Groundwater Monitoring Work Plan

Former Chevron Station 90129
4700 Brooklyn Avenue NE
Seattle, Washington 98105
FSID: 81966648
CSID: 10632

Project number: 60742603

May 15, 2025

Chevron Environmental Management Company
5001 Executive Parkway, Suite 200
San Ramon, CA 94583

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Quality information

Prepared by	Checked by	Verified by	Approved by
Ashley Lunde	Lili Celovsky		Ashley Lunde
Ashley Lunde Project Manager	Lillian Celovsky, EIT Environmental Engineer	Renee Knecht, LG Senior Geologist	Ashley Lunde Project Manager

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Prepared for:

Chevron Environmental Management Company
5001 Executive Parkway, Suite 200
San Ramon, California 94583

Prepared by:

AECOM
1111 3rd Avenue, Suite 1600
Seattle, Washington 98101
USA

T: 206.438.2700
aecom.com

Table of Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

AO	Agreed Order
Arcadis	Arcadis U.S., Inc.
AS	air sparge
bgs	below ground surface
CEMC	Chevron Environmental Management Company
COC	contaminant of concern
CSM	conceptual site model
CUL	cleanup level
Draft FS Report	*Draft for Agency Review – Feasibility Study Report*
Ecology	Washington State Department of Ecology
Ecology Guidance	*Guidance on Remediation of Petroleum-Contaminated Groundwater by Natural Attenuation*
MNA	monitored natural attenuation
MTCA	Model Toxics Control Act
No.	Number
PLP	Potentially Liable Person
property	Former Chevron Station 90129 located at 4700 Brooklyn Avenue NE in Seattle, Washington (King County Tax Parcel 8816400985)
site	property and surrounding right-of-way areas
SVE	soil vapor extraction
USEPA	United States Environmental Protection Agency
UST	underground storage tank
Work Plan	*Groundwater Monitoring Work Plan*

1. Introduction

On behalf of Chevron Environmental Management Company (CEMC), AECOM has prepared this *Groundwater Monitoring Work Plan* (Work Plan) for Former Chevron Station 90129, located at 4700 Brooklyn Avenue NE, Seattle, Washington (property; Figure 1). Model Toxics Control Act (MTCA) Washington Administration Code 173-340-200, defines a site as an area where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, placed, or otherwise come to be located. The site is defined in Agreed Order (AO) Number (No.) 13815 as the property (parcel no. 8816400985) and surrounding right-of-way areas (Washington State Department of Ecology [Ecology] 2017). Potentially Liable Persons (PLPs) for the site are identified in the AO as CEMC and FH Brooklyn, LLC. The property is currently owned by GEDR Brooklyn, LLC (King County 2025) and is occupied by The ‘M’, a 24-story apartment building with retail/commercial space on the ground floor and two levels of below-grade parking (Arcadis U.S., Inc. [Arcadis] 2024). A site location map is presented on Figure 1, and a site plan is included as Figure 2. Site regulatory identifiers include Cleanup Site Identification No. 10632 and Facility Site Identification No. 81966648.

On June 7, 2024, Arcadis submitted a *Draft for Agency Review – Feasibility Study Report* (Draft FS Report) for the site to Ecology which identified and evaluated remedial action alternatives for site cleanup (Arcadis 2024). Based on the property and surrounding site conditions/use and potential receptors and exposure pathways for the contaminants of concern (COCs) remaining in soil and groundwater, monitored natural attenuation (MNA), coupled with institutional controls, was the recommended remedial alternative for site cleanup. Via email correspondence on September 16, 2024, Ecology provided comments on the Draft FS Report. Since Ecology comments were provided, AECOM took over as CEMC’s environmental consultant for the site. Ecology requested that geochemical parameters be collected to assess current attenuation processes prior to considering MNA as a viable remedial alternative for site cleanup.

The purpose of this Work Plan is to present a groundwater monitoring plan consistent with the requirements of Ecology’s *Guidance on Remediation of Petroleum-Contaminated Groundwater by Natural Attenuation* (Ecology Guidance; Ecology 2005) to assess the viability of long-term MNA as a remedial alternative for the site. This Work Plan has been prepared to meet the following objectives:

- Show that natural attenuation processes are occurring at the site by collecting and analyzing data to confirm these natural attenuation processes are reducing contaminant concentrations.
- Demonstrate that these natural attenuation processes will continue to occur at rates sufficient to achieve cleanup objectives within a reasonable timeframe.
- Ensure that the natural attenuation processes will be adequately protective of human health and the environment during the cleanup period. This evaluation includes demonstrating that there are no unacceptable risks to human health or the environment from the contaminants during the attenuation process.

1.1 Site Background

Based on available records, the site was occupied by a service station from as early as 1919 through 2016 (Arcadis 2024). Chevron U.S.A. Inc. (CUSA) or its affiliates, owned the property beginning in May 1946 and sold the property to Bedrock Northwest, Inc. in October 2003. The property was acquired by FH Brooklyn, LLC in August 2015 (Ecology 2017) who sold the property to GEDR Brooklyn, LLC in September 2021 (King County 2025).

Since 1969, four generations of fuel systems/service station/convenience store configurations have existed at the site (Ecology 2017). The most recent of these systems was installed in 1991 and upgraded in 1998 and included two double-walled, 12,000-gallon, gasoline underground storage tanks (USTs) and one double-walled, 12,000-gallon diesel UST situated in the southwestern portion of the property (Ecology 2017). Four dispenser islands were located on the west-central portion of the property (Ecology 2017). The USTs were removed by GEDR Brooklyn LLC (the owner at that time) in February 2017 (Aspect Consulting, LLC 2017; Arcadis 2024). The service station building, four dispenser islands, and associated piping were removed in 2018 (Arcadis 2020). The existing mixed-use building was constructed in 2020 (Arcadis 2024).

CEMC began independent investigation and cleanup activities in 1990 following UST removals in 1989, including groundwater monitoring, limited soil removal (during station rebuilds), and operation of an air sparge (AS)/soil vapor extraction (SVE) system (Ecology 2017).

