5	<1.5				-	
MW-13 MW-13	11/18/2010 3/15/2011	3-18 3-18	99.02 99.02							UNAB	LE TO SAMPLE -	AREA FLOODED					
MW-13	6/2/2011	3-18	99.02							UNAB	LE TO SAMPLE -	AREA FLOODED					
MW-13 MW-13	8/25/2011 11/10/2011	3-18 3-18	99.02 99.02							UNAB	LE TO SAMPLE -	AREA FLOODED					
MW-13	2/9/2012	3-18	99.02	3.50	95.52	86	<29	<67	<0.5	< 0.5	< 0.5	<1.5					
MW-13 MW-13	5/31/2012 8/28/2012	3-18 3-18	99.02 99.02	1.20 6.69	97.82 92.33	<50 <50	<32 <28	<75 <66	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-13	11/21/2012	3-18	99.02	1.12	97.90	<50	<29	<69	< 0.5	< 0.5	<0.5	<1.5	-	-		-	
MW-13 MW-13	2/8/2013 5/10/2013	3-18 3-18	99.02 99.02	2.13 4.36	96.89 94.66	<50 <50	<28 <28	120 <66	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-13	8/8/2013	3-18	99.02	6.72	92.30	<50	<29	<68	<0.5	<0.5	<0.5	<1.5	-	-		-	
MW-13 MW-13	10/23/2013 2/25/2014	3-18 3-18	99.02 99.02	4.17 3.02	94.85 96.00	<50 <50	<28 <29	<66 <69	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-13	5/28/2014	3-18	99.02	4.92	94.10	<50	<29	<67	< 0.5	< 0.5	< 0.5	<1.5	-		-	-	
MW-13 MW-13	8/26/2014 11/4/2014	3-18 3-18	99.02 99.02	6.83 1.22	92.19 97.80	<50 <50	<29 <29	<67 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5			-	-	
MW-13	3/23-24/2015	3-18	99.02	2.93	96.09	<50	<30	<71	<0.5	<0.5	<0.5	<1.5	-		-	-	
MW-13	5/26-27/2015	3-18	99.02	4.72	94.30	<50 =50	<28	<66	<0.5	<0.5	<0.5	<1.5					
MW-13 MW-13	8/13/2015 11/16-17/2015	3-18 3-18	99.02 99.02	7.80 2.96	91.22 96.06	<50 <50	100 50	<100 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <15	-			-	
MW-13	2/21-22/2016	3-18	99.02	2.96	96.06	<50	<46 77	<100	< 0.5	< 0.5	< 0.5	<1.5					
MW-13 MW-13	5/15-16/2016 8/15-16/2016	3-18 3-18	99.02 99.02	4.79 5.76	94.23 93.26	<50 <50	77 <46	<100 <100	<0.5 <0.2	<0.5 <0.2	<0.5 <0.2	<1.5 <0.2	-			-	
MW-13	11/15/2016	3-18	99.02	2.72	96.30	<50	<45	<100	<0.2	< 0.2	<0.2	< 0.2					
MW-13 MW-13	1/10/2019 7/21/2019	3-18 3-18	99.02 99.02	2.41 3.95	96.61 95.07					NOT F	PART OF MONITO	ORING PROGRAM ORING PROGRAM					
MW-13	2/12/2020	3-18	950.32							WELL	INADVERTENTL	Y NOT GAUGED					WELL RESURVEYED
MW-14 MW-14	12/2/2008 3/18/2009	3-18 3-18	98.50 98.50	2.76 1.71	95.74 96.79	 <50	 <29	 <67	 <0.5	<0.5	 <0.5	 <0.5	 <0.5	-		-	
MW-14	05/26-27/2009	3-18	98.50	3.49	95.01	<50	180	<69	0.600	< 0.5	<0.5	<0.5	< 0.5		-	-	
MW-14	8/3-4/2009	3-18	98.50	5.58	92.92	<50	550	<74	0.900	< 0.5	0.700	<0.5	<0.5				
MW-14 MW-14	12/29-30/2009 2/4-5/2010	3-18 3-18	98.50 98.50	3.81 3.88	94.69 94.62	<50 <50	42 37	<65 <69	2 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-		-	-	
MW-14	6/1/2010	3-18	98.50	2.96	95.54	<50	<29	<68	< 0.5	< 0.5	<0.5	<1.5					
MW-14 MW-14	8/10/2010 11/18/2010	3-18 3-18	98.50 98.50	6.40 2.71	92.10 95.79	<50 <50	120 <29	<90 76	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-14	3/15/2011	3-18	98.50	2.91	95.59	<50	<31	94	2	1	<0.5	<1.5				-	



Well	Date	Screen Interval	Top of Casing (ft)	Depth to Water (ft. bTOC)	Groundwater Elevation (ft. above NAVD 88)	TPH-GRO	TPH-DRO	TPH-HRO	Benzene	Toluene	Ethylbenzene	Total Xylenes	Methyl tert- butyl ether	Dissolved Lead	Total Lead	Naphthalene	Comments
MW-14 MW-14	6/2011 8/25/2011 8/25/2011 1/10/2011 2/10/2012 8/27/2012 8/27/2012 2/2013 8/27/2012 2/2013 8/2/2013 1/2/25/2014 1/2/2014	3-18 3-18 3-18 3-18 3-18	98.50 98	3.83 6.55 3.60 3.50 3.40 6.41 2.86 3.04 4.44 6.44 6.46 2.92 5.89 2.97 3.00 5.28 7.19 3.10 2.94 4.87 5.70	94.67 91.95 94.90 95.10 95.10 92.69 95.64 94.06 95.04 95.04 95.08 95.22 97.33 95.73 95.22 97.34 95.48 95.48 95.73	କଟି	229 48 49 290 80 311 228 228 228 228 229 229 249 249 249 249 249 249 249 249	190 <80 <711 <67 <73 <88 <66 <67 <69 <65 <100 <400 <100 <100 <100 <100 <100 <100	<ul> <li>40.5</li> <li>40.2</li> <li>40.2</li> </ul>	<ul> <li>&lt;0.5</li> <li>&lt;0.2</li> <li>&lt;0.2</li> <li>NOT F</li> </ul>	<ul> <li>-0.5</li> <li< td=""><td>41.5 41.</td><td></td><td></td><td></td><td></td><td></td></li<></ul>	41.5 41.					
MW-15	12/2/2008 3/18/2009 3/18/2	3-18 3-18 3-18 3-18 3-18 3-18 3-18 3-18	97.81 97.81	1.73 1.45 2.75 5.59 2.48 2.54 1.67 5.16 1.38 1.60 2.55 5.80 3.05 2.50 2.50 2.50 2.50 2.50 2.50 2.50 2	96.08 96.36 95.36 92.26 95.33 95.27 96.14 92.26 95.33 95.27 96.44 92.21 94.76 95.31 95.49 95.92 95.92 95.92 95.92 95.92 95.92 95.92 95.92 95.92 95.91 95.92 95.91 95.92 95.91 95.92 95.91 95.92 95.91 95.92 95.91 95.92 95.91 95.92 95.91 95.91 95.91 95.91 95.91	1,200 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,300 1,300 1,300 1,300 1,300 750 820 1,100 740 740 580 630 430 900 760 870 360 480 580 580 900 460 180 330 1,000 1,200 1,200 1,200 1,200	300 1400 1400 1500 1600 1600 1600 1600 1600 1600 16				1 1 1 1 1 1 8 1 1 9 1 0 9 9 1 1 1 1 1 1 1 1 1 1 1 1 1	~~ <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.9 3.2 <0.0 <0.0 <0.0 <0.0 <0.0 <0.0 <0.0 <0	<0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5				WELL RESURVEYED
MW-16	12/2/2008 3/18/2009 8/3-4/2009 8/3-4/2009 8/3-4/2009 8/3-4/2009 2/4-5/2010 8/10/2010 1/18/2010 1/18/2011 1/18/2011 1/16/2011 2/10/2012 8/28/2011 1/10/2012 8/28/2013 1/20/2013 1/20/2013 1/20/2013 1/20/2013 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014 1/20/2014	3-18 3-18 3-18 3-18 3-18 3-18 3-18 3-18	97.73 97.73 97.73 97.73 97.73 97.73 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63	2.32 1.30 2.97 5.36 2.89 2.89 2.79 6.33 2.44 2.71 3.60 6.60 4.35 3.35 3.80 6.39 2.83 2.91 4.16 4.26 3.80 6.23 4.16 4.26 4.35	95.41 96.43 94.76 92.37 94.84 95.84 92.30 95.92 95.92 95.92 95.92 95.28 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.29 95.27 95	520 680 410 500 810 1,400 550 710 890 490 110 510 370 530 130 390 480 480 450 170 580 660 660 660 660 660 660 660 660 660 6	1,200 390 540 710 380 280 2840 420 1,500 230 850 1,240 421 1,200 2,400 1,200 1										



Well	Date	Screen Interval	Top of Casing (ft)	Depth to Water (ft. bTOC)	Groundwater Elevation	TPH-GRO	TPH-DRO	TPH-HRO	Benzene	Toluene	Ethylbenzene	Total Xylenes	Methyl tert- butyl ether	Dissolved Lead	Total Lead	Naphthalene	Comments
MW-16	5/26-27/2015	3-18	98.63	4.72	(ft. above NAVD 88) 93.91	180	93	<66	<0.5	<0.5	0.500	<2.0		-			
MW-16 MW-16	8/13/2015 11/16-17/2015	3-18 3-18	98.63 98.63	7.13 2.98	91.50 95.65	100 1,700	150 1,700	<100 250	<0.5 1	<0.5 1	<0.5 2	<1.5 2	-	-			
MW-16 MW-16	2/21-22/2016 5/15-16/2016	3-18 3-18	98.63 98.63	2.68 4.89	95.95 93.74	<b>1,800</b> 400	<b>760</b> 280	<100 <100	1 <0.5	1 <0.5	1 <0.5	2 <1.5	-	-			
MW-16 MW-16	8/15-16/2016 11/15/2016	3-18 3-18	98.63 98.63	5.69 2.56	92.94 96.07	700	290 380	<100 <100	0.500	<0.2	0.800	2	-	-	-	-	
MW-16	1/10/2019	3-18	98.63	2.31	96.32	<b>940</b> 610	590	<100	0.9 J	0.6 J	1 1 J	2 <1.5				-	
MW-16 MW-16	7/21/2019 2/12/2020	3-18 3-18	98.63 949.89	3.77 2.18	94.86 947.71	<b>2,000</b> '	550 670	<100 184 J	<0.2 <1.00	0.5 J <1.00	<0.4 <1.00	<1.0 <3.00	-	-			
MW-16 DUP	2/12/2020	3-18	949.89	2.18	947.71	105	665	175 J	<1.00	<1.00	<1.00	<3.00					WELL RESURVEYED
MW-17 MW-17	12/2/2008 3/18/2009	3-18 3-18	97.76 97.76	2.21 1.29	95.55 96.47	 <50	310	200	<0.5	<0.5	<0.5	<0.5	<0.5	-		-	
MW-17	5/26-27/2009	3-18	97.76	2.78	94.98	130	360	<69	<0.5	<0.5	<0.5	<0.5	<0.5		-	-	
MW-17 MW-17	8/3-4/2009 12/29-30/2009	3-18 3-18	97.76 97.76	5.45 3.44	92.31 94.32	<50 <50	100 150	<68 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <1.5	<0.5	-		-	
MW-17 MW-17	2/4-5/2010 6/1/2010	3-18 3-18	97.76 97.76	3.49 2.54	94.27 95.22	53 <50	220 82	<69 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		-	
MW-17 MW-17	8/10/2010 11/18/2010	3-18 3-18	97.76 97.76	6.22 2.34	91.54 95.42	<50 <50	87 70	<90 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-17	3/15/2011	3-18	97.76	2.55	95.21	94	140	84	2	2	<0.5	<1.5	-	-	-	-	
MW-17 MW-17	6/2/2011 8/25/2011	3-18 3-18	97.76 97.76	3.41 6.70	94.35 91.06	70 <50	280 95	160 <73	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-17 MW-17	11/10/2011 2/10/2012	3-18 3-18	97.76 97.76	4.00 3.20	93.76 94.56	<50 <50	100 <29	<68 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-17	5/31/2012	3-18	97.76	3.60	94.16	<50	81	<71	<0.5	< 0.5	<0.5	<1.5					
MW-17 MW-17	8/28/2012 11/20/2012	3-18 3-18	97.76 97.76	6.35 2.53	91.41 95.23	<50 <50	<29 <29	<68 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		-	
MW-17 MW-17	2/7/2013 5/9/2013	3-18 3-18	97.76 97.76	2.89 4.13	94.87 93.63	<50 <50	<29 <29	<67 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-			
MW-17 MW-17	8/8/2013 10/23/2013	3-18 3-18	97.76 97.76	6.24 4.04	91.52 93.72	<50 <50	<28	<66 <69	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5		-		-	
MW-17	2/25/2014	3-18	97.76	2.48	95.28	56	<29 <28	<65	< 0.5	< 0.5	< 0.5	<1.5	-	-	-	-	
MW-17 MW-17	5/27/2014 8/25/2014	3-18 3-18	97.76 97.76	3.64 5.97	94.12 91.79	<50 <50	36 <28	<67 <66	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-17 MW-17	11/4/2014 3/23-24/2015	3-18 3-18	97.76 97.76	2.61 2.88	95.15 94.88	<50 <50	99 <29	<68 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-17	5/26-27/2015	3-18	97.76	4.71	93.05	<50	31	<67	< 0.5	< 0.5	<0.5	<1.5					
MW-17 MW-17	8/13/2015 11/16-17/2015	3-18 3-18	97.76 97.76	7.26 2.70	90.50 95.06	<50 79	58 65	<100 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-				
MW-17 MW-17	2/21-22/2016 5/15-16/2016	3-18 3-18	97.76 97.76	2.62	95.14 93.00	100 <50	110 87	<100 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-				
MW-17	8/15-16/2016	3-18	97.76	5.73	92.03	<50 <50	60	<100	< 0.2	< 0.2	<0.2	<0.2					
MW-17 MW-17	11/15/2016 1/10/2019	3-18 3-18	97.76 97.76	2.41 2.38	95.35 95.38	<500	74	<100	<0.2	<0.2 NOT F	<0.2 ART OF MONITO	<0.2 RING PROGRAM	1		-	-	
MW-17 MW-17	7/21/2019 2/12/2020	3-18 3-18	97.76 949.85	3.54 2.00	94.22 947.85					NOT F	ART OF MONITO ART OF MONITO	RING PROGRAM RING PROGRAM	1				WELL RESURVEYED
MW-18	12/2/2008	3-18	98.44	3.41	95.03						-	-		-		-	
MW-18 MW-18	3/18/2009 5/26-27/2009	3-18 3-18	98.44 98.44	2.61 3.83	95.83 94.61	<50 120	73 390	<72 110	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5				
MW-18 MW-18	8/3-4/2009 12/29-30/2009	3-18 3-18	98.44 98.44	6.51 3.02	91.93 95.42	<50 <50	130 360	<70 120	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5	<0.5		-		
MW-18	2/4-5/2010	3-18	98.44	2.77	95.67	<50	130	310	< 0.5	<0.5	<0.5	<1.5	-				
MW-18 MW-18	6/1/2010 8/10/2010	3-18 3-18	98.44 98.44	1.62 5.66	96.82 92.78	<50 <50	<30 310	<69 400	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.6	-			-	
MW-18 MW-18	11/18/2010 3/15/2011	3-18 3-18	98.44 98.44	0.85 1.17	97.59 97.27	<50 <50	42 60	160 200	<0.5 3	<0.5 2	<0.5 <0.5	<1.5 <1.5	-				
MW-18 MW-18	6/2/2011 8/25/2011	3-18 3-18	98.44 98.44	1.46 6.10	96.98 92.34	<50 <50	<300 710	<700 230	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		-	
MW-18	11/10/2011	3-18	98.44	3.40	95.04	<50	<29	<69	< 0.5	< 0.5	<0.5	<1.5	-		-	-	
MW-18 MW-18	2/10/2012 5/31/2012	3-18 3-18	98.44 98.44	2.40 1.20	96.04 97.24	<50 <50	<29 <29	<68 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-18 MW-18	8/27/2012 11/20/2012	3-18 3-18	98.44 98.44	5.35 1.23	93.09 97.21	<50 <50	31 <29	190 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-				
MW-18 MW-18	2/7/2013 5/9/2013	3-18 3-18	98.44 98.44	0.97 3.74	97.47 94.70	<50 <50	<28 <28	<66 <66	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5					
MW-18	8/8/2013	3-18	98.44	5.65	92.79	<50	<29	<67	< 0.5	< 0.5	<0.5	<1.5	-			-	
MW-18 MW-18	10/23/2013 2/25/2014	3-18 3-18	98.44 98.44	3.60 1.33	94.84 97.11	<50 <50	<29 <29	<68 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-				
MW-18 MW-18	5/27/2014 8/25/2014	3-18 3-18	98.44 98.44	2.68 5.27	95.76 93.17	<50 <50	<29 <28	<67 <66	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-		-		
MW-18	11/4/2014	3-18	98.44	1.31	97.13	<50	<29	<68	<05	< 0.5	<0.5	<1.5		-		-	
MW-18 MW-18	3/23-24/2015 5/26-27/2015	3-18 3-18	98.44 98.44	1.01 4.41	97.43 94.03	<50 <50	<30 <29	<71 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		-	
MW-18 MW-18	8/13/2015 11/16-17/2015	3-18 3-18	98.44 98.44	6.82 1.08	91.62 97.36	<50 <50	77 <46	<100 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		=	
MW-18 MW-18	2/21-22/2016 5/15-16/2016	3-18 3-18	98.44 98.44	1.19	97.25 95.22	<50 <50	<47 <46	<100 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		=	
MW-18	8/15-16/2016	3-18	98.44	5.21	93.23	<50	<46	<100	< 0.2	< 0.2	<0.2	<0.2	-	-		-	
MW-18 MW-18	11/15/2016 1/10/2019	3-18 3-18	98.44 98.44	0.44	98.00	<50	<45	<100	<0.2	<0.2 NOT F	<0.2 ART OF MONITO	<0.2 RING PROGRAM		-			
MW-18 MW-18	7/21/2019 2/12/2020	3-18 3-18	98.44 949.19	0.84	948.35				NOT PART	NOT F	ART OF MONITO RING PROGRAM.	RING PROGRAM	1	GED.			WELL RESURVEYED
										C. MONTO	I NOONAW.	LL INADVER	. E.VIET GAO	J_D.			TELE REGULTED
MW-19 MW-19 MW-19	12/2/2008 3/18/2009 5/26-27/2009	3-18 3-18 3-18	98.54 98.54 98.54	3.78 2.90 4.56	94.76 95.64 93.98	<50 <50	<29 360	 <68 500	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	-	-	-	



					Groundwater												
Well	Date	Screen Interval	Top of Casing (ft)	Depth to Water (ft. bTOC)	Elevation (ft. above NAVD 88)	TPH-GRO	TPH-DRO	TPH-HRO	Benzene	Toluene	Ethylbenzene	Total Xylenes	Methyl tert- butyl ether	Dissolved Lead	Total Lead	Naphthalene	Comments
MW-19 MW-19	8/3-4/2009 12/29-30/2009	3-18 3-18	98.54 98.54	6.88 3.02	91.66 95.52	<50 <50	<29 <29	<68 <69	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <1.5	<0.5 	-		-	
MW-19 MW-19	2/4-5/2010 6/1/2010	3-18 3-18	98.54 98.54	3.75 3.14	94.79 95.40	<50 <50	<30 <30	<70 <69	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		=	
MW-19 MW-19	8/10/2010 11/18/2010	3-18 3-18	98.54 98.54	6.41 1.89	92.13 96.65	<50 <50	<29 <29	<90 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.6 <1.5	-	-		-	
MW-19	3/15/2011	3-18	98.54 98.54	2.78	95.76	<50	44	85	2	2	< 0.5	<1.5		-			
MW-19 MW-19	6/2/2011 8/25/2011	3-18 3-18	98.54	3.94 6.95	94.60 91.59	<50 <50	36 41	79 <70	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-	-	=	
MW-19 MW-19	11/10/2011 2/10/2012	3-18 3-18	98.54 98.54	4.70 4.05	93.84 94.49	<50 <50	<29 <29	<69 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-			
MW-19 MW-19	5/31/2012 8/27/2012	3-18 3-18	98.54 98.54	4.30 6.90	94.24 91.64	<50 <50	<32 <32	<75 <75	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-19 MW-19	11/20/2013 2/7/2013	3-18 3-18	98.54 98.54	3.18 3.74	95.36 94.80	<50 <50	<28 <29	<66 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5		-		-	
MW-19	5/9/2013	3-18	98.54	5.03	93.51	<50	<29	<68	< 0.5	< 0.5	<0.5	<1.5	-	-	-	-	
MW-19 MW-19	8/8/2013 10/23/2013	3-18 3-18	98.54 98.54	6.89 4.83	91.65 93.71	<50 <50	<29 <29	<67 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-			
MW-19 MW-19	2/24/2014 5/27/2014	3-18 3-18	98.54 98.54	3.40 4.52	95.14 94.02	<50 <50	<29 <29	<67 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-				
MW-19 MW-19	8/25/2014 11/4/2014	3-18 3-18	98.54 98.54	6.59 1.86	91.95 96.68	<50 <50	<28 <33	<66 <77	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<15 <1.5		-		-	
MW-19	3/23-24/2015	3-18	98.54	1.00	97.54	<50	<28	<66	< 0.5	< 0.5	<0.5	<1.5	-			-	
MW-19 MW-19	5/26-27/2015 8/13/2015	3-18 3-18	98.54 98.54	5.64 7.79	92.90 90.75	<50 <50	<28 <46	<66 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-			
MW-19 MW-19	11/16-17/2015 2/21-22/2016	3-18 3-18	98.54 98.54	2.70 3.45	95.84 95.09	<50 <50	<46 <46	<100 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-				
MW-19 MW-19	5/15-16/2016 8/15-16/2016	3-18 3-18	98.54 98.54	5.55 6.46	92.99 92.08	<50 <50	<46 <46	<100 <100	<0.5 <0.2	<0.5 <0.2	<0.5 <0.2	<1.5 <0.2	-			-	
MW-19	11/15/2016	3-18	98.54	2.74	95.80	<50 <50	<45	<100	<0.2	< 0.2	< 0.2	< 0.2			-	-	
MW-19 WELL ABANDO	1/10/2019 ONED MARCH 2	3-18 2018	98.54							NOT P	ART OF MONITO	RING PROGRAM	I				
MW-20 MW-20	12/2/2008 3/18/2009	3-18 3-18	98.92 98.92	1.93 1.85	96.99 97.07	 <50	 <29	 <67	 <0.5	 <0.5	 <0.5	 <0.5	 <0.5	-		-	
MW-20	5/26-27/2009	3-18	98.92	3.60	95.32	<50	63	<69	<0.5	< 0.5	<0.5	<0.5	< 0.5				
MW-20 MW-20	12/29-30/2009		98.92 98.92	7.28 2.81	91.64 96.11	<50 <50	75 <29	<70 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <1.5	<0.5	-			
MW-20 MW-20	2/4-5/2010 6/1/2010	3-18 3-18	98.92 98.92	2.70 2.30	96.22 96.62	<50 <50	<30 <29	<70 <69	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5					
MW-20 MW-20	8/10/2010 11/18/2010	3-18 3-18	98.92 98.92	6.49 1.80	92.43 97.12	<50 <50	350 <29	300 170	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-20	3/15/2011	3-18	98.92	2.26	96.66	<50	<29	170	2	2	<0.5	<1.5	-			-	
MW-20 MW-20	6/3/2011 8/25/2011	3-18 3-18	98.92 98.92	2.73 7.27	96.19 91.65	<50 <50	<31 120	<71 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			-	
MW-20 MW-20	11/10/2011 2/10/2012	3-18 3-18	98.92 98.92	3.55 2.45	95.37 96.47	<50 <50	<30 <28	<69 <66	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-				
MW-20 MW-20	5/30/2012 8/28/2012	3-18 3-18	98.92 98.92	2.80 6.82	96.12 92.10	<50 <50	<30 70	<70 <69	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5					
MW-20	11/21/2012	3-18	98.92	1.93	96.99	<50	<28	<66	<0.5	< 0.5	<0.5	<1.5	-			-	
MW-20 MW-20	2/7/2013 5/10/2013	3-18 3-18	98.92 98.92	2.40 4.06	96.52 94.86	<50 <50	<28 <29	<66 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-				
MW-20 MW-20	8/8/2013 10/22/2013	3-18 3-18	98.92 98.92	6.18 3.81	92.74 95.11	<50 <50	<29 <30	<67 <70	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-		-	
MW-20 MW-20	2/25/2014 5/28/2014	3-18 3-18	98.92 98.92	2.26 2.76	96.66 96.16	<50 <50	<29 <29	<67 <67	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5				-	
MW-20	8/26/2014	3-18	98.92	6.08	92.84	<50	30	<66	<0.5	< 0.5	<0.5	<1.5	-			-	
MW-20 MW-20	11/3/2014 3/23-24/2015	3-18 3-18	98.92 98.92	1.90 1.98	97.02 96.94	<50 <50	<28 <29	<66 <68	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-	-			
MW-20 MW-20	5/26-27/2015 8/13/2015	3-18 3-18	98.92 98.92	4.88 7.81	94.04 91.11	<50 <50	<29 89	<68 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-				
MW-20 MW-20	11/16-17/2015 2/21-22/2016	3-18 3-18	98.92 98.92	2.20 1.94	96.72 96.98	<50 <50	<45 <46	<100 <100	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<1.5 <1.5	-			=	
MW-20	5/15-16/2016	3-18	98.92	3.89	95.03	<50	<47	<100	<0.5	< 0.5	<0.5	<1.5					
MW-20 MW-20	8/15-16/2016 11/15/2016	3-18 3-18	98.92 98.92	5.76 1.84	93.16 97.08	<50 <50	300 <45	<100 <100	<0.2 <0.2	<0.2 <0.2	<0.2 <0.2	<0.2 <0.2	-				
MW-20 WELL ABANDO	1/10/2019 ONED MARCH 2	3-18 2 <b>018</b>	98.92		-					NOT P	ART OF MONITO	RING PROGRAM	I				
MW-1	7/9/2004	5-15	97.62	3.92	93.7	<50	630	210	<0.5	<0.5	<0.5	<0.5	<0.5	<0.99		<1	
MW-1 MW-1	10/11/2004 1/25/2005	5-15 5-15	97.62 97.62	1.79	95.83 95.61	<50 <48	120 <79	<100 <99	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	<0.5 <0.5	-	-		=	
MW-1	4/13/2005	5-15	97.62	1.19	96.43	<48	450	<99	< 0.5	< 0.5	<0.5	<1.5	-	-			
MW-1 MW-1	7/11/2005 8/13/2007	5-15 5-15	97.62 97.62		95.24 TO LOCATE	48	380	<110 	<0.5	<0.5	<0.5	<1.5 	-	-		-	
MW-1 NOT PART OF	12/2/2008 MONITORING F	5-15 PROGRAM	97.55	2.17	95.38		-		-	-	-	-	-			-	
MW-2	7/9/2004	5-15	99.18	5.06	94.12	2,500	1,800	320	1,100	35	160	59	<0.5	<0.99		19	
MW-2 MW-2	10/11/2004 1/25/2005	5-15 5-15	99.18 99.18	2.68 2.82	96.50 96.36	2,500 2,200	560 1,700	<99 180	1,100 880	37 33	170 150	44 35	-	-		-	
MW-2 MW-2 DUP	4/13/2005 4/13/2005	5-15 5-15	99.18	2.31 2.31	96.87 96.87	2,800 2,700	960 960	110 120	1,100 1,100	45 48	380	80	-	-			
MW-2	7/11/2005	5-15	99.18 99.18	3.16	96.02	2,300	1,400	180	760	26	380 170	84 41	-			Ξ	
MW-2 DUP ABANDONED II	7/11/2005 N OCTOBER 20	5-15 1 <b>06</b>	99.18	3.16	96.02	2,100	1,500	170	810	25	150	36	-				
MW-3	7/9/2004	5-15	100.00	6.03	93.97	80	290	150	22	0.600	6	5	<0.5	<0.99		<1	
											-	-				**	