An interim action was performed in 2018 to remove petroleum impacted soil and allow for the redevelopment of the property. Interim action soil removal was completed in conjunction with the mass excavation for property redevelopment. Details of the interim action were included in the 2019 *Interim Action Report* (Aspect 2019). Soil on the property was excavated to an average depth of 21 feet below ground surface (bgs) to accommodate the installation of two levels of underground parking. Quantities of 6,837 tons of petroleum impacted soil exceeding MTCA Method A cleanup levels (CULs) and 1,259 tons of soil with concentrations less than MTCA Method A CULs were removed from the property and disposed offsite (Aspect 2019). Confirmation samples collected from the final extents of the excavation indicated that all petroleum-impacted soil exceeding MTCA Method A CULs was removed from the property (Aspect 2019). In addition, 1,842,284 gallons of groundwater were extracted, treated, and discharged into Portage Bay as a part of construction dewatering.

A more extensive summary of site investigations and cleanup actions was presented in the Draft FS Report (Arcadis 2024).

Several historical former dry-cleaning businesses were located in the vicinity of the site, including Carson Cleaners, which was located across Brooklyn Avenue NE to the west (Figure 2; Arcadis 2024). Carson Cleaners has been identified as a source of chlorinated solvents at and in the vicinity of the site. The former Carson Cleaners facility is currently undergoing remedial investigation activities and is managed under a separate Agreed Order (No. DE 19805).

1.2 Site Geology

Observations in previous soil borings indicated that the site is underlain by unconsolidated materials consisting of fill and beach deposits. However, as mentioned above, soil on the property was excavated to an average depth of 21 feet bgs to install two levels of underground parking (Arcadis 2024). Soils in the area consist of fill underlain by fine to medium sand, with dense silt encountered below 25 to 30 feet bgs (SAIC Energy, Environment, and Infrastructure, LLC 2011; Arcadis 2024).

The topography at the site generally slopes to the southwest, toward the Lake Washington Ship Canal and Portage Bay (Figure 1).

1.3 Site Hydrogeology

Groundwater monitoring began at the site in 1990 and continued until November 2016, when it was put on hold until 2020. The previous monitoring frequency was typically quarterly; however, multiple years had only semi-annual sampling (Arcadis 2024).

- Monitoring network: There are 11 groundwater wells associated with the site: MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-25, MW-27, MW-28, MW-30, and MW-31 (Arcadis 2024).
- Observed depth to water: Depth to water at the site ranges between 15 and 18 feet bgs (Arcadis 2024).
- Groundwater elevation: Groundwater elevation ranges from approximately 198 to 203 feet above mean sea level with a typical seasonal fluctuation of approximately 5 feet (Arcadis 2024).
- Groundwater flow direction: Groundwater flow direction is predominantly to the east-southeast, with a more easterly direction in the southern portion of the site and southerly in the northern portion of the site, as indicated on the rose diagram insert on Figure 3. Horizontal hydraulic gradients at the site range from approximately 0.01 to 0.02 feet per foot (Arcadis 2024).

The approximate monitoring well locations are shown on Figure 2. Historical groundwater gauging and sampling results are summarized in Table 1, and groundwater elevation contours from the third quarter (Q3) 2024 are depicted on Figure 3. The approximate extent of COCs in relation to MTCA Method A CULs for Q3 2024 is depicted on Figure 4.

2. Proposed Site Remedy

MNA is defined as the reliance on natural attenuation processes (in the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a timeframe that is reasonable compared to the timeframe offered by other, more active methods. The natural attenuation processes include a variety of physical, chemical, or biological processes that, under favorable conditions, act to reduce the mass, toxicity, mobility, volume, or concentration of COCs in groundwater. These in-situ processes include diffusion, dilution, sorption, biodegradation, volatilization, and chemical and/or biological stabilization, transformation, or destruction of COCs.

Natural attenuation processes are typically occurring at all sites with contamination. However, these natural attenuation processes occur in varying degrees of effectiveness depending on the types and concentrations of contaminants present, and the physical, chemical, and biological characteristics of the soil and groundwater.

2.1 MNA Assessment

Natural attenuation is the reduction in concentrations of COCs in groundwater over time due to naturally-occurring physical, chemical, and biological processes. Natural attenuation processes include both destructive (e.g., biodegradation and abiotic degradation) and non-destructive (e.g., dispersion, dilution, adsorption, and volatilization) processes. Destructive processes are generally preferred in support of natural attenuation because they transform potentially harmful COCs into innocuous end products. However, non-destructive processes may also play an important role in decreasing COC concentrations to levels that are acceptable.

The United States Environmental Protection Agency's (USEPA's) tiered lines of evidence approach (USEPA 1999) will be applied to evaluate the viability of MNA as a remedy at the site. The tiers of evidence for this approach include:

1. Historical groundwater data that demonstrate a clear and significant trend of decreasing contaminant mass and/or concentrations over time at appropriate monitoring points;
2. Hydrogeologic and geochemical data that can be used to demonstrate indirectly the types of natural attenuation processes active at a site, and the rate at which such processes will reduce contaminant concentrations to required levels; and
3. Data from field studies that directly demonstrate the occurrence of particular natural attenuation processes at a site and their ability to degrade COCs.

The first tier of evidence is the most critical, as it indicates whether attenuation processes, acting together, result in the meaningful reduction of COCs in groundwater under site conditions. This line of evidence is established based on statistical analysis of concentration trends. The second tier of evidence is developed based on assessment of the groundwater geochemical conditions; these are assessed to ascertain which attenuation processes the environment is conducive to, and whether expected degradation products of specific reactions are observed. Rates at which attenuation processes are expected to reduce contaminant concentrations to required levels are assessed based on statistical trend analysis, as applicable. The third tier of evidence is not required in all cases, particularly when effective natural attenuation is firmly demonstrated based on the first two lines of evidence. If there is an initial lack of sufficient evidence under the first two tiers that MNA is proceeding as expected, then additional data may be collected to fulfill the third line of evidence.

The Ecology Guidance was also used to develop this preliminary MNA evaluation and will guide implementation and assessment. This guidance stipulates evaluation of the following five factors:

1. Demonstration that, prior to relying solely on natural attenuation to achieve cleanup standards, the groundwater plume is stable or shrinking;
2. Demonstration that destructive mechanisms of natural attenuation (i.e., chemical or biological degradation) are occurring and are substantial contributors to contaminant reductions observed at the site;
3. Demonstration that the estimated restoration timeframe by natural attenuation is reasonable;
4. Demonstration that natural attenuation is protective of human health and the environment during the restoration time frame; and
5. Demonstration that source control is achieved to the maximum extent practicable.