Well	Date	Screen Interval	Top of Casing (ft)	Depth to Water (ft. bTOC)	Groundwater Elevation (ft. above NAVD 88)	TPH-GRO	TPH-DRO	TPH-HRO	Benzene	Toluene	Ethylbenzene	Total Xylenes	Methyl tert- butyl ether	Dissolved Lead	Total Lead	Naphthalene	Comments
MW-3 DUP	7/9/2004	5-15	100.00	6.03	93.97	100	300	190	23	0.600	6	5	<0.5	<0.99		<1	
MW-3	10/11/2004	5-15	100.00	4.27	95.73	<50	<79	<98	2	<0.5	<0.5	<0.5					
MW-3 MW-3	1/25/2005 4/13/2005	5-15 5-15	100.00	4.13 3.78	95.87 96.22	<48 <48	<b>670</b> 89	120 <97	2	<0.5	<0.5 <0.5	<0.5	-				
MW-3	7/11/2005	5-15 5-15	100.00 100.00	4.69	95.22	<48	<87	<110	2	<0.5 <0.5	<0.5	<1.5 <1.5				-	
	N OCTOBER 20		100.00	4.03	33.31	V40	201	2110	-	<b>40.3</b>	40.5	<1.5					
MW-4	7/9/2004	5-15	97.88	5.30	92.58	1,600	1,700	240	160	13	67	6	<0.5	<0.99		4	
MW-4	10/11/2004	5-15	97.88	1.66	96.22	1,800	520	<97	140	16	76	10					
MW-4	1/25/2005	5-15	97.88	1.79	96.09	2,000	410	<98	140	16	79	9					
MW-4 MW-4	4/13/2005 7/11/2005	5-15 5-15	97.88 97.88	1.40 2.18	96.48 95.70	2,100 1.800	1,300 1,200	110 170	120 54	16 8	81 43	15 7					
ABANDONED I			97.00	2.10	95.70	1,000	1,200	170	54	٥	43	,	-	-	-	-	
MW-5	10/11/2004	5-15	98.31	2.79	95.52	90	130	<99	<0.5	<0.5	<0.5	<0.5		-			
MW-5	1/25/2005	5-15	98.31	2.79	95.52	100	860	130	< 0.5	< 0.5	< 0.5	< 0.5					
MW-5	4/13/2005	5-15	98.31	2.23	96.08	110	530	<97	< 0.5	< 0.5	<0.5	<1.5					
MW-5	7/11/2005	5-15	98.31	3.38	94.93	64	590	140	<0.5	<0.5	<0.5	<1.5					
MW-5 ABANDONED/I	8/13/2007 DESTROYED	5-15	98.31	UNABLE	TO LOCATE		-		-		-	-	-	-		-	
MW-6	10/11/2004	5-20	98.3	2.26	96.04	1,000	600	<97	1	0.700	<0.5	1				-	
MW-6	1/25/2005	5-20	98.3	2.46	95.84	1,100	1,600	260	1	0.700	<0.5	1					
MW-6 DUP	1/25/2005	5-20	98.3	2.46	95.84	1,100	1,700	270	1	0.700	0.600	1					
MW-6	4/13/2005	5-20	98.3	1.78	96.52	860	900	120	<2.0	1	0.900	<5.0					
MW-6 ABANDONED I	7/11/2005 N MARCH 2007	5-20	98.3	3.16	95.14	1,000	1,200	150	2	1	1	2	-			-	
MW-8	10/11/2004	5-20	99.21	2.81	96.40	1,200	330	<98	6	<0.5	2	1				-	
MW-8	1/25/2005	5-20	99.21	2.63	96.58	1,300	740	170	5	<0.5	1	1					
MW-8	4/13/2005	5-20	99.21	2.44	96.77	1,000	470	<100	6	0.700	2	<5.0					
MW-8 ABANDONED I	7/11/2005 N MARCH 2007	5-20	99.21	3.23	95.98	1,400	670	<110	6	0.900	3	4	-			-	
MW-9	10/11/2004	5-20	97.52	1.9	95.62	<0.5	<80	<50	<0.5	<0.5	<0.5					_	
MW-9	1/25/2005	5-20	97.52	1.68	95.84	<0.5	<78	<48	<0.5	<0.5	<0.5	_	-			-	
MW-9	4/13/2005	5-20	97.52	1.57	95.95	<0.5	<81	<48	<0.5	<0.5	<1.5						
MW-9	7/11/2005	5-20	97.52	2.25	95.27	< 0.5	<83	<48	< 0.5	< 0.5	<1.5						
MW-9	8/13/2007	5-21	98.52						UNAB	LE TO LOCA	TE SINCE REMEI	DIAL EXCAVATO	N ACTIVITIES				
MW-9	12/29-30/2009		97.52	3.15	94.37							<del>.</del>				-	
MW-9 NOT PART OF	2/12/2020 MONITORING I	5-20 PROGRAM	949.98							NOT F	ART OF MONITO	KING PROGRAM	N				WELL RESURVEYED
MW-10	10/11/2004	5-20	98.78	2.09	96.69	1 900	560	<95	51	7	25	7					
MW-10 DUP	10/11/2004	5-20	98.78	2.09	96.69	1,800 1,900	500	<95 <98	51	7	25 25	6				-	
MW-10	1/25/2005	5-20	98.78	2.08	96.70	1,700	540	<110	37	6	23	5				-	
MW-10	4/13/2005	5-20	98.78	1.64	97.14	1,700	760	<100	24	4	19	7	-			-	
MW-10	7/11/2005	5-20	98.78	2.54	96.24	1,500	910	<110	31	4	17	5					
NOT PART OF	MONITORING/S	SAMPLING PROG	SRAM					-									

Table 1. Groundwater Gauging Data and Analytical Results

Former Standard Oil Bulk Plant No. 302095

149 and 167 Main Street

Morton, Washington



#### Notes:

Results reported in micrograms per liter (µg/L)

Screen interval is in feet below top of casing.

BOLD and highlighted values are greater than their respective MTCA Method A cleanup level

BOLD values are non-detect below the laboratory reporting limit (RL), but the RL is greater than the MTCA Method A cleanup level

Laboratory analytical methods for historical data may not be consistent with current analytical methods. Consult laboratory reports for historical analytical methods used. Top of Casing data prior to first quarter of 2020 was measured relative to arbitrary 100-foot elevation.

Top of Casing data after the first quarter of 2020 (02/12/20) measured relatvie to North American Vertical Datum of 1988 (NAVD 88).

= The requirement for no headspace at the time of analysis was not met. The container used for the testing had headspace at the time of analysis.

800/1,000 = GRO MTCA Method A CUL with benzene present is 800 µg/L and without is 1,000 µg/L

#### Abbreviations:

-- = Not applicable, not available, or not analyzed

BTEX = benzene, toluene, ethylbenzene, and xylenes

CUL = Cleanup Level

DUP = Blind duplicate sample results

ft = feet

nt = teet
ft. bTOC = feet below top of casing
ft. above NAVD 88 = feet above North American Vertical Datum of 1988
MTCA = Model Toxics Control Act Cleanup

MW = groundwater monitoring well

NE = not established

TPH-DRO = Total Petroleum Hydrocarbon as Diesel Range Organics

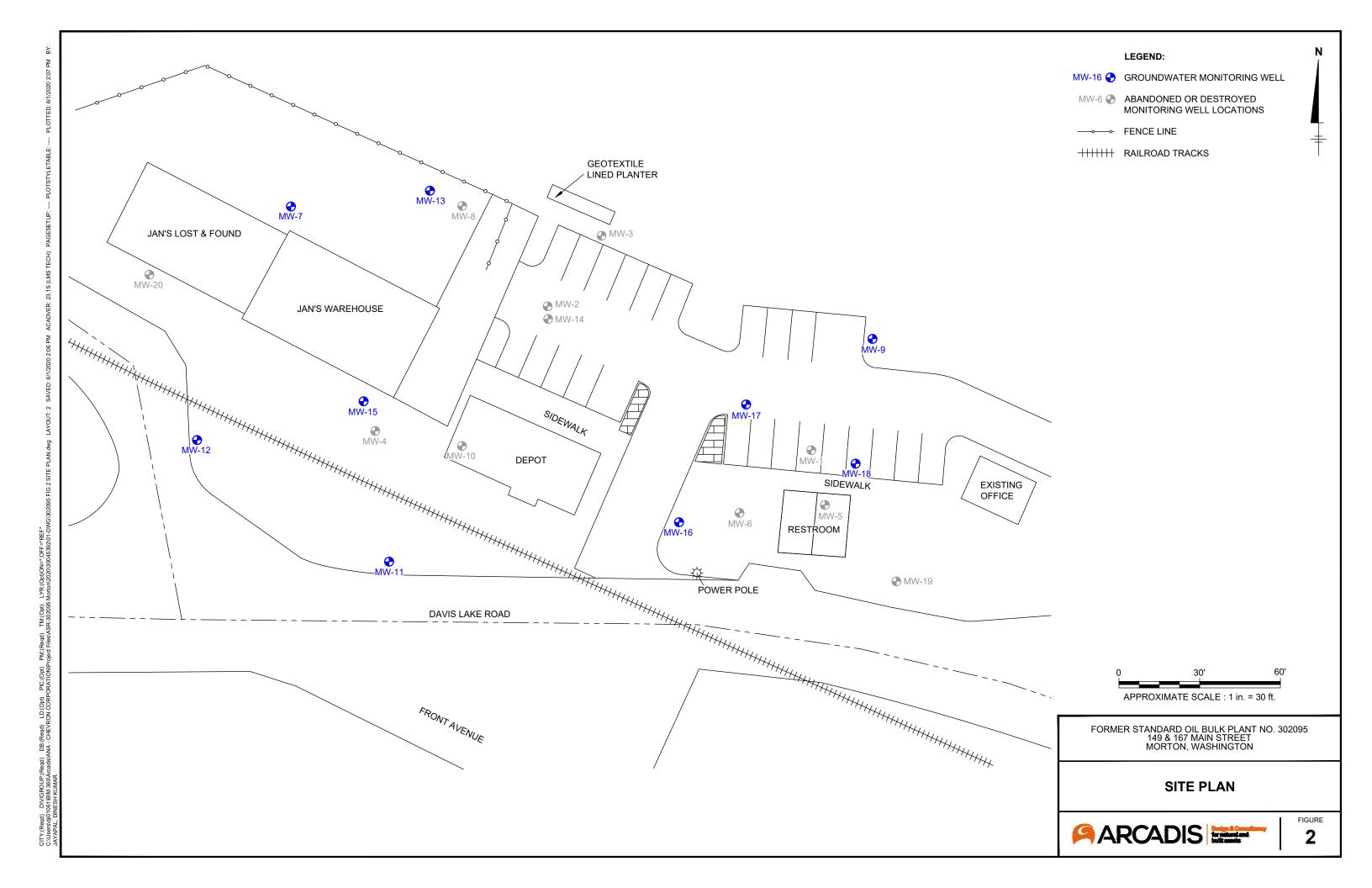
TPH-GRO = Total Petroleum hydrocarbons as Gasoline-Range Organics TPH-HRO = Total Pretoleum Hydrocarbons as Heavy Oil Range Organics

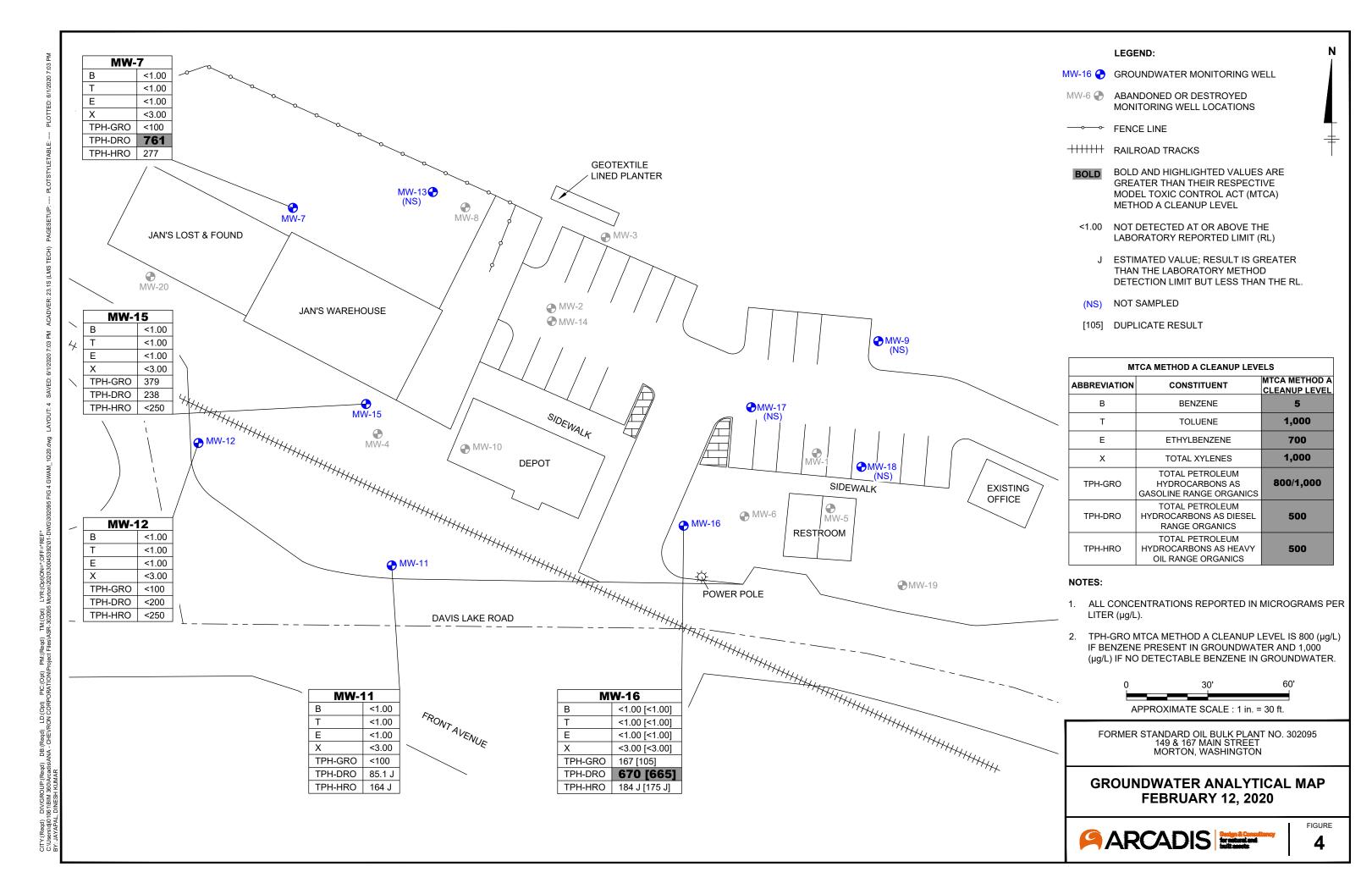
#### **Laboratory Qualifiers:**

- < = Not detected at or above the laboratory RL.
- J = Estimated value; result is greater than the laboratory Method Detection Limit (MDL) but less than the RL.