This preliminary MNA evaluation is aimed at demonstrating the stability of COCs in groundwater and understanding the contributing attenuation mechanisms at the site. The results from geochemical parameter sampling provide a line of evidence that natural attenuation is supported by destructive biodegradation. Source control is achieved based on removal of the primary sources (USTs and other service station infrastructure) and absence of any significant remaining secondary source material.

3. Monitoring Plan

The following section details the proposed monitoring plan to evaluate the processes of natural attenuation in site groundwater. A Sampling and Analysis Plan is included as Table 2.

3.1 Baseline Groundwater Monitoring

Baseline groundwater monitoring will be conducted in the first year. The entire remaining site monitoring well network (MW-18 through MW-23, MW-25, MW-27, MW-28, MW-30, and MW-31) will continue to be gauged and sampled quarterly with laboratory analysis/field measurement for site COCs and primary geochemical parameters. Secondary geochemical parameters (defined in Table 2) will also be analyzed during this period to evaluate natural attenuation processes at all remaining site monitoring wells. For the evaluation process, monitoring wells MW-19 and MW-20 will serve as upgradient wells, and well MW-30 will be considered the downgradient sentinel well.

3.2 Groundwater Performance Monitoring

Following four quarters of baseline groundwater monitoring, provided that the plume is determined to be shrinking or stable during the first year and quarterly monitoring indicates semi-annual monitoring will provide sufficient data, performance monitoring will then be conducted on a semi-annual basis for 2 years. Following 2 years of semi-annual performance monitoring, and provided that the plume is determined to be shrinking or stable during the first 3 years and semi-annual monitoring indicates annual monitoring will provide sufficient data, the frequency of monitoring may be reduced to an annual basis for subsequent years.

During the performance monitoring phase, the entire site monitoring well network will be gauged and sampled. Laboratory analysis/field measurement for site COCs, primary geochemical parameters, and secondary geochemical parameters will continue for the entire site monitoring well network.

Following the first year of baseline groundwater monitoring and 4 years of performance monitoring, if it is concluded that the monitoring well network may be reduced and still provide sufficient data to demonstrate MNA is occurring at the site, a request to reduce the number of sampled monitoring wells may be submitted to Ecology.

3.3 Groundwater Sampling Methodology

Each well will be gauged and sampled using low-flow methodology with a peristaltic pump. Primary geochemical parameters including pH, temperature, conductivity, turbidity, dissolved oxygen, and oxidation-reduction potential will be measured during the purging process with a YSI multiparameter water-quality meter (or equivalent) and flow-through cell. Prior to collecting samples, field parameters will be allowed to stabilize in accordance with USEPA's 2017 Low Stress Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells (USEPA 2017). Further details regarding the field procedures and stabilization criteria are included in the monitoring well sampling standard operating procedures attached as Appendix A.

3.4 Investigation-Derived Waste

Purge water generated during groundwater monitoring activities will be transported off-site for proper disposal.

4. Contingency Plan

Ecology Guidance recommends the development of a site-specific contingency plan that describes monitoring results that would trigger additional action. Triggers for the site would include:

- Evidence of increased contaminant concentrations within the plume;
- Evidence of plume expansion or plume migration to a sentinel well;
- Evidence of new or renewed releases of contaminants;

- Evidence that biodegradation is not occurring; or
- Evidence that contaminant concentrations are not decreasing at a sufficiently rapid rate to achieve cleanup standards within the acceptable restoration time frame.

This contingency plan includes tiered contingent actions dependent on the trigger condition.

If evidence of statistically increasing concentration trends is observed within the plume, evidence of plume expansion or migration to a sentinel well is observed, and/or evidence of a new or renewed release of contaminants is discovered, the following contingency actions may be implemented:

- Modify the performance monitoring plan to provide for more frequent sampling or additional parameters to enhance the ability to evaluate the progress of natural attenuation and any potential threats posed to receptors;
- If data gaps are identified following modifications of the performance monitoring plan, conduct additional site investigation to re-evaluate the conceptual site model (CSM); and
- Based on the results of additional site investigation and updated CSM, the selected site remedy may be re-evaluated at that time if warranted.

If, following 1 year of baseline monitoring and 4 years of performance monitoring, evidence suggests that biodegradation is not occurring and/or contaminant concentrations are not decreasing at a sufficiently rapid rate to achieve cleanup standards within an acceptable restoration time frame, the following contingency actions may be implemented:

- Modify the performance monitoring plan to provide for more frequent sampling or additional parameters to enhance the ability to evaluate the progress of natural attenuation and any potential threats posed to receptors; and
- Following modifications of the performance monitoring plan, if evidence remains that biodegradation is not occurring and/or contaminant concentrations are not decreasing (i.e., MNA does not appear to be occurring) or MNA is not occurring at a sufficient rate to meet a reasonable timeframe, the selected site remedy may be re-evaluated at that time.

5. Data Evaluation and Reporting

Results of the groundwater monitoring and sampling events will be evaluated to demonstrate that natural attenuation is occurring at the site and presented in quarterly reports to be submitted to Ecology. Following four quarters of baseline monitoring, an MNA analysis will be included in a revised Draft FS Report and submitted to Ecology for approval. The MNA analysis will include documentation of a stable or decreasing plume using COC concentration iso-contour figures, time-series plots of COC concentrations and measured depths to water, a linear regression analysis for site COCs at select monitoring wells, and discussion of water quality and observed trends.

6. References

Arcadis U.S., Inc. (Arcadis). 2020. Draft 2019 Site Investigation Summary, Former Chevron Facility No. 90129, 4700 Brooklyn Avenue NE, Seattle, Washington. April 30.

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United States Environmental Protection Agency (USEPA). 1999. Final OSWER Directive “Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites” (OSWER Directive Number 9200.4-17P). April 21.

USEPA. 2017. Low Stress Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells. September 19.

Washington State Department of Ecology (Ecology). 2005. Guidance on Remediation of Petroleum-Contaminated Ground Water By Natural Attenuation. July.

Ecology. 2017. Agreed Order No. 13815. January 11.

Tables

Table 1 - Summary of Groundwater Gauging and Select Analytical Results
Former Chevron Station 90129
4700 Brooklyn Avenue Northeast, Seattle, Washington

Well	Date	Top of Casing (ft NAVD 88)	Static Depth to Water (ft bTOC)	LNAPL Thickness (ft)	Groundwater Elevation (ft NAVD 88)	GRO (µg/L)	DRO (µg/L)	HRO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	EDB (µg/L)	PCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)	Total Lead (µg/L)	2-Methylnaphthalene (µg/L)	Naphthalene (µg/L)	Comments/Remarks
Model Toxics Control Act (MTCA) Method A Cleanup Levels (CULs) in µg/L						**800/1000**	**500**	**500**	**5**	**1000**	**700**	**1000**	**20**	**0.01**	**5**	**5**	**0.2**	**15**		**160**	
MW-17	12/26/2019	215.4	18.09	0	197.31	240	**610**	<360	3.7	<0.39	6.6	1.2 J	<0.44	<0.0020	**9.5**	3.7	**<0.22**	<2.7	--	--	
MW-17	2/18/2020	215.4	17.15	0	198.25	**822**	**1930**	267	**9.92**	0.489 J	25.2	32.6	<0.102	<0.0024	4.05	**5.1**	<0.118	<1.9	--	--	
MW-17	4/29/2020	--	--	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--	--	Well abandoned to accommodate utility installation during construction
MW-18	12/26/2019	215.95	18.7	0	197.25	<100	<66	<97	<0.53	<0.39	<0.50	<0.75	<0.44	<0.0020	3.8	<0.85	**<0.22**	<2.7	--	--	
MW-18	2/18/2020	215.95	17.84	0	198.11	38.5 BJ	<66	<83	<0.089	<0.412	<0.158	<0.316	<0.102	<0.0024	2.94	<0.153	<0.118	<1.9	--	--	
MW-18	4/29/2020	215.95	17.87	0	198.08	79.4 BJ	--	--	<0.0941	<0.278	<0.137	0.335	<0.101	<0.00636	3.9	<0.190	**<0.234**	<2.9	--	--	
MW-18	9/3/2020	215.95	18.03	0	197.92	57.8 BJ	--	--	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	4.53	0.056	<0.100	<6.00	--	--	
MW-18	12/9/2020	215.95	18.05	0	197.9	<100	--	--	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	2.23	<0.0400	<0.100	<6.00	--	--	
MW-18	3/3/2021	215.95	17.63	0	198.32	<100	--	--	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	**5.42**	<0.0400	<0.100	<2.00	--	--	
MW-18	6/16/2021	215.95	19.31	0	196.64	<100	--	--	0.0290 J	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	2.34	0.07	<0.100	<2.00	--	--	
MW-18	6/20/2023	215.95	20.27	0	195.68	<100	491	<250	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0208***	0.184	<0.0400	<0.100	10.7 B	--	--	
MW-18	10/11/2023	215.95	20.3	0	195.65	83.5 B J	81.0 J	<83.3	0.0210 J	0.0810 J	0.136	0.289	<0.0118	**<0.0210***	1.93	0.39	<0.0273	<2.99	--	--	
MW-18	12/26/2023	215.95	19.24	0	196.71	<31.6	295	**714**	<0.0160	0.0600 J	<0.0212	<0.191	<0.0118	**<0.0210***	2.9	0.235	<0.0273 J3	**27.6**	--	0.316 B J	
MW-18	3/7/2024	215.95	18.42	0	197.53	<31.6	114 J	<83.3	<0.0160	0.482	0.26	1.57	<0.0118	**<0.0210***	2.26	0.379	<0.0273	<2.99	--	<0.124 C3	
MW-18	6/14/2024	215.95	18.84	0	197.11	<31.6	**590**	**1150**	0.0330 J	0.449	<0.0212	<0.191	<0.0118	**<0.0210***	0.508 C5	0.681	<0.0273	<2.99	--	<0.124	
MW-18	9/11/2024	215.95	19.19	0	196.76	<31.6 [<31.6]	**1320 [1610]**	**1830 [1900]**	0.0230 J [0.0460]	0.436 [0.466]	<0.0212 [<0.0212]	<0.191 [<0.191]	<0.0118 [<0.0118]	**<0.0210* [<0.0210]**	0.713 [0.636]	0.231 [0.270]	<0.0273 [<0.0273]	3.54 J [12.1]	-- [--]	<0.124 [<0.124]	
MW-19	12/26/2019	216.36	18.97	0	197.39	<100	<63	<93	<0.53	<0.39	<0.50	<0.75	<0.44	<0.0020	<0.41	<0.85	**<0.22**	<2.7	--	--	
MW-19	2/18/2020	216.36	18.39	0	197.97	42.4 BJ	<66	114 J	<0.089	<0.412	<0.158	<0.316	<0.102	<0.0024	<0.199	<0.153	<0.118	<1.9	--	--	
MW-19	4/29/2020	216.36	18.58	0	197.78	49 BJ	--	--	<0.0941	<0.278	<0.137	<0.174	<0.101	<0.00536	<0.300	<0.190	**<0.234**	<2.9	--	--	
MW-19	9/3/2020	216.36	18.58	0	197.78	51.2 BJ	--	--	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	0.138	<0.0400	<0.100	<6.00	--	--	
MW-19	12/9/2020	216.36	18.05	0	198.31	34.5 BJ	--	--	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	0.0830 J	<0.0400	<0.100	<6.00	--	--	
MW-19	3/3/2021	216.36	16.69	0	199.67	<100	--	--	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	0.131	<0.0400	<0.100	<2.00	--	--	
MW-19	6/16/2021	216.36	21.14	0	195.22	<100	--	--	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	0.0750 J	<0.0400	<0.100	<2.00	--	--	
MW-19	9/22/2021	216.36	20.21	0	196.15	<100 [84.2 J]	--	--	<0.0400 [<0.0400]	0.0750 J [0.0770 J]	0.0620 J [0.0610 J]	<0.260 [<0.260]	<0.0400 [<0.0400]	**<0.0200* [<0.0200]**	0.0690 J [0.122]	<0.0400 [<0.0400]	<0.100 [<0.100]	<2.00 [<2.00]	--	--	