#### **Current Analytical Methods:**

# **FIGURES**





# **ATTACHMENT A**

**Technical Guidance Instructions for Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells** 



# TGI - LOW-FLOW GROUNDWATER PURGING AND SAMPLING PROCEDURES FOR MONITORING WELLS

Rev: #1

Rev Date: May 8, 2020

TGI – Low-Flow Groundwater Purging and Sampling Procedures in Monitoring Wells Rev #: 1 | Rev Date: May 8, 2020

# **VERSION CONTROL**

Revision No	Revision Date	Page No(s)	Description	Reviewed by
0	October 12, 2018	All	Updated and re-written as TGI with new branding and content	Marc Killingstad
1	May 8, 2020	Pages 5, 10-11	Added clarification/details for equipment requirements and procedure steps based on USEPA guidance	Marc Killingstad

# **APPROVAL SIGNATURES**

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Technical Expert Reviewed by:	/ 1	May 8, 2020
	Marc Killingstad (Technical Expert)	Date:

## 1 INTRODUCTION

This document describes general and/or specific procedures, methods, actions, steps, and considerations to be used and observed by Arcadis staff when performing work, tasks, or actions under the scope and relevancy of this document. This document may describe expectations, requirements, guidance, recommendations, and/or instructions pertinent to the service, work task, or activity it covers.

It is the responsibility of the Arcadis Certified Project Manager (CPM) to provide this document to the persons conducting services that fall under the scope and purpose of this procedure, instruction, and/or guidance. The Arcadis CPM will also ensure that the persons conducting the work falling under this document are appropriately trained and familiar with its content. The persons conducting the work under this document are required to meet the minimum competency requirements outlined herein, and inquire to the CPM regarding any questions, misunderstanding, or discrepancy related to the work under this document.

This document is not considered to be all inclusive nor does it apply to all projects. It is the CPM's responsibility to determine the proper scope and personnel required for each project. There may be project- and/or client- and/or state-specific requirements that may be more or less stringent than what is described herein. The CPM is responsible for informing Arcadis and/or Subcontractor personnel of omissions and/or deviations from this document that may be required for the project. In turn, project staff are required to inform the CPM if or when there is a deviation or omission from work performed as compared to what is described herein.

In following this document to execute the scope of work for a project, it may be necessary for staff to make professional judgment decisions to meet the project's scope of work based upon site conditions, staffing expertise, regulation-specific requirements, health and safety concerns, etc. Staff are required to consult with the CPM when or if a deviation or omission from this document is required that has not already been previously approved by the CPM. Upon approval by the CPM, the staff can perform the deviation or omission as confirmed by the CPM.

# 2 SCOPE AND APPLICATION

Groundwater samples are collected from monitoring wells to evaluate groundwater quality. The protocol presented in this Technical Guidance Instruction (TGI) describes the procedures to purge monitoring wells and collect groundwater samples using the low flow purging/sampling methodology. This protocol has been developed in accordance with the United States Environmental Protection Agency (USEPA) Region I Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells (EQASOP-GW4; September 19, 2017).

Both filtered and unfiltered groundwater samples may be collected using this low-flow sampling method. Filtered samples will be obtained using a 0.45-micron disposable filter. Project teams will evaluate the last time the monitoring wells were developed and determine if additional development might be necessary. Water samples will not be taken immediately following well development. Sufficient time will be allowed for the groundwater flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

# 3 PERSONNEL QUALIFICATIONS

Arcadis field sampling personnel will have completed or are in the process of completing site-specific training as well as having current health and safety training as required by Arcadis, client, or regulations, such as 40-hour HAZWOPER training and/or OSHA HAZWOPER site supervisor training. Arcadis personnel will also have current training as identified in the site-specific Health and Safety Plan (HASP) which may include first aid, cardiopulmonary resuscitation (CPR), Blood Borne Pathogens (BBP) as needed. The HASP will also identify any access control requirements.

Prior to mobilizing to the field, the groundwater sampling team will review and be thoroughly familiar with relevant site-specific documents including but not limited to the task-specific work plan or field implementation plan (FIP)/field sampling plan, Quality Assurance Project Plan (QAPP), HASP, historical information, and other relevant site documents.

Arcadis field sampling personnel will be knowledgeable in the relevant processes, procedures, and TGIs and possess the demonstrated required skills and experience necessary to successfully complete the desired field work. Additionally, the groundwater sampling team will review and be thoroughly familiar with documentation provided by equipment manufacturers and become familiar with the operation of (i.e., hands-on experience) all equipment that will be used in the field prior to mobilization.

## 4 EQUIPMENT LIST

Specific to this activity, the following materials (or equivalent) will be used:

- Site-specific HASP and health and safety documents identified in the HASP
- Field Implementation Plan (FIP) that includes site map, well construction records, sampling plan (sample analyses, sample volume required, and sample holding time), and prior groundwater sampling records (if available)
- Field notebook and/or smart device (phone or tablet)
- Low-flow sampling field forms (Attachment A)
- Appropriate personal protective equipment (PPE) (e.g., latex or nitrile gloves, safety glasses, etc.)
   as specified in the HASP
- Well keys and other tools to remove manhole covers (manual torque wrench with 9/16" socket and flat head screwdriver typical)
- Photoionization detector (PID) or Flame ionization detector (FID) (as appropriate, depending on site-specific constituents of concern)
- Electronic water-level indicator (e.g., Solinist Model 101) or oil/water interface probe with 0.01foot accuracy (oil/water as appropriate, note that sampling will not be performed when sheen or light non-aqueous phase liquid [LNAPL] is present)
- Down-hole multi-parameter water-quality sonde (temperature/pH/specific conductivity/oxidation reduction [ORP]/turbidity/dissolved oxygen) meter coupled with flow-through-cell for measurements, for example:

- YSI 6-Series Multi-Parameter Instrument
- Horiba U-22 Multi-Parameter Instrument.
- Hydrolab Series 3 or Series 4a Multiprobe and Display.

NOTE: Transparent, small volume flow-through-cells (e.g., 250 milliliters or less) are preferred as they allow for easy detection of air bubbles and sediment buildup in the cell, which can interfere with the monitoring instrument probes. A small volume cell also allows for quick turnover of water in the cell between measurements of the indicator field parameters. It is recommended to use a flow-through-cell and monitoring probes from the same manufacturer and model to avoid incompatibility between the probes and flow-through-cell.

- Plastic sheeting (e.g., Weatherall Visqueen) to protect all down-hole sampling equipment from contact with potential sources of contamination.
- Decontamination equipment
  - Non-phosphate laboratory soap (Alconox or equivalent), brushes, clean buckets or clean wash tubs—new buckets or tubs will be purchased if it cannot be determined if the present items are clean
  - Distilled or de-ionized water for equipment decontamination
- Indelible ink pen
- 150-foot measuring tape (or sufficient length for the maximum site depth requirement)
- Sampling pump, which may consist of one or more of the following:
  - o Submersible pump (e.g., Grundfos Redi-Flo 2)
  - o Peristaltic pump (e.g., ISCO Model 150)
  - Bladder pump (e.g., Marschalk System 1, QED Micropurge, Geotech)
- Appropriate controller and power source for pump:
  - Submersible and peristaltic pumps require electric power from either a generator or a deep cell battery
  - Submersible pumps such as Grundfos require a pump controller to run the pump
  - Bladder pumps require a pump controller and a gas source (e.g., air compressor or compressed N2 or CO2 gas cylinders)
- Teflon® tubing or Teflon®-lined polyethylene tubing of an appropriate size for the pump being used
  - For peristaltic pumps, dedicated Tygon® tubing (or other type as specified by the manufacturer) will be used through the pump apparatus
  - Teflon® will not be used when sampling for per- and polyfluoroalkyl substances (PFAS)
- Graduated cylinder and stop watch or other device to measure time to determine pumping rate

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- Appropriate water sample containers (supplied by the laboratory)
- Appropriate blanks (trip blank supplied by the laboratory)
- Sample labels and Chain-of-Custody forms (COC)
- 0.45-micron disposable filters (if field filtering is required)
- A supplemental turbidity meter (e.g., Horiba U-10, Hach 2100P, LaMotte 2020) may be required for specific projects and will be specified in the project FIP/ work plan and the kick-off notes.
  - o If used, in-line 'T' and valve allows for collection of water for turbidity measurements before the pump discharge enters the flow-through cell

NOTE: The maintenance requirements for the above equipment generally involve decontamination or periodic cleaning, battery charging, and proper storage, as specified by the manufacturer. For operational difficulties, the equipment will be serviced by a qualified technician.

#### 5 CAUTIONS

Different USEPA regions and/or state regulatory agencies may stipulate deviations from this document. It is the responsibility of the Project Team (Project Manager and Technical Lead) to be fully aware of the requirements from the applicable regulatory framework.

#### Weather

- If heavy precipitation occurs, and no cover over the sampling area and monitoring well can be
  erected, sampling may be discontinued until adequate cover is provided. Rain water could
  compromise groundwater samples.
- Avoid extreme weather situations. Be aware that thermal currents and vertical mixing of cold and warm water inside the well casing could create a convection cell within the well and compromise data collection (e.g., biological mechanisms).
  - Direct sunlight and hot ambient temperatures may cause the groundwater in the tubing or flow-through-cell to heat up and de-gas. This may result in the loss of volatile organic compounds (VOCs) and dissolved gases. Shade the equipment from direct sunlight, keep the tubing as short as possible, and avoid the hottest times of the day.
  - Sampling during freezing conditions may adversely impact the data quality objectives.
     USEPA recommends low-flow sampling be conducted at air temperatures above 32°F
     (0°C) or taking special precautions to prevent groundwater from freezing in the equipment.

#### **Cross-Contamination**

 To mitigate potential cross-contamination, groundwater samples are to be collected in a predetermined order from least impacted to impacted based on previous analytical data. If no analytical data are available, collect samples in order of up-gradient, then furthest down-gradient to source area locations.

- Note that permanent markers could introduce volatile constituents into the samples; *therefore*, *indelible ink is recommended* to be used for labels on sample containers or sample coolers.
- When using a gasoline generator, this power source will be set-up at least 30 feet downwind from the well to avoid exhaust fumes to contaminate samples.

#### **Pumps**

- Preferred methods of extracting groundwater are adjustable rate, submersible pumps such as centrifugal pumps or bladder pumps constructed of stainless steel or polytetrafluoroethylene (PTFE, i.e. Teflon®). However, PTFE will not be used when sampling for per- and polyfluoroalkyl substances (PFAS). PTFE could contain PFAS.
- When using a bladder pump for collecting VOCs and dissolved gases, "best practice" is to set-up the pump to deliver sufficient water to fill a 40 mL VOC vial.
- The use of peristaltic pumps will be based on the type of data to be collected. Because the use a peristaltic pump can result in de-gassing of VOC and / or dissolved gases from groundwater, a different type of pump will be considered if these compounds are of concern.
- Manual or motor driven inertial pumping devices are not recommended because they cause greater disturbance during purging and pumping than regular pumps and are less easily controlled. This could cause a higher degree of data variability.

#### Tubing

- When sampling for VOCs, SVOCs, pesticides, PCBs and inorganics, use of PTFE (Teflon®) or PTFE-lined tubing is preferred. However, PTFE tubing will not be used when sampling for PFAS.
- PVC, polypropylene or polyethelene tubing may be used when sampling for metals or other inorganics.
- Tubing with inside diameters of 1/4 or 3/8 inch is recommended because this will help ensure tubing remains water filled when operating at very low pumping rates.

#### **General Precautions**

- Store and/or stage empty and full sample containers and coolers out of direct sunlight.
- It may be necessary to field filter the groundwater for some parameters (e.g., metals) during collection, depending on preservation, analytical method, and project quality objectives. The taskkick-off notes and the FIP/work plan will list the samples that require field filtering.
- Be careful not to overtighten lids with Teflon® liners or septa (e.g., 40 mL vials). Over-tightening can cause the glass to shatter or impair the integrity of the Teflon® seal.

# **6 HEALTH AND SAFETY CONSIDERATIONS**

The HASP will be followed, as appropriate, to ensure the safety of field personnel.

Appropriate personal protective equipment (PPE) will be worn at all times in line with the task and the site-specific HASP.

Review all site-specific and procedural hazards as they are provided in the HASP, and review Job Safety Analysis (JSA) documents in the field each day prior to beginning work.

Access to wells may expose field personnel to hazardous materials such as contaminated groundwater or non-aqueous phase liquid (NAPL) (e.g., oil). Other potential hazards include pressurized wells, stinging insects that may inhabit well heads, other biologic hazards (e.g. ticks in long grass/weeds around well head), and potentially the use of sharp cutting tools (scissors, knife)—open well caps slowly and keep face and body away to allow to vent any built-up pressure; only use non-toxic peppermint oil spray for stinging insect nests; review client-specific health and safety requirements, which may preclude the use of fixed/folding-blade knives, and use appropriate hand protection.