MW-19	12/14/2021	216.36	19.5	0	196.86	<31.6	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	<0.00568	0.12	<0.0160	<0.0273	1.75 B J	--	--	
MW-19	3/31/2022	216.36	19.59	0	196.77	68.0 B J	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	<0.00557	0.240 C5	<0.0160	<0.0273	<0.849	--	--	
MW-19	6/13/2022	216.36	19.4	0	196.96	51.6 B J	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118 C3	<0.00574	0.172	<0.0160	<0.0273	<0.849	--	--	
MW-19	8/18/2022	216.5	19.25	0	197.25	<31.6	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	0.182	<0.0160	<0.0273	<0.849	--	--	
MW-19	1/4/2023	216.5	18.9	0	197.6	<31.6	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	0.176	<0.0160	<0.0273	<0.849	--	--	
MW-19	3/15/2023	216.5	17.95	0	198.55	119 B	--	--	<0.0160	0.147 J	<0.0212	<0.191	<0.0118	**<0.0210***	**112**	**5.73**	<0.0273	<0.849	--	--	
MW-19	6/20/2023	216.5	--	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--	--	Unable to access well
MW-19	10/11/2023	216.5	20.48	0	196.02	<31.6 J3	423	<83.3	<0.0800	<0.250	<0.106	<0.955	<0.059	**<0.105***	0.175 J	<0.0800	<0.137	<2.99	--	--	
MW-19	12/26/2023	216.5	19.15	0	197.35	<31.6	354	126 J	<0.0160	0.0850 J	0.0450 J	0.217 J	<0.0118	**<0.0210***	0.15	<0.0160	<0.0273	12.1	--	<0.124	
MW-19	3/7/2024	216.5	19.51	0	196.99	<31.6	259	<83.3	<0.0160	0.121 J	<0.0212	<0.191	<0.0118	**<0.0210***	0.197	<0.0160	<0.0273	<2.99	--	<0.124 C3	
MW-19	6/14/2024	216.5	19.88	0	196.62	<31.6	328	<83.3	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	0.124 C5	<0.0160	<0.0273	<2.99	--	<0.124	
MW-19	9/11/2024	216.5	19.98	0	196.52	<31.6	403	107 J	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	0.15	<0.0160 J4	<0.0273	<2.99	--	<0.124	
MW-20	12/26/2019	215.87	18.46	0	197.41	<100	<60	<89	<0.53	<0.39	<0.50	<0.75	<0.44	<0.0020	**100**	**20**	**<0.22**	<2.7	--	--	
MW-20	2/18/2020	215.87	17.51	0	198.36	62.3 BJ	<66	95.2 J	<0.089	<0.412	<0.158	<0.316	<0.102	<0.0024	**52**	**21.6**	<0.118	<1.9	--	--	
MW-20	4/29/2020	215.87	17.54	0	198.33	76.4 BJ	--	--	<0.0941	<0.278	<0.137	<0.174	<0.101	<0.00536	**107**	**13.7**	**<0.234**	<2.9	--	--	
MW-20	9/3/2020	215.87	17.76	0	198.11	100 BJ	--	--	0.0280 J	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	**116**	**7.19**	<0.100	<6.00	--	--	
MW-20	12/9/2020	215.87	18.74	0	197.13	71.0 BJ	--	--	0.0280 J	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	**138**	**9.47**	<0.100	<6.00	--	--	
MW-20	3/3/2021	215.87	15.49	0	200.38	82.3 BJ	--	--	0.0210 J	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	**135**	**12.9**	<0.100	<2.00	--	--	
MW-20	6/16/2021	215.87	18.73	0	197.14	42.8 J	--	--	0.0300 J	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	**142**	**7.36**	<0.100	<2.00	--	--	
MW-20	9/22/2021	215.87	19.05	0	196.82	49.8 J	--	--	0.0240 J	0.0760 J	<0.100	<0.260	<0.0400	**<0.0200***	**133 E**	**6.66**	<0.100	<2.00	--	--	
MW-20	12/14/2021	215.87	18.37	0	197.5	110 B	--	--	0.0240 J	<0.0500	<0.0212	<0.191	<0.0118	<0.00536	**137**	**15.4**	<0.0273	<0.849	--	--	
MW-20	3/31/2022	215.87	18.21	0	197.66	104 B [102 B]	-- [--]	-- [--]	0.0210 J [<0.0160]	<0.0500 [<0.0500]	<0.0212 [<0.0212]	<0.191 [<0.191]	<0.0118 [<0.0118]	<0.00536 [<0.00552]	**117 [128]**	**15.3 [15.2]**	<0.0273 [<0.0273]	<0.849 [<0.849]	--	--	
MW-20	6/13/2022	215.87	18.11	0	197.76	111 B	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118 C3	<0.00536	**125**	**13.3**	<0.0273	<0.849	--	--	
MW-20	8/18/2022	216.01	19.4	0	196.61	<31.6	--	--	<0.0800	<0.250	<0.106	<0.955	<0.0590	**<0.105***	0.275 J	<0.0800	<0.137	<0.849	--	--	
MW-20	1/4/2023	216.01	19.12	0	196.89	59.5 J [65.1 J]	--	--	<0.0800 [<0.0800]	<0.250 [<0.250]	<0.106 [<0.106]	<0.955 [<0.955]	<0.0590 [<0.0590 J4]	**<0.105* [<0.105]**	**107 [77.3]**	**16.6 [13.3]**	**<0.137 [<0.137]**	<0.849 [<0.849]	--	--	
MW-20	3/15/2023	216.01	17.84	0	198.17	110 B	--	--	<0.0800	<0.250	<0.106	<0.955	<0.0590	**<0.105***	**101**	**5.42**	**<0.137**	<0.849	--	--	
MW-20	6/20/2023	216.01	19.19	0	196.82	40.7 J [50.5 J]	<200 [<200]	<250 [<250]	<0.0400 [<0.0400]	<0.200 [<0.200]	<0.100 [<0.100]	<0.260 [<0.260]	<0.0400 [<0.0400]	**<0.0216* [<0.0202]**	**104 C4 [95.1 C4]**	**10.1 [9.95]**	<0.100 [<0.100]	<6.00 [4.61 B J]	--		