Generators and cord and plug equipment will employ an overcurrent protection device such as an integrated ground fault circuit interrupter (GFCI) cord. Grundfos pump controllers will not run properly with a GFCI, so the power source will be equipped with other overcurrent protection means.

Overtightening of lids with Teflon® liners can cause the glass to shatter and create a risk for hand injuries.

# 7 PROCEDURE

Field personnel will set up and perform low-flow sampling in accordance with the following procedures.

- 1. Review FIP and groundwater sampling records from previous sampling events (if available) prior to mobilization to estimate the optimum pumping rate and anticipated drawdown for each well to perform sampling as efficiently as possible (i.e., reach a stabilized pumping condition).
- 2. Calibrate field instruments according to manufacturer procedures for calibration and record calibration procedure and results in field log.
- 3. All equipment will either be new or decontaminated in accordance with appropriate guidance document (*TGI Groundwater and Soil Sampling Equipment Decontamination*) prior to use.
- 4. Visually inspect the well to ensure that it is undamaged, properly labeled and secured
  - a) Damage or other conditions that may affect the integrity of the well will be recorded in the Field Activity Daily Log and brought to the attention of the designated Field Manager and/or Project Manager
  - b) Record well construction and conditions on the Low-Flow Sampling Field Form (Attachment A)
- 5. Place clean plastic sheeting on the ground near the well to keep monitoring and sampling equipment off the surface unless the equipment is elevated above the ground (e.g. on a table).
- 6. Open the well cover while standing upwind of the well. Remove the well cap and place it on the plastic sheeting. If appropriate or required for site-specific conditions, insert the photoionization detector (PID) probe approximately 4 to 6 inches into the casing or the well headspace and cover it with a gloved hand. Record the PID reading in the field log. Perform air monitoring in the breathing zone according to the HASP and/or JSA.
- 7. Measure and record the initial depth to groundwater prior to placing the pumps.

8. Prepare and install the pump in the well.

NOTE: Groundwater will be purged from the wells using an appropriate pump. If the depth to water is below the sampling range of a peristaltic pump (approximately 25 feet below ground surface), a submersible or bladder pump will be used, provided that the well is constructed with a casing diameter of at least two (2) inches (the minimum well diameter capable of accommodating such pumps). For smaller diameter wells, where the depth to water is below the sampling range of a peristaltic pump, alternative sampling methods (i.e., bailing or small diameter bladder pumps) will be used to purge and sample the groundwater. Bladder pumps are preferred over peristaltic and submersible pumps to prevent volatilization if sampling of VOCs and/or dissolved gasses is required. Purge water will be collected and containerized according to the direction of the project team.

- a) For submersible and non-dedicated bladder pumps, decontaminate the pump according to site decontamination procedures. Non-dedicated bladder pumps will require a new bladder and attachment of an air-line, sample discharge line, and safety cable prior to placement in the well. Attach the air-line tubing to the air-port on the top of the bladder pump. Attach the sample discharge tubing to the water port on the top of the bladder pump. Take care not to reverse the air and discharge tubing lines during bladder pump setup, as this could result in bladder failure or rupture. Attach and secure a safety cable to the eyebolt on the top of pump (if present, depending on pump model used). Slowly lower the pump, safety cable, tubing, and electrical lines into the well to a depth corresponding to the approximate center of the saturated screen section of the well. Avoid twisting and tangling of safety cable, tubing, and electrical lines while lowering the pump into the well; twisted and tangled lines could result in the pump becoming stuck in the well casing. Also, make sure to keep tubing and lines from touching the ground or other surfaces while introducing them into the well, as this could lead to unintended contamination.
- b) If using a bladder pump, connect the air-line to the pump controller output port. The pump controller will be connected to a supply line from an air compressor or compressed gas cylinder using an appropriate regulator and air hose. Tighten the regulator connector onto the gas cylinder (if used) to prevent leaks. Teflon® tape may be used on the threads of the cylinder to provide a tighter seal. Once the air compressor or gas cylinder is connected to the pump controller, turn on the compressor or open the valve on the cylinder to begin the gas flow. Turn on the pump controller power (if an on/off switch is present) and verify that all batteries are charged and fully functioning before starting the pump.
- c) If a peristaltic pump is being used, slowly lower the sampling tubing into the well to a depth corresponding to the approximate center of the saturated screen section of the well. The pump intake or sampling tube must be kept at least two (2) feet above the bottom of the well to prevent mobilization of any sediment present in the bottom of the well.
- d) If using an in-line 'T' and valve, install between pump discharge water line and the bottom inlet port of the flow-through cell. Attach a short piece of tubing to the outlet. This set-up will be used to collect samples for turbidity readings.

- 9. Connect the pump discharge water line to the bottom inlet port on the flow-through cell connected to the multi-parameter water-quality sonde and make sure to record equipment/instrument identification (manufacturer and model number).
- 10. Before starting the pump, ensure that the water level inside the well has stabilized (i.e., measure the water level multiple times after deploying the pump in the well).
- 11. Start pumping the well at 200 to 500 milliliters (mL) per minute (or at lower site-specific rate if specified) and adjust the pumping rate to cause little or no water level drawdown in the well (less than 0.3 feet below the initial static depth to water measurement): the water level should stabilize, however, this is not always possible.
- 12. If the well diameter is of sufficient size, measure the water level every 3 to 5 minutes (or as appropriate, lower flow rates may require longer time between readings) during pumping.
- 13. Maintain a steady flow rate to the extent practicable and do not break pump suction or cause entrainment of air in the sample.
- 14. Record pumping rate adjustments and depths to water.

If necessary, reduce pumping rates to the minimum capabilities of the pump to avoid pumping the well dry and/or to stabilize indicator parameters; if the recharge rate of the well is very low, use alternative purging techniques, which will vary based on the well construction and screen position.

For wells screened across the water table, the well may be pumped dry and sampling can commence as soon as the volume in the well has recovered sufficiently to permit collection of samples.

For wells screened entirely below the water table, the well can be pumped until a stabilized level (which may be greater than the maximum displacement goal of 0.3 feet) is maintained and monitoring for stabilization of field indicator parameters can commence; if a lower stabilization level cannot be maintained, the well may be pumped until the drawdown is at a level slightly higher than top of the well screen.

- 15. After water levels have stabilized and a sufficient volume has been purged (see note below), continue pumping and begin monitoring field indicator parameters using a multi-parameter water-quality sonde coupled with a flow-through-cell.
  - NOTE: The final purge volume must be greater than the stabilized drawdown volume plus the pump's tubing volume. If the drawdown has exceeded 0.3 feet and stabilizes, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.
- 16. Use the flow to measure all indicator field parameters, except for turbidity, every 3 to 5 minutes (or after each volume of the flow-through cell has been purged or other appropriate interval); turbidity samples will be collected before the flow-through-cell using the T-valve and a clean container such as a glass beaker.
- 17. Record field indicator parameters on the groundwater sampling log.

- 18. The well is considered stabilized and ready for sample collection when three consecutive readings are within the following limits:
  - Turbidity within ± 10% for values greater than 5 nephelometric turbidity units [NTUs] or if three turbidity values are less than 5 NTUs, consider the values stabilized
  - **Dissolved Oxygen (DO)** within ± 10% for values greater than 0.5 mg/L or if three DO values are less than 0.5 mg/L, consider the values stabilized
  - Specific Conductance within ± 3%
  - **Temperature** within ± 3%
  - **pH** within ± 0.1 unit
  - Oxidation/Reduction Potential (ORP) within ±10 millivolts (mV)

NOTE: Alternate stabilization goals may exist in different geographic regions, consult the site-specific FIP/work plan for stabilization criteria).

NOTE: While achieving turbidity levels less than 5 NTU and a stable drawdown of less than 0.3 feet is desirable, sample collection may still take place provided the indicator field parameter criteria in this procedure are met.

- 19. If the parameters have stabilized but turbidity remains relatively high (e.g., greater than 50 NTUs), the pump flow rate may be decreased to a minimum rate of 100 mL/min to reduce turbidity levels as low as possible. If groundwater turbidity has been minimized (i.e., consecutive readings within ± 10%) and the values for all other parameters have stabilized, the well may be sampled; however, consult specifications in the FIP/work plan and/or the project technical lead prior to sampling.
- 20. If after one (1) hour of purging indicator field parameters have not stabilized, consult specifications in the FIP/work plan and/or the project technical lead prior to sampling.

In general, three potential options are available if stabilization criteria are not met:

- a) Continue purging until stabilization is achieved.
- b) Discontinue purging, do not collect any samples, and record in field logbook/on the sampling form that stabilization could not be achieved (documentation must describe attempts to achieve stabilization).
- c) Discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization. There is a risk that the analytical data obtained under these conditions, particularly metals and hydrophobic organic analytes, may reflect a sampling bias and, as a result, the data may not meet the data quality objectives of the sampling event.

NOTE: DO is extremely susceptible to various external influences (including temperature or the presence of bubbles on the DO meter); therefore, great care will be taken to minimize the agitation or other disturbance of water within the flow-through cell while collecting these measurements. If air bubbles are present on the DO probe or in the discharge tubing, remove them before taking a measurement. If DO values are not within acceptable range for the temperature of groundwater, again check for and remove air bubbles on the probe before re-measuring. The table below may be

used as a general guide for DO values under various temperatures; however, understand that the table corresponds to freshwater solubility and groundwater contaminants may affect oxygen solubility. If DO value is 0.00 or less, then the meter will be serviced and re-calibrated. If DO values are above possible results, then the meter will be serviced and re-calibrated.

NOTE: During extreme weather conditions, stabilization of field indicator parameters may be difficult to attain. Modifications to the sampling procedures to alleviate these conditions (e.g., measuring the water temperature in the well adjacent to the pump intake) will be documented in the field logbook/on the sampling form.

NOTE: If other field conditions are suspected of preventing stabilization of certain parameters, detailed observations will be documented in the field logbook/on the sampling form.

Oxygen Solubility in Fresh Water

Temperature	Dissolved Oxygen					
(degrees C)	(mg/L)					
0	14.6					
1	14.19					
2	13.81					
3	13.44					
4	13.09					
5	12.75					
6	12.43					
7	12.12					
8	11.83					
9	11.55					
10	11.27					
11	11.01					
12	10.76					
13	10.52					
14	10.29					
15	10.07					
16	9.85					
17	9.65					
18	9.45					
19	9.26					
20	9.07					
21	8.9					
22	8.72					
23	8.56					
24	8.4					
25	8.24					
26	8.09					
27	7.95					
28	7.81					
29	7.67					
30	7.54					
31	7.41					
32	7.28					
33	7.16					
34	7.05					
35	6.93					

Reference: Vesilind, P.A., Introduction to Environmental Engineering, PWS Publishing Company, Boston, 468 pages (1996).

- 21. Complete the sample label(s) and cover the label(s) with clear packing tape to secure the label onto the container.
- 22. After the indicator parameters have stabilized, collect groundwater samples by diverting flow out of the unfiltered discharge tubing into the appropriate labeled sample container.
  - a) If a flow-through analytical cell is being used to measure field parameters, the flow-through cell will be disconnected after stabilization of the field indicator parameters and prior to groundwater sample collection.
  - b) Under no circumstances will analytical samples be collected from the discharge of the flow-through cell.
  - c) If an in-line 'T' and valve are used, the valve needs to be removed as well.
  - d) Samples will be collected in the following order: VOCs, total organic carbon (TOC), semi-volatile organic compounds (SVOCs), metals and cyanide, and others (or other order as defined in the site-specific FIP/work plan).
  - e) When the container is full, tightly screw on the cap.
- 23. If sampling for total and filtered metals and/or polychlorinated biphenyls (PCBs), a filtered and unfiltered sample will be collected.
  - a) Install an in-line, disposable 0.45-micron particle filter on the discharge tubing after the appropriate unfiltered groundwater sample has been collected.
  - b) Continue to run the pump until an initial volume of "flush" water has been run through the filter in accordance with the manufacturer's directions (generally 100 to 300 mL).
  - c) Collect the filtered groundwater sample by diverting flow out of the filter into the appropriately labeled sample container.
  - d) When the container is full, tightly screw on the cap.
- 24. Secure with packing material and store the samples on ice in an insulated transport container provided by the laboratory and include a temperature blank in each container to be shipped.
- 25. Record on the Low-Flow Sampling Field Form (and bound field logbook) the time at which sampling procedures were completed, any pertinent observations of the sample (e.g., physical appearance and the presence or lack of odors or sheens), and the values of the stabilized field indicator parameters as measured during the final reading during purging (see **Attachment A**).
- 26. Turn off the pump and air compressor or close the gas cylinder valve if using a bladder pump setup.
- 27. Slowly remove the pump, tubing, lines, and safety cable from the well.
  - a) If using dedicated tubing, do not allow the tubing or lines to touch the ground or any other surfaces which could contaminate them.
  - b) If using dedicated tubing, it will be folded without pinching it to a length that will allow the well to be capped and also facilitate retrieval of the tubing during later sampling events.
  - c) Use a length of rope or string to tie the tubing to the well cap.

- d) Alternatively, if tubing and safety line are to be saved and reused for sampling the well at a later date, coil the tubing neatly and placed in a clean plastic bag that is clearly labeled with the well ID ensuring the bag is tightly sealed before placing it in storage.
- 28. Secure the well and properly dispose of personal protective equipment (PPE) and disposable equipment.
- 29. Complete the procedures for packaging, shipping, and handling with the associated Chain-of-Custody.
- 30. Complete decontamination for flow-through analytical cell and submersible or bladder pump, as appropriate (*TGI Groundwater and Soil Sampling Equipment Decontamination*).
- 31. At the end of each day of the sampling event, perform calibration check of field instruments and record procedure and results in field log.

#### 8 WASTE MANAGEMENT

Materials generated during groundwater sampling activities, including disposable equipment and excess purge water, will be stored on site in appropriately labeled containers and disposed of properly. Waste will be managed in accordance with the *TGI – Investigation-Derived Waste Handling and Storage*, the procedures identified in the FIP or QAPP as well as state-, federal- or client-specific requirements. Be certain that waste containers are properly labeled and documented in the field logbook.

## 9 DATA RECORDING AND MANAGEMENT

Management of the original documents from the field will be completed in accordance with the site-specific QAPP.

In general, forms (e.g., Low-Flow Sampling Field Forms), logs/notes (including daily field and calibration logs), digital records, and Chain-of-Custody records will be maintained by the field team lead.

Field logs and Chain-of-Custody records will be transmitted to the Arcadis Project Manager and/or Task Manager, as appropriate, at the end of each day unless otherwise directed. Electronic data files will be sent to the project team and uploaded to the electronic project folder daily.

Records generated as a result of this TGI will be controlled and maintained in the project record files in accordance with project requirements.

# 10 QUALITY ASSURANCE

Quality assurance procedures shall be conducted in accordance with the Arcadis Quality Management System or the site-specific QAPP.

Unless described otherwise in the project-specific FIP/work plan, QAPP, or Sampling and Analysis Plan, quality assurance/quality control samples will be collected as follows:

One duplicate for every 10 samples

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• One laboratory matrix/matrix spike sample for every 20 samples

In addition to the quality control samples to be collected in accordance with this TGI, the following quality control procedures will be observed in the field:

- Collect samples from monitoring wells, in order of increasing concentration, to the extent known based on review of historical site information if available
- Equipment blanks will include the pump and tubing (if using disposable tubing) or the pump only (if using tubing dedicated to each well)
- Collect equipment blanks after wells with higher concentrations (if known) have been sampled
- Operate all monitoring instrumentation in accordance with manufacturer's instructions and calibration procedures—calibrate instruments at the beginning of each day, verify the calibration at the end of each day, and record all calibration activities in the field notebook
- Clean all groundwater sampling equipment prior to use in the first well and after each subsequent well following the procedure for equipment decontamination

## 11 REFERENCES

- USEPA. 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document (September 1986).
- USEPA. 1991. *Handbook Groundwater, Volume II Methodology*, Office of Research and Development, Washington, DC. USEPN62S, /6-90/016b (July 1991).
- USEPA Region I. 2017. Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells (EQASOP-GW4; September 19, 2017).
- U.S. Geological Survey (USGS). 1977. *National Handbook of Recommended Methods for Water-Data Acquisition: USGS Office of Water Data Coordination*. Reston, Virginia.

#### 12 ATTACHMENTS

A. Low-Flow Sampling Field Form

#### **GROUNDWATER SAMPLING FORM**



											Page	of
Project No.					Well ID					Date		
Project Name	/Location _									Weather		
Measuring Pt Description			Screen Setting (ft-bmp)			Casing Diameter (in.)				Well Mate	rial	PVC SS
Static Water Level (ft-bmp		7	Гotal Depth (ft-bmp)			Water Column (ft)		Gall	ons in Well			
			ump Intake (ft-bmp)							Sample	•	
Pump On/Off						Contrifugal			Method			
			Malana a Dimana d				Other					
			Volumes Purged Gallons Purged				Sample ID			Sampled b	)V	
						Replicate	e/Code No.		-			
Time	Minutes Elapsed	Rate (gpm)/(mL/min)	Depth to Water (ft)	Gallons Purged	рН	Cond. (μMhos)/(mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp.	Redox (mV)	Арр	earance
	Liapseu	200mL/min +	-0.3	i uigeu	± 0.1	± 3%	± 10%	± 10%	± 3%	± 10mV	Color	Odor
		Stal	oilization Calculat	tions (±)								
							400/					
	s	tabilization Crit	eria		± 0.1 s.u	±3%	± 10% or within 1	± 10%	±3%	±10 mV		
(1) <b>Turbidity</b> < 50	0 NTU and ±1	10% or within 1 NTU	of a previous reading w	hen <10 N	TU		NTU <sup>(1)</sup>					
Constituents			•		Containe	er			Number		Preserv	ative
				•						_		
				ı						-		
				•						-		
				ı						-		
				ŗ						-		
										-		
				·						•		
Comments												
Well Casing \ Gallons/Foot	Volumes 1" = 0.04	1.	.5" = 0.09	2.5" = 0.2	6	3.5" = 0.50	6" = 1.47					
	1.25" = 0.0		" = 0.16	3" = 0.37		4" = 0.65						
Well Inform	ation											
Well Loca							Well I	Locked at	Arrival:	Yes	/	No
Condition of	of Well:						Well Lock		_	Yes	/	No
Well Comp	oletion:	Flush I	Mount / St	ick Up			Key	Number <sup>-</sup>	To Well:			GW Samp Form

# **ATTACHMENT B**

**Field Data Sheets** 



# **Daily Log**

Project Name :302095Weather(°F) :Partly CloudyProject Number :30012387Prepared By:Trevor Bryant

**Purpose:** Survey oversight and groundwater monitoring

PPE: Level D

**Equipment:** Peristaltic Pump

Date	Time	Description of Activities
2/12/2020	09:02	Arcadis and otak on site. PPE put on and health and safety tailgate began.
2/12/2020	10:04	Gauging began
2/12/2020	11:05	Purging and sampling began at MW-16
2/12/2020	11:27	MW-16 samples. DUP-1 taken at MW-16
2/12/2020	12:27	MW-7 sampled.
2/12/2020	12:38	MW-11 sampled.
2/12/2020	13:15	MW- 15 sampled
2/12/2020	13:16	MW-12 sampled
2/12/2020	14:10	Wells secured, site cleaned up and Arcadis off site
2/12/2020	14:45	Arcadis back on site to check MW-18 for product.
2/12/2020	15:01	After a bail down of MW-18 no product was visible and the groundwater pulled up had no odor. O/W interface probe detection was likely a false positive.
2/12/2020	15:10	Arcadis off site



### **Waste Management:**

	Drums On Site										
Date	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments		
2/12/2020					no						



## **Groundwater Gauging Log**

Client:					Chevron		
Project Name	/Location:				302095 Mortor	า	
Date(s):					2/12/2020		
Sampler(s):					Trevor Bryant		
Equipment:				oil/\	water interface p	orobe	
Well	Date	Time	Depth to Water (ft)	Well Depth (ft)	Depth to LNAPL (ft)	PID (ppmv)	Remarks
MW-18	2/12/2020	10:21:00	0.84	14.9		0	Screen submerged Top of casing is cracked but no signs of surface water infilitration
MW-16	2/12/2020	10:28:00	2.18	18.52		62.6	2 bolts missing
MW-12	2/12/2020	10:36:00	2.35	19.41		0	Missing 2 bolts Was buried
MW-11	2/12/2020	10:38:00	1.61	19.16		0	Monument filled with sediment All 3 bolts missing
MW-15	2/12/2020	10:42:00	1.25	17.5		6.8	Monument full of water
MW-17	2/12/2020	10:45:00	2	17.8		12	Not locked, locking mechanism broken/missing
MW-7	2/12/2020		3.11	19.03		0	



Project N	umber	300123	87	Well ID		MW	MW-7			ate	2/12/2020	
Project N	Project Name/Location		5 Morton						V	Veather(°F)	Partly cloudy, 43	
Measuring Pt. T		Top of (	Casing	Screen Setting	Screen Setting (ft-bmp)			sing ameter (in)	/	Vell Casing Naterial	PVC	
Static Wa Level (ft-l	ic Water el (ft-bmp)			Total De	Total Depth (ft-bmp)		03 Water Column(ft)		16	Sallons in Vell	2.59	
MP Eleva	tion	951.11		Pump In	take (ft-bmp	<b>o)</b> 8		rge thod		Sample Method	Low-Flow	
Sample T	ime	12:27		Volumes	s Purged	0.31	Sa	mple ID	MW-7	ampled by	Trevor Brya	ant
Purge Sta	art	12:11		Gallons	Purged	0.79	Re	plicate/				
Purge En	d	12:26					Co	de No.				
Time	Minutes Elapsed	Rate (mL/min)	Depth to Water (ft)	Gallons Purged	pH (standard units)	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (°C)	Redox (mV)	Appea Color	rance
12:11	0	200	3.11	0.00	6.28	0.192		3.47	9.3	99.8	Clear	None
12:14	3	200	3.31	0.16	6.17	0.19		2.82	9	95.2	Clear	None
12:17	3	200	3.52	0.32	6.06	0.189		2.97	9.1	92.6	Clear	None
12:20	3	200	3.65	0.48	6.03	0.189		2.66	9.1	91.7	Clear	None
12:23	3	200	3.61	0.63	5.98	0.19		2.56	9	90.8	Clear	None
12:26	3	200	3.6	0.79	5.97	0.19		2.54	9	90.4	Clear	None

### Comments:

### Well Casing Volume Conversion

Well diameter (inches) = 1 = 0.04 + 1.5 = 0.09 + 2.5 = 0.26 + 3.5 = 0.50 + 6 = 1.47

gallons per foot 1.25 = 0.06 2 = 0.16 3 = 0.37 4 = 0.65

Well Information

Well Location: Behind thrift store Well Locked at Arrival: no

Condition of Well: Good Well Locked at Departure: no

Well Completion: Flush mount Key Number To Well: NA



Project N		30012387 Well ID				MW	MW-11				2/12/2020	
Project N	Project Name/Location		302095 Morton							Weather(°F)	Overcast, 45F	
Measuring Pt. Description Static Water Level (ft-bmp)		Top of Casing		Screen Setting (	Screen Setting (ft-bmp)			Casing 2		Well Casing Material	PVC	
				Total Depth (ft-bmp)		19.	16	ter lumn(ft)	18	Gallons in Well	2.85	
MP Eleva	ation	949.22		Pump In	take (ft-bmp	<b>o)</b> 8		rge thod		Sample Method	Low-Flow	
Sample 1	Гime	12:38		Volumes	s Purged	0.28	∃ Sa	mple ID	MW-11	Sampled by	Sydney Cla	ark
Purge St	art	12:20		Gallons	Purged	0.79	e Re	plicate/				
Purge En	nd	12:44			_		Co	de No.				
Time	Minutes Elapsed	Rate (mL/min)	Depth to Water (ft)	Gallons Purged	pH (standard units)	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperatur (°C)	Redox (mV)	Appea Color	rance Odor
12:20	0	200		0.00	5.71	0.364		1.49	10.8	214.5	None	None
12:23	3	200		0.16	5.88	0.323		0.64	10.5	187.3	None	None
12:26	3	200		0.32	6.19	0.321		0.55	10.4	167.2	None	None
12:29	3	200		0.48	6.28	0.313		0.55	10.3	152.5	None	None
12:32	3	200		0.63	6.25	0.304		0.54	10.4	143	None	None
12:35	3	200		0.79	6.25	0.296		0.56	10.5	132.7	None	None

### **Well Casing Volume Conversion**

Well diameter (inches) = 1 = 0.04 + 1.5 = 0.09 + 2.5 = 0.26 + 3.5 = 0.50 + 6 = 1.47

gallons per foot 1.25 = 0.06 2 = 0.16 3 = 0.37 4 = 0.65

Well Information

Well Location: See site map Well Locked at Arrival: no

DTW was not collected because only 1 oil/water interface probe was available during sampling.

Condition of Well: Buried under gravel Well Locked at Departure: no

Well Completion: Flush mount Key Number To Well: NA



Project N	lumber	300123	87	Well ID		MW	-12		İ	Date	2/12/2020	
Project N	lame/Locatio	n 302095	095 Morton					,	Weather(°F)	Partly cloudy, 43		
Description Static Water		Top of (	Casing	Screen Setting	(ft-bmp)		Casing Diameter (in)		/	Well Casing Material	PVC	
		2.51 Total Depth		pth (ft-bmp)	19.4	l1	Water 1 Column(ft)		Gallons in Well	2.75		
MP Eleva	ition	949.53		Pump In	take (ft-bmp	) 6		rge thod		Sample Method	Low-Flow	
Sample T	Time	13:16		Volumes	s Purged	0.35	Sa Sa	mple ID	MW-12	Sampled by	Trevor Bry	ant
Purge Sta	art	12:59		Gallons	Purged	0.95		plicate/				
Purge En	ıd	13:14					Co	de No.				
Time	Minutes Elapsed	Rate (mL/min)	Depth to Water	Gallons Purged	pH (standard	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen	Temperatur (°C)	e Redox (mV)	Appea Color	orance
12:59	0	200	(ft) 2.51	0.00	units) 5.87	0.159		(mg/L) 4.12	10.5	153.3	Clear	None
13:02	3	200	2.51	0.16	5.68	0.161		3.85	10.1	153.9	Clear	None
13:05	3	200	2.51	0.32	5.57	0.16		3.8	10.2	155.7	Clear	None
13:08	3	200	2.51	0.63	5.54	0.16		3.74	10.1	156.7	Clear	None
13:11	3	200	2.51	0.79	5.52	0.159		3.69	10	157.8	Clear	None
13:14	3	200	2.51	0.95	5.52	0.159		3.66	10	159	Clear	None

### Comments:

### Well Casing Volume Conversion

Well diameter (inches) = 1 = 0.04 1.5 = 0.09 2.5 = 0.26 3.5 = 0.50 6 = 1.47

gallons per foot 1.25 = 0.06 2 = 0.16 3 = 0.37 4 = 0.65

Well Information

Well Locked at Arrival: no

Condition of Well: Good, buried under sediment Well Locked at Departure: no

Well Completion: Flush Mount Key Number To Well: NA



	Date	2/12/2020	
	Weather(°F)	Overcast, 45F	
asing 2	Well Casing Material	PVC	
ater Dlumn(ft)	Gallons in We	2.64 Low-Flow	
irge Low-Flo	Sample Method		
mple ID MW-1	15 Sampled by	Sydney Clark	
eplicate/			
de No.			
	perature Redox (mV)	Appearance Color Odd	
	9.6 33.8	Clear Non	
0.32	9.1 6.5	Clear Non	
0.3	8.9 6.6	Clear Non	
0.27	8.9 7.1	Clear Non	
	0.27		