MW-20	10/11/2023	216.01	19.16	0	196.85	71.3 J	<66.7	<83.3	<0.160	<0.500	<0.212	<1.91	<0.118	**<0.210***	**104**	**10.2**	**<0.273**	<2.99	--		
MW-20	12/26/2023	216.01	18.63	0	197.38	67.4 J	72.5 J	<83.3	0.0260 J	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	**89.5**	**25.6**	<0.0273	<2.99	--	<0.124	
MW-20	3/7/2024	216.01	18.11	0	197.9	56.9 J	<66.7	<83.3	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	**109**	**20.5**	<0.0273 J4	<2.99	--	<0.124	
MW-20	6/14/2024	216.01	18.55	0	197.46	58.0 J	<66.7	<83.3	<0.0800	<0.250	<0.106	<0.955	<0.0590	**<0.105***	**166 C5**	**14.5**	<0.137	<2.99	--	<0.620	
MW-20	9/11/2024	216.01	19.03	0	196.98	81.1 J	<66.7	<83.3	0.0210 J	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	**175**	**9.78**	<0.0273	<2.99	--	<0.124	
MW-21	12/26/2019	213.89	17.32	0	196.57	<100	<64	<95	<0.53	<0.39	<0.50	<0.75	<0.44	<0.0020	<0.41	<0.85	**<0.22**	<2.7	--	--	
MW-21	2/18/2020	213.89	16.42	0	197.47	<31.6	<66	114 J	<0.089	<0.412	<0.158	<0.316	<0.102	<0.0024	<0.199	<0.153	<0.118	<1.9	--	--	
MW-21	4/29/2020	213.89	16.52	0	197.37	37.0 BJ	--	--	<0.0941	<0.278	<0.137	<0.174	<0.101	<0.00536	<0.300	<0.190	**<0.234**	<2.9	--	--	
MW-21	9/2/2020	213.89	16.02	0	197.87	68.2 BJ [47.2 BJ]	--	--	<0.0400 [<0.0400]	<0.200 [<0.200]	<0.100 [<0.100]	<0.260 [<0.260]	<0.0400 [<0.0400]	**<0.0200* [<0.0200]**	0.124 [0.12]	0.093 [0.078]	<0.100 [<0.100]	<6.00 [<6.00]	--	--	
MW-21	12/8/2020	213.89	16.39	0	197.5	<100 [<100]	--	--	<0.0400 [<0.0400]	<0.200 [<0.200]	<0.100 [<0.100]	<0.260 [<0.260]	<0.0400 [<0.0400]	**<0.0200* [<0.0200]**	0.0420 J [0.0464 J]	<0.0400 [<0.0400]	<0.100 [<0.100]	<6.00 [<6.00]	--	--	
MW-21	3/3/2021	213.89	15.49	0	198.4	<100 [47.3 BJ]	--	--	<0.0400 [<0.0400]	<0.200 [<0.200]	<0.100 [<0.100]	<0.260 [<0.260]	<0.0400 [<0.0400]	**<0.0200* [<0.0200]**	0.0420 J [0.0510 J]	0.0400 J [0.0390 J]	<0.100 [<0.100]	<2.00 [<2.00]	--	--	
MW-21	6/17/2021	213.89	16.51	0	197.38	36.1 BJ [115 B]	--	--	<0.0400 [<0.0400]	0.0550 J [0.0670 J]	<0.100 [<0.100]	<0.260 [<0.260]	<0.0400 [<0.0400]	**<0.0200* [<0.0200]**	0.0730 J [0.0610 J]	0.0310 J [0.0340 J]	<0.100 [<0.100]	<2.00 [<2.00]	--	--	
MW-21	9/22/2021	213.89	17.23	0	196.66	<100	--	--	<0.0400	0.127 J	0.0560 J	0.226 J	<0.0400	**<0.0200***	<0.100	0.0320 J	<0.100	<2.00	--	--	
MW-21	12/14/2021	213.89	16.86	0	197.03	48.6 BJ	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	<0.00563	0.128	0.712	<0.0273	<0.849	--	--	
MW-21	3/31/2022	213.89	16.31	0	197.58	54.7 B J	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	<0.00547	<0.0280	<0.0160	<0.0273	<0.849	--	--	
MW-21	6/13/2022	213.89	16.31	0	197.58	51.5 B J	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118 C3	<0.00563	<0.0280	<0.0160	<0.0273	<0.849	--	--	
MW-21	8/18/2022	214	16.58	0	197.42	32.9 B J	--	--	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	<0.0280	<0.0160	<0.0273	<0.849	--	--	
MW-21	1/4/2023	214	16.23	0	197.77	484	--	--	**6.73**	0.106 J	0.118	<0.191	<0.0118	**<0.0210***	**9.79**	**583**	**20.8**	<0.849	--	--	
MW-21	3/15/2023	214	15.35	0	198.65	**1100**	--	--	**8.1**	<2.50	<1.06	<9.55	<0.590	**<1.05***	<1.40	**465**	**12.1**	<0.849	--	--	
MW-21	6/20/2023	214	18	0	196	**1000**	180 J	<250	**7.29**	0.136 J	0.0470 J	<0.260	<0.0400	**<0.0200***	**7.95 C4**	**524 C4**	**33.3**	<6.00	--	--	
MW-21	10/11/2023	214	18.3	0	195.7	**916 J3 [802 J3]**	235 [229 J3]	<83.3 [<83.3]	**6.55 [6.72]**	<2.50 [<0.500]	<1.06 [<0.212]	<9.55 [<1.91]	<0.590 [<0.118]	**<1.05* [<0.210]**	**8.05 [3.93]**	**538 [522]**	**18.8 [22.2]**	<2.99 [<2.99]	--	--	
MW-21	12/26/2023	214	16.93	0	197.07	**987**	295	<83.3	**8**	<2.50	<1.06	<9.55	1.85 J	**<1.05***	5.00 J	**591**	**38.7 C5 J3**	<2.99	--	16.4 B J	
MW-21	3/7/2024	214	17.12	0	196.88	519	239	<83.3	**7.21**	<0.500	<0.212	<1.91	<0.118	**<0.210***	4.95	**693**	**46**	<2.99	--	<1.24 C3	
MW-21	6/14/2024	214	17.22	0	196.78	334	99.0 J	<83.3	1.34	<0.500	<0.212	<1.91	<0.118	**<0.210***	0.610 J	**275**	**5.54**	<2.99	--	<1.24	
MW-21	9/11/2024	214	17.71	0	196.29	740	196 J	<83.3	**7.05**	0.135 J	<0.0212	<0.191	<0.0118	**<0.0210***	**5.8**	**540**	**40.7**	5.57 J	--	<0.124	
MW-22	12/26/2019	212.93	16.8	0	196.13	<100	73 J	<91	**10**	<0.39	<0.50	<0.75	<0.44	<0.0020	1.1 J	**410**	**6.4**	<2.7	--	--	