### Well Casing Volume Conversion

Well diameter (inches) = 1 = 0.04 + 1.5 = 0.09 + 2.5 = 0.26 + 3.5 = 0.50 + 6 = 1.47

gallons per foot 1.25 = 0.06 2 = 0.16 3 = 0.37 4 = 0.65

**Well Information** 

Well Locked at Arrival: no

Condition of Well: Good

Well Locked at Departure: no

Well Completion: Flush mount

Key Number To Well: NA



Project N	Project Number 30012387  Project Name/Location 302095 Morton  Measuring Pt. Description Top of Casing		87	Well ID		MW-16					2/12/2020		
Project N			Morton							Weather(°F)	Sunny, 45		
			Casing	Screen Setting	(ft-bmp)		Casing Diameter (in)		,	Well Casing Material	PVC		
Static Wa		2 18 Total Denth (ft-hmn) 18 52		Water Column(ft)	16	Gallons in Well	2.66						
MP Eleva	tion	949.89	49.89 <b>Pump Intake (ft-bmp)</b> 8 <b>Purge</b> Low-Flo <b>Method</b>			Sample Method	Low-Flow						
Sample T	ime	11:27		Volume	s Purged	0.24	4 5	Sample ID	MW-16	Sampled by	Trevor Bry	ant	
Purge Sta	urge Start 11:13			Gallons Purged		0.63	0.63 <b>Re</b> p		DUP-1				
Purge En	d	11:26					(	Code No.					
Time	Minutes Elapsed	Rate (mL/min)	Depth to Water (ft)	Gallons Purged	pH (standard units)	Conductivity (mS/cm)	Turbidit (NTU)	()yvaen	Temperatur (°C)	Redox (mV)	App	earance Odor	
11:14	0	200	2.31	0.00	4.99	0.421		9.07	10.6	93.2	None	Slight odor	
11:17	3	200	2.31	0.16	5.63	0.331		4.86	10.6	42.5	None	Slight odor	
11:20	3	200	2.31	0.32	5.86	0.306		4	10.6	24.1	None	Slight odor	
11:23	3	200	2.31	0.48	5.93	0.304		3.46	10.6	11.8	None	Slight odor	
11:26	3	200	2.31	0.63	6.03	0.303		3.19	10.4	4.1	None	Slight odor	

### Comments:

### Well Casing Volume Conversion

Well diameter (inches) =  $1 = 0.04 \ 1.5 = 0.09 \ 2.5 = 0.26 \ 3.5 = 0.50 \ 6 = 1.47$  gallons per foot  $1.25 = 0.06 \ 2 = 0.16 \ 3 = 0.37 \ 4 = 0.65$ 

Well Information

Well Location: See site map Well Locked at Arrival: no

Condition of Well: Good Well Locked at Departure: no

Well Completion: Flush mount Key Number To Well: NA

# **ATTACHMENT B**

Regulatory Directive, April 24, 2017



# STATE OF WASHINGTON DEPARTMENT OF ECOLOGY

PO Box 47775 · Olympia, Washington 98504-7775 · (360) 407-6300
711 for Washington Relay Service · Persons with a speech disability can call 877-833-6341

April 24, 2017

# **Electronic Copy**

Mr. Don Wyll Principal Project Manager Leidos 18912 North Creek Parkway, Suite 101 Bothell, WA 98011

Re: Former Chevron Bulk Plant (Wolfe and Parks Property), Morton, Washington. Compliance Groundwater Monitoring Modifications Approval Letter.

Dear Mr. Wyll:

I reviewed your proposed modifications to the Compliance Groundwater Monitoring Plan (copy enclosed) for the Former Chevron Bulk Plant (Wolfe and Parks Property) Site located at 149 and 167 Main Street, Morton, Washington. I also reviewed the results of the groundwater monitoring conducted at this Site from 2004 through 2016.

Based on my review of the above information, Ecology is here by approving your request except the abandonment of monitoring wells MW-13 and MW-17. Ecology's approval include the following:

- Reduction in the sampling frequency from quarterly to semi-annual.
- Reduction in the number of monitoring wells from twelve to five (MW-7, MW-11, MW-12, MW-15 and MW-16) for chemical analysis.
- Abandonment of four monitoring wells (MW-14, MW-18, MW-19 and MW-2). Based on the results of groundwater monitoring, Ecology understands that the contaminant concentrations in these wells were either below the laboratory detection limits or below the Model Toxics Control Act (MTCA) Method A cleanup levels since December 2008 (30 rounds of monitoring). Since continued monitoring of these wells will not provide any valuable information, it is Ecology's opinion that it is appropriate to discontinue the monitoring and abandon these wells.

- Ecology would like to retain the monitoring wells MW-13 and MW-17 just for water level measurements. Ecology believes that measurement of water level elevations in seven wells (MW-7, MW-11, MW-12, MW-13, MW-15, MW-16 and MW-17) will aid to develop a more accurate groundwater flow direction at the site.
- The two rounds of semi-annual groundwater monitoring must reflect the lowest and highest water level elevations (seasons). Please review the existing water level elevation data and select two rounds (seasons) for reflecting the lowest and highest water level conditions at the Site. These two rounds may coincide with the summer and winter seasons.

If you have any questions, regarding this approval, please call me at (360) 407-6335.

Sincerery

Panjini Balaraju, P.E.

By Certified Mail: [91 7199 9991 7037 0279 7772]

Enclosure: (1)

cc: Central File

# **ATTACHMENT D**

**Laboratory Report and Chain-of-Custody Documentation** 



# ANALYTICAL REPORT

February 24, 2020

### Arcadis - Chevron - WA

Sample Delivery Group: L1189490

Samples Received: 02/14/2020

Project Number: 30012387.W9401

302095 Description:

194 MAIN AVE, MORTON, WA 98356 Site:

Report To: Trevor Bryant

1100 Olive Way

Suite 800

Seattle, WA 98101

Entire Report Reviewed By:

Buar Ford

Brian Ford

Project Manager 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 Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

















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Sc: Sample Chain of Custody



















### SAMPLE SUMMARY



Received date/time

Received date/time

Received date/time 02/14/20 08:45

02/14/20 08:45

02/14/20 08:45

Collected date/time

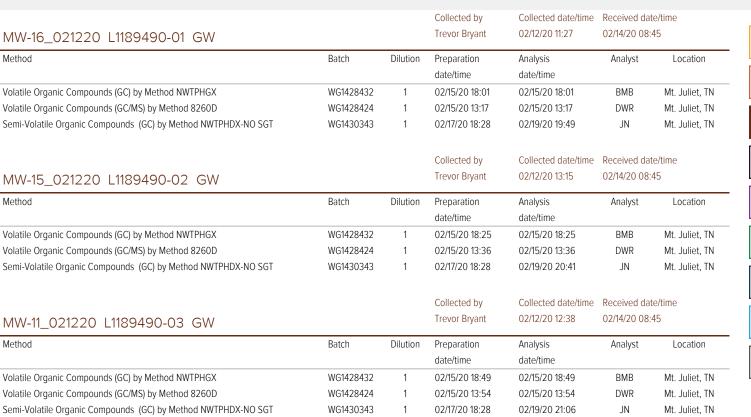
Collected date/time

Collected date/time

02/12/20 00:00

02/12/20 13:16

02/12/20 12:27



















## MW-7\_021220 L1189490-04 GW

Method	Batch	Dilution	Preparation	Analysis	Analyst	Location
			date/time	date/time		
Volatile Organic Compounds (GC) by Method NWTPHGX	WG1428432	1	02/15/20 19:13	02/15/20 19:13	BMB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1428424	1	02/15/20 14:13	02/15/20 14:13	DWR	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1430343	1	02/17/20 18:28	02/19/20 21:32	JN	Mt. Juliet, TN

Collected by

Trevor Bryant

Collected by

Trevor Bryant

Collected by

Trevor Bryant

MW-12	021220	L1189490-05	GW
1V1VV 1Z_	_021220		$\circ$

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC) by Method NWTPHGX	WG1428432	1	02/15/20 19:37	02/15/20 19:37	BMB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1428424	1	02/15/20 14:32	02/15/20 14:32	DWR	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1430343	1	02/17/20 18:28	02/19/20 21:58	JN	Mt. Juliet, TN

# DUP-1\_021220 L1189490-06 GW

Method	Batch	Dilution	Preparation	Analysis	Analyst	Location
			date/time	date/time		
Volatile Organic Compounds (GC) by Method NWTPHGX	WG1428432	1	02/15/20 20:01	02/15/20 20:01	BMB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1428424	1	02/15/20 14:51	02/15/20 14:51	DWR	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1430343	1	02/17/20 18:28	02/19/20 22:23	JN	Mt. Juliet, TN

Arcadis - Chevron - WA

# SAMPLE SUMMARY

ONE LAB. NATIONWIDE.



TRIP BLANK_021220 L1189490-07 NONE			Collected by Trevor Bryant	Collected date/time 02/12/20 00:00	Received date/tir 02/14/20 08:45	ne
Method	Batch	Dilution	Preparation	Analysis	Analyst	Location
			date/time	date/time		



















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 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.

Cn

Ss











Brian Ford Project Manager

Buar Ford

ONE LAB. NATIONWIDE.

Collected date/time: 02/12/20 11:27

### Volatile Organic Compounds (GC) by Method NWTPHGX

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	ug/l		ug/l	ug/l		date / time	
Gasoline Range Organics-NWTPH	167		31.6	100	1	02/15/2020 18:01	WG1428432
(S) a,a,a-Trifluorotoluene(FID)	107			78.0-120		02/15/2020 18:01	<u>WG1428432</u>







### Volatile Organic Compounds (GC/MS) by Method 8260D

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	ug/l		ug/l	ug/l		date / time	
Benzene	U		0.331	1.00	1	02/15/2020 13:17	WG1428424
Toluene	U		0.412	1.00	1	02/15/2020 13:17	WG1428424
Ethylbenzene	U		0.384	1.00	1	02/15/2020 13:17	WG1428424
Total Xylenes	U		1.06	3.00	1	02/15/2020 13:17	WG1428424
(S) Toluene-d8	99.4			80.0-120		02/15/2020 13:17	WG1428424
(S) 4-Bromofluorobenzene	103			77.0-126		02/15/2020 13:17	WG1428424
(S) 1,2-Dichloroethane-d4	93.9			70.0-130		02/15/2020 13:17	WG1428424



Cn



# СQс



## Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	ug/l		ug/l	ug/l		date / time	
Diesel Range Organics (DRO)	670		66.7	200	1	02/19/2020 19:49	WG1430343
Residual Range Organics (RRO)	184	<u>J</u>	83.3	250	1	02/19/2020 19:49	WG1430343
(S) o-Terphenyl	96.3			52.0-156		02/19/2020 19:49	WG1430343

ONE LAB. NATIONWIDE.

Collected date/time: 02/12/20 13:15

### Volatile Organic Compounds (GC) by Method NWTPHGX

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	ug/l		ug/l	ug/l		date / time	
Gasoline Range Organics-NWTPH	379		31.6	100	1	02/15/2020 18:25	WG1428432
(S) a,a,a-Trifluorotoluene(FID)	102			78.0-120		02/15/2020 18:25	WG1428432





### Volatile Organic Compounds (GC/MS) by Method 8260D

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	ug/l		ug/l	ug/l		date / time	
Benzene	U		0.331	1.00	1	02/15/2020 13:36	WG1428424
Toluene	U		0.412	1.00	1	02/15/2020 13:36	WG1428424
Ethylbenzene	U		0.384	1.00	1	02/15/2020 13:36	WG1428424
Total Xylenes	U		1.06	3.00	1	02/15/2020 13:36	WG1428424
(S) Toluene-d8	103			80.0-120		02/15/2020 13:36	WG1428424
(S) 4-Bromofluorobenzene	102			77.0-126		02/15/2020 13:36	WG1428424
(S) 1,2-Dichloroethane-d4	94.1			70.0-130		02/15/2020 13:36	WG1428424



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## Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	ug/l		ug/l	ug/l		date / time	
Diesel Range Organics (DRO)	238		66.7	200	1	02/19/2020 20:41	WG1430343
Residual Range Organics (RRO)	U		83.3	250	1	02/19/2020 20:41	WG1430343
(S) o-Terphenyl	92.6			52.0-156		02/19/2020 20:41	WG1430343

ONE LAB. NATIONWIDE.

Collected date/time: 02/12/20 12:38

Volatile Organic C	ompound	ds (GC) by I	Method	NWTPHGX			
	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	ug/l		ug/l	ug/l		date / time	
Gasoline Range Organics-NWTPH	U		31.6	100	1	02/15/2020 18:49	WG1428432
(S) a,a,a-Trifluorotoluene(FID)	109			78.0-120		02/15/2020 18:49	WG1428432





## Volatile Organic Compounds (GC/MS) by Method 8260D

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	ug/l		ug/l	ug/l		date / time	
Benzene	U		0.331	1.00	1	02/15/2020 13:54	WG1428424
Toluene	U		0.412	1.00	1	02/15/2020 13:54	WG1428424
Ethylbenzene	U		0.384	1.00	1	02/15/2020 13:54	WG1428424
Total Xylenes	U		1.06	3.00	1	02/15/2020 13:54	WG1428424
(S) Toluene-d8	106			80.0-120		02/15/2020 13:54	WG1428424
(S) 4-Bromofluorobenzene	110			77.0-126		02/15/2020 13:54	WG1428424
(S) 1,2-Dichloroethane-d4	94.4			70.0-130		02/15/2020 13:54	WG1428424



Cn









	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	ug/l		ug/l	ug/l		date / time	
Diesel Range Organics (DRO)	85.1	<u>J</u>	66.7	200	1	02/19/2020 21:06	WG1430343
Residual Range Organics (RRO)	164	<u>J</u>	83.3	250	1	02/19/2020 21:06	WG1430343
(S) o-Terphenyl	89.5			52.0-156		02/19/2020 21:06	WG1430343

Analyte

Gasoline Range

Organics-NWTPH

### SAMPLE RESULTS - 04 L1189490

Dilution

Analysis

date / time

02/15/2020 19:13

02/15/2020 19:13

Batch

WG1428432

WG1428432

ONE LAB. NATIONWIDE.