Table 1 - Summary of Groundwater Gauging and Select Analytical Results
Former Chevron Station 90129
4700 Brooklyn Avenue Northeast, Seattle, Washington

Well	Date	Top of Casing (ft NAVD 88)	Static Depth to Water (ft bTOC)	LNAPL Thickness (ft)	Groundwater Elevation (ft NAVD 88)	GRO (µg/L)	DRO (µg/L)	HRO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	EDB (µg/L)	PCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)	Total Lead (µg/L)	2-Methylnaphthalene (µg/L)	Naphthalene (µg/L)	Comments/Remarks
Model Toxics Control Act (MTCA) Method A Cleanup Levels (CULs) in µg/L						**800/1000**	**500**	**500**	**5**	**1000**	**700**	**1000**	**20**	**0.01**	**5**	**5**	**0.2**	**15**		**160**	
MW-22	2/18/2020	212.93	16.22	0	196.71	536	92.2 J	110 J	**9.33**	<0.412	<0.158	<0.316	<0.102	<0.0024	1.11	**447**	**5.13**	1.98 J	--	--	
MW-22	4/29/2020	212.93	16.25	0	196.68	549 B	--	--	**8.28**	<0.278	<0.137	<0.174	<0.101	<0.00536	<3.00	**384**	**5**	<2.9	--	--	
MW-22	9/2/2020	212.93	16.12	0	196.81	412 B	--	--	3.2	<0.200	<0.100	<2.60	<0.400	**<0.0200***	1.99	**233**	**1.57**	<6.00	--	--	
MW-22	12/7/2020	212.93	16.07	0	196.86	188 B	--	--	2.24	<0.200	<0.100	<2.60	<0.400	**<0.0200***	2.29	**158**	**1**	<6.00	--	--	
MW-22	3/3/2021	212.93	15.4	0	197.53	127 B	--	--	2.66	<0.200	<0.100	<2.60	<0.400	**<0.0200***	1.54	**168**	**1.23**	<2.00	--	--	
MW-22	6/17/2021	212.93	16.18	0	196.75	440	--	--	**6.39**	<2.00	<1.00	<2.60	<0.400	**<0.0200***	0.430 J	**306**	**2.94**	<2.00	--	--	
MW-22	9/22/2021	212.93	16.5	0	196.43	570	--	--	**5.75**	<2.00	<1.00	<2.60	<0.400	**<0.0200***	<1.00	**421**	**7.22**	<2.00	--	--	
MW-22	12/14/2021	212.93	16.87	0	196.06	673 B	--	--	**6.98**	0.560 J	<0.212	<1.91	0.53	<0.00547	0.800 J	**482**	**7.5**	<0.849	--	--	
MW-22	12/14/2021	212.93	--	--	--	**832 B**	--	--	**7.17**	0.0860 J	<0.0212	<0.191	<0.0118	<0.00536	1.05	**547**	**9.57**	<0.849	--	--	
MW-22	3/31/2022	212.93	16.11	0	196.82	533 B	--	--	**5.1**	<0.500	<0.212	<1.91	<0.118	<0.00547	0.510 J	**356**	**5.09**	<0.849	--	--	
MW-22	6/13/2022	212.93	16.23	0	196.7	555 B	--	--	**5.37**	<0.500	<0.212	<1.91	<0.118 C3	<0.00541	0.510 J	**296**	**2.99**	<0.849	--	--	
MW-22	8/18/2022	213.09	16.3	0	196.79	555 [409]	--	--	**5.92** [<1.60]	<0.500 [<5.00]	<0.212 [<2.12]	<1.91 [<19.1]	<0.118 [<1.18]	**<0.0210*** [<0.00547]	0.690 J [<2.80]	**352 [304]**	**4.70 [<2.73]**	<0.849 [<0.849]	--	--	
MW-22	1/4/2023	213.09	17.05	0	196.04	503	--	--	**7**	0.620 J	<0.212	<0.191	<0.118	**<0.210***	0.830 J	**448**	**7.33**	<0.849	--	--	
MW-22	3/15/2023	213.09	16.11	0	196.98	**1120**	--	--	**7.83**	<0.500	<0.212	<1.91	<0.118	**<0.210***	<0.280	**450**	**9.99**	<0.849	--	--	
MW-22	6/20/2023	213.09	17.16	0	195.93	**875**	86.7 J	<250	**8.33**	<2.00	<1.00	<2.60	<0.400	**<0.0212***	0.420 J	**453**	**10.2**	5.47 B J	--	--	
MW-22	10/11/2023	213.09	17.6	0	195.49	**859 J3**	105 J	<83.3	**9.37**	<0.500	<0.212	<1.91	<0.118	**<0.210***	0.660 J	**429**	**8.68**	10.3	--	--	
MW-22	12/26/2023	213.09	17.46	0	195.63	**887 [890]**	161 J [148 J]	<83.3 [<83.3]	**5.78 [5.76]**	<0.500 [<0.500]	<0.212 [<0.212]	<1.91 [<1.91]	<0.118 [<0.118]	**<0.210* [<0.210]**	<0.280 [<0.280]	**285 [315]**	**4.00 C5 J3 [7.95]**	6.34 [6.95]	-- [--]	<1.24 [<1.24]	
MW-22	3/7/2024	213.09	16.85	0	196.24	430 [434]	130 J [107 B J]	<83.3 [<83.3]	**5.66 [5.83]**	<0.500 [0.0840 J]	<0.212 [<0.0212]	<1.91 [<0.191]	<0.118 [<0.0118]	**<0.210* [<0.0210]**	<0.280 J4 [<0.560]	**232 [261]**	**9.54 C5 J4 [9.92 C5 J4]**	<2.99 [<2.99]	--	<1.24 [<0.124]	
MW-22	6/14/2024	213.09	16.63	0	196.46	570 [640 B]	<66.7 [84.9 J]	<83.3 [145 J]	**5.23 [5.93]**	<0.500 [0.0940 J]	<0.212 [<0.0212]	<1.91 [<0.191]	<0.118 [<0.0118]	**<0.210* [<0.0210]**	<0.280 [0.213 C5]	**237 [211]**	**6.93 [8.67]**	<2.99 [**3.04 J***]	--	<1.24	
MW-22	9/11/2024	213.09	17.09	0	196	627	117 J	<83.3	**6.53**	0.113 J	<0.0212	<0.191	<0.0118	**<0.0210***	<1.40	**222**	**13**	<2.99	--	<0.124	
MW-23	12/26/2019	211.72	16.15	0	195.57	<100	<66	<98	**16**	<0.39	<0.50	<0.75	<0.44	<0.0020	<0.41	**130**	**22**	<2.7	--	--	