Collected date/time: 02/12/20 12:27

ug/l

31.6

ug/l

100

ug/l

U



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	<sup>2</sup> Tc

(S) a,a,a-Trifluorotoluene(FID)	109	78.0-120
Volatile Organic Co	mpounds (GC/MS) by Method	8260D

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	ug/l		ug/l	ug/l		date / time	
Benzene	U		0.331	1.00	1	02/15/2020 14:13	WG1428424
Toluene	U		0.412	1.00	1	02/15/2020 14:13	WG1428424
Ethylbenzene	U		0.384	1.00	1	02/15/2020 14:13	WG1428424
Total Xylenes	U		1.06	3.00	1	02/15/2020 14:13	WG1428424
(S) Toluene-d8	107			80.0-120		02/15/2020 14:13	WG1428424
(S) 4-Bromofluorobenzene	111			77.0-126		02/15/2020 14:13	WG1428424
(S) 1,2-Dichloroethane-d4	94.0			70.0-130		02/15/2020 14:13	WG1428424



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# Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

		-					
	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	ug/l		ug/l	ug/l		date / time	
Diesel Range Organics (DRO)	761		66.7	200	1	02/19/2020 21:32	WG1430343
Residual Range Organics (RRO)	277		83.3	250	1	02/19/2020 21:32	WG1430343
(S) o-Terphenyl	94.7			52.0-156		02/19/2020 21:32	WG1430343

Collected date/time: 02/12/20 13:16

# SAMPLE RESULTS - 05

ONE LAB. NATIONWIDE.

# Volatile Organic Compounds (GC) by Method NWTPHGX

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	ug/l		ug/l	ug/l		date / time	
Gasoline Range Organics-NWTPH	U		31.6	100	1	02/15/2020 19:37	WG1428432
(S) a,a,a-Trifluorotoluene(FID)	116			78.0-120		02/15/2020 19:37	WG1428432









	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	ug/l		ug/l	ug/l		date / time	
Benzene	U		0.331	1.00	1	02/15/2020 14:32	WG1428424
Toluene	U		0.412	1.00	1	02/15/2020 14:32	WG1428424
Ethylbenzene	U		0.384	1.00	1	02/15/2020 14:32	WG1428424
Total Xylenes	U		1.06	3.00	1	02/15/2020 14:32	WG1428424
(S) Toluene-d8	108			80.0-120		02/15/2020 14:32	WG1428424
(S) 4-Bromofluorobenzene	110			77.0-126		02/15/2020 14:32	WG1428424
(S) 1,2-Dichloroethane-d4	93.6			70.0-130		02/15/2020 14:32	WG1428424



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## Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	ug/l		ug/l	ug/l		date / time	
Diesel Range Organics (DRO)	U		66.7	200	1	02/19/2020 21:58	WG1430343
Residual Range Organics (RRO)	U		83.3	250	1	02/19/2020 21:58	WG1430343
(S) o-Terphenyl	91.6			52.0-156		02/19/2020 21:58	WG1430343

ONE LAB. NATIONWIDE.

Collected date/time: 02/12/20 00:00

1189490

### Volatile Organic Compounds (GC) by Method NWTPHGX

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	ug/l		ug/l	ug/l		date / time	
Gasoline Range Organics-NWTPH	105		31.6	100	1	02/15/2020 20:01	WG1428432
(S) a,a,a-Trifluorotoluene(FID)	115			78.0-120		02/15/2020 20:01	WG1428432







## Volatile Organic Compounds (GC/MS) by Method 8260D

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	ug/l		ug/l	ug/l		date / time	
Benzene	U		0.331	1.00	1	02/15/2020 14:51	WG1428424
Toluene	U		0.412	1.00	1	02/15/2020 14:51	WG1428424
Ethylbenzene	U		0.384	1.00	1	02/15/2020 14:51	WG1428424
Total Xylenes	U		1.06	3.00	1	02/15/2020 14:51	WG1428424
(S) Toluene-d8	102			80.0-120		02/15/2020 14:51	WG1428424
(S) 4-Bromofluorobenzene	106			77.0-126		02/15/2020 14:51	WG1428424
(S) 1,2-Dichloroethane-d4	96.6			70.0-130		02/15/2020 14:51	WG1428424



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# Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT $\,$

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	ug/l		ug/l	ug/l		date / time	
Diesel Range Organics (DRO)	665		66.7	200	1	02/19/2020 22:23	WG1430343
Residual Range Organics (RRO)	175	<u>J</u>	83.3	250	1	02/19/2020 22:23	WG1430343
(S) o-Terphenyl	96.3			52.0-156		02/19/2020 22:23	WG1430343

## QUALITY CONTROL SUMMARY

ONE LAB. NATIONWIDE.

Volatile Organic Compounds (GC) by Method NWTPHGX

L1189490-01,02,03,04,05,06

### Method Blank (MB)

(MB) R3501689-3 02/15/	20 12:14			
	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	ug/l		ug/l	ug/l
Gasoline Range Organics-NWTPH	U		31.6	100
(S) a,a,a-Trifluorotoluene(FID)	108			78.0-120





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

(LCS) R3501689-1 02/15/	20 11:02 • (LCSE	D) R3501689-2	2 02/15/20 11:20	6							
	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits	
Analyte	ug/l	ug/l	ug/l	%	%	%			%	%	
Gasoline Range Organics-NWTPH	5500	4940	5330	89.8	96.9	70.0-124			7.59	20	
(S) a.a.a-Trifluorotoluene(FID)				92.7	95.0	78.0-120					











### QUALITY CONTROL SUMMARY

ONE LAB. NATIONWIDE.

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

L1189490-01,02,03,04,05,06

### Method Blank (MB)

Analyte         MB Result ug/l         MB MDL ug/l         MB RDL ug/l           Benzene         U         0.331         1.00           Ethylbenzene         U         0.384         1.00           Toluene         U         0.412         1.00           Xylenes, Total         U         1.06         3.00           (S) Toluene-d8         105         80.0-120		07:09	(MB) R3500278-3 02/15/20
Benzene         U         0.331         1.00           Ethylbenzene         U         0.384         1.00           Toluene         U         0.412         1.00           Xylenes, Total         U         1.06         3.00	IB MDL MB RDL	MB Result MB Qualifier MB MDL	
Ethylbenzene         U         0.384         1.00           Toluene         U         0.412         1.00           Xylenes, Total         U         1.06         3.00	g/l ug/l	ug/l ug/l	Analyte
Toluene         U         0.412         1.00           Xylenes, Total         U         1.06         3.00	.331 1.00	U 0.331	Benzene
Xylenes, Total U 1.06 3.00	.384 1.00	U 0.384	Ethylbenzene
	.412 1.00	U 0.412	Toluene
(S) Toluene-d8 105 80.0-120	06 3.00	U 1.06	Xylenes, Total
	80.0-120	105	(S) Toluene-d8
(S) 4-Bromofluorobenzene 109 77.0-126	77.0-126	109	(S) 4-Bromofluorobenzene
(S) 1,2-Dichloroethane-d4 95.1 70.0-130	70.0-130	95.1	(S) 1,2-Dichloroethane-d4

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

(LCS) R3500278-1 02/15/20 06:12 • (LCSD) R3500278-2 0	02/15/20 06:31
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	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits	
Analyte	ug/l	ug/l	ug/l	%	%	%			%	%	
Benzene	5.00	4.81	5.03	96.2	101	70.0-123			4.47	20	
Ethylbenzene	5.00	4.72	5.00	94.4	100	79.0-123			5.76	20	
Toluene	5.00	4.92	5.08	98.4	102	79.0-120			3.20	20	
Xylenes, Total	15.0	15.0	15.6	100	104	79.0-123			3.92	20	
(S) Toluene-d8				106	105	80.0-120					
(S) 4-Bromofluorobenzene				108	111	77.0-126					
(S) 1,2-Dichloroethane-d4				94.6	95.2	70.0-130					

















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### QUALITY CONTROL SUMMARY

ONE LAB. NATIONWIDE.

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

L1189490-01,02,03,04,05,06

### Method Blank (MB)

(MB) R3501211-1 02/19/20	09:16			
	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	ug/l		ug/l	ug/l
Diesel Range Organics (DRO)	U		66.7	200
Residual Range Organics (RRO)	U		83.3	250
(S) o-Terphenyl	91.5			52 0-156





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

(LCS) R3501211-2 02/19/20	0 10:59 • (LCSD	) R3501211-3 (	02/19/20 11:24							
	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	%	%	%			%	%
Diesel Range Organics (DRO)	1500	1500	1550	100	103	50.0-150			3.28	20
(S) o-Terphenyl				114	114	52.0-156				















### **GLOSSARY OF TERMS**

### ONE LAB. NATIONWIDE.



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.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

### Abbreviations and Definitions

Appreviations and	a 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.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
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

The identification of the analyte is acceptable; the reported value is an estimate.





















## **ACCREDITATIONS & LOCATIONS**





### State Accreditations

Alabama	40660
Alaska	17-026
Arizona	AZ0612
Arkansas	88-0469
California	2932
Colorado	TN00003
Connecticut	PH-0197
Florida	E87487
Georgia	NELAP
Georgia <sup>1</sup>	923
Idaho	TN00003
Illinois	200008
Indiana	C-TN-01
lowa	364
Kansas	E-10277
Kentucky <sup>1 6</sup>	90010
Kentucky <sup>2</sup>	16
Louisiana	Al30792
Louisiana <sup>1</sup>	LA180010
Maine	TN0002
Maryland	324
Massachusetts	M-TN003
Michigan	9958
Minnesota	047-999-395
Mississippi	TN00003
Missouri	340
Montana	CERT0086

Nebraska	NE-OS-15-05
Nevada	TN-03-2002-34
New Hampshire	2975
New Jersey-NELAP	TN002
New Mexico <sup>1</sup>	n/a
New York	11742
North Carolina	Env375
North Carolina <sup>1</sup>	DW21704
North Carolina <sup>3</sup>	41
North Dakota	R-140
Ohio-VAP	CL0069
Oklahoma	9915
Oregon	TN200002
Pennsylvania	68-02979
Rhode Island	LAO00356
South Carolina	84004
South Dakota	n/a
Tennessee 1 4	2006
Texas	T104704245-18-15
Texas <sup>5</sup>	LAB0152
Utah	TN00003
Vermont	VT2006
Virginia	460132
Washington	C847
West Virginia	233
Wisconsin	9980939910
Wyoming	A2LA

### Third Party Federal Accreditations

A2LA – ISO 17025	1461.01
A2LA - ISO 17025 5	1461.02
Canada	1461.01
EPA-Crypto	TN00003

AIHA-LAP,LLC EMLAP	100789
DOD	1461.01
USDA	P330-15-00234

<sup>&</sup>lt;sup>1</sup> Drinking Water <sup>2</sup> Underground Storage Tanks <sup>3</sup> Aquatic Toxicity <sup>4</sup> Chemical/Microbiological <sup>5</sup> Mold <sup>6</sup> Wastewater n/a Accreditation not applicable

### Our Locations

Pace National 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. Pace National performs all testing at our central laboratory.



















Arcadis - Chevron - WA			Billing Informati							Analys	Conta	T Pr	servat	ive		Г	_ Chain of Custoo	y Page	
1100 Olive Way Suite 800			630 PI	Attn: Accourpayable 630 Plaza Dr. te. 600 Highlands Ra.h, CO 80129													Pace	Analytical  Center for Testing & In	
Seattle WA 98101			1 4 4			1	-												
Report to: Trevor Bryant	Carl.Don	Email To: Trevo Brand Parcadis.com; Carl.Donovan@readis.com;											1		12065 Lebanon Ri Mount Juliet, TN : Phone: 615-758-5	7122			
Project Description: 302095	Morto	cie:		р-нс					7				Phone: 800-767-5 Fax: 615-758-585	159					
Phone: <b>206-325-5254</b> Fax:	Client Project 30012387	t#		Land Project #	un 202095		HG	40mlAmb-HCI-BT	-								SDG# [1]	89490 95	
Collected by (print):	Site/Facility I		PTON WA	.O.#			(Amp)		nb HCI								Acctnum: CH	VARCWA	
Treubr Bryant Collected by (signature):	Rush? (	Lab MUST Be	e Notified)					LVIIOSGT	40slAmb				1				Template: <b>T16</b> Prelogin: <b>P75</b>	2145	
Immediately Packed on Ice N Y	Next Da	y 5 Da y 10 D	v (Rad Only)	Standur	suits Needed A TAT	No.	8260D	WWTPHDX LI	NWTPH63%						- to		PM: 110 - Brian Ford PB:		
Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	Catrs	BTEX	NWT	LAN		7,						Shipped Via: F	Sample # (lab	
MU-16	6	GW		2/12/20	11:27	8	X	X	X									-01	
MW-15	6	GW			1315	18	X	X	X									02	
MW-II	6	GW			1238	8	X	50	×				1948					02	
MU-7	6	GW			12:27	8	X	X	X	144.5					Alexander of the second		1	OH	
MW-12	6	GW	1		1316	8	X	X	X							1 78		CS	
Dup-1	6	GW	1	1	-	8	X	X	X									CL	
Trip Blank	-	GW				2						4						07	
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				Part of the second	The state of the s	1 2		- 40				-			100				
Matrix: S - Soil AIR - Air F - Filter SW - Groundwater B - Bin assay VW - WasteWater	p.emarks:	.amarks:								pH Temp Flow Other					Sample Receipt Checklist COC Seal Present/Intact: MP Y COC Signed/Accurate: Bottles arrive in tact: Correct bottles used:				
OW - Drinking Water OT - Other	Samples return UPS Fee	1	387	2 4	819	59	18			Sufficient volume sent:  If Appl icable  VOA Zero Headspace:									
elinquished by : (Signature)  Date:  2 // elinquished by : (Signature)  Date:		Date: 2/13	100	ime: Re	Received by: (Signature)			77				reived: Ves / No				Preservation Correct, Checked: Y RAD Screen <0.5 mR/hr:			
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elinquished by : (Signature)		Date:	T	me: Re	ceived for lab by:	ure)		-	Date: Time: 7 8:45				5	Hold:	Condition NCF / C				