MW-23	2/18/2020	211.72	15.82	0	195.9	246	67.2 J	159 J	**8.69**	<0.412	<0.158	<0.316	<0.102	<0.0024	<0.199	**59.8**	**7.85**	<1.9	--	--	
MW-23	4/29/2020	211.72	15.69	0	196.03	148	--	--	4.1 J	<0.278	<0.137	<0.174	<0.101	<0.00536	<0.300	**14**	**4.24 J**	4.59 J	--	--	
MW-23	9/2/2020	211.72	15.69	0	196.03	626	--	--	**6.95**	<2.00	<1.00	<2.60	<0.400	**<0.0200***	0.360 J	**12.8**	**8.2**	<6.00	--	--	
MW-23	12/7/2020	211.72	15.54	0	196.18	209 B	--	--	**5.92**	<2.00	<1.00	<2.60	<0.400	**<0.0200***	<1.00	**6.68**	**5.48**	<6.00	--	--	
MW-23	3/2/2021	211.72	14.95	0	196.77	103 B	--	--	4.28	<2.00	<1.00	<2.60	<0.400	**<0.0200***	<1.00	**7.45**	**5.02**	<2.00	--	--	
MW-23	9/22/2021	211.72	15.82	0	195.9	334	--	--	4.2	<2.00	<1.00	<2.60	<0.400	**<0.0200***	<1.00	**28.9**	**9.08**	<2.00	--	--	
MW-23	12/14/2021	211.72	15.44	0	196.28	353 B	--	--	**5.75**	<0.500	<0.212	<1.91	<0.118	<0.00547	<0.280	**205**	**7.81**	1.88 BJ	--	--	
MW-23	3/31/2022	211.72	15.9	0	195.82	261 B	--	--	2.9	<0.500	<0.212	<1.91	<0.118	<0.00547	<0.280	**74.2**	**4.87**	<0.849	--	--	
MW-23	6/13/2022	211.72	15.52	0	196.2	382 B	--	--	4.05	<0.500	<0.212	<1.91	<0.118	<0.00536	<0.280	**43.2**	**3.75 C3**	<0.849	--	--	
MW-23	8/18/2022	211.9	15.9	0	196	296 B	--	--	**5.59**	<0.500	<0.212	<1.91	<0.118	**<0.0210***	<0.280	**34.4**	**11.4**	<0.849	--	--	
MW-23	1/4/2023	211.9	15.26	0	196.64	474	--	--	**8.82**	<0.500	<0.212	<0.191	<0.118	**<0.210***	<0.280	**328**	**15.8**	<0.849	--	--	
MW-23	3/15/2023	211.9	13.9	0	198	65.6 B J	--	--	0.155	<0.0500	<0.0212	<0.191	0.0170 J	**<0.0210***	0.883	0.0240 J	**8.55**	<0.849	--	--	
MW-23	6/20/2023	211.9	16.2	0	195.7	701	<400	<500	**9.09**	<2.00	<1.00	<2.60	<0.400	**<0.0228***	<1.00	**368**	**23.5**	6.94 B	--	--	
MW-23	10/11/2023	211.9	16.4	0	195.5	644 J3	<66.7	<83.3	**9.8**	<0.500	<0.212	<1.91	<0.118	**<0.210***	<0.280	**366**	**20.2**	<2.99	--	--	
MW-23	12/26/2023	211.9	16.37	0	195.53	455	92.4 J	<83.3	4.08	<0.500	<0.212	<1.91	<0.118	**<0.210***	<0.280	**183**	**7.75 C5 J3**	<2.99	--	<1.24	
MW-23	3/7/2024	211.9	15.96	0	195.94	112	84.2 J	<83.3	0.47	<0.500	<0.212	<1.91	<0.118	**<0.210***	<0.280 J4	**87.1**	**0.720 J J4**	<2.99	--	<1.24	
MW-23	6/14/2024	211.9	16.04	0	195.86	700	<66.7	<83.3	**5.96**	<0.500	<0.212	<1.91	<0.118	**<0.210***	<0.280	**151**	**12.3**	<2.99	--	<1.24	
MW-23	9/11/2024	211.9	16.25	0	195.65	674	97.3 J	<83.3	**10.4**	0.129 J	<0.0212	<0.191	<0.0118	**<0.0210***	<1.40	**152**	**31.3**	<2.99	--	<0.124	
MW-25	12/26/2019	212.81	16.62	0	196.19	210 J	110 J	<100	**53**	3.4	7	2.8 J	<0.44	<0.0020	**16**	**600**	**180**	<2.7	--	--	
MW-25	2/18/2020	212.81	15.98	0	196.83	**1500**	107 J	122 J	**42.2**	2.82	2.1	1.58	<0.102	<0.0024	4.49	**530**	**92.7**	<1.9	--	--	
MW-25	5/5/2020	212.81	16.03	0	196.78	**1630**	--	--	**28.1**	<5.56	<2.74	<3.48	<2.02	<0.00536	**22.8**	**496**	**53.7**	<2.9	--	--	
MW-25	9/2/2020	212.81	16.04	0	196.77	**1810**	--	--	**24.1**	1.54 J	1.26 J	<5.20	<0.800	**<0.0200***	**15.6**	**695**	**47.3**	<6.00	--	--	
MW-25	12/8/2020	212.81	16.05	0	196.76	**1480**	--	--	**21.1**	<4.00	0.860 J	<5.20	<0.800	**<0.0200***	**29.2**	**837**	**27.7**	<6.00	--	--	
MW-25	3/2/2021	212.81	15.21	0	197.6	620	--	--	**13.5**	<4.00	<2.00	<5.20	<0.800	**<0.0200***	**27.8**	**570**	**27.4**	<2.00	--	--	
MW-25	6/16/2021	212.81	16.01	0	196.8	218	--	--	2.52	<4.00	<2.00	<5.20	<0.800	**<0.0200***	**50.1**	**225**	**3.54**	<2.00	--	--	
MW-25	12/14/2021	212.81	16.11	0	196.7	**1700**	--	--	**20.2**	<1.00	<0.424	<3.82	<0.236	<0.00552	<0.560	**366**	**62**	1.71 BJ	--	--	
MW-25	3/31/2022	212.81	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
MW-25	8/18/2022	212.97	16.1	0	196.87	638	--	--	**48.4**	0.633	0.146	<0.191	<0.0118	**<0.0210***	**6.3**	**147**	**55.4**	<0.849	--	--	
MW-25	1/4/2023	212.97	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
MW-25	3/15/2023	212.97	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Unable to access well
MW-25	6/20/2023	212.97	16.8	0	196.17	**873**	191 J	465	**31.7**	<4.00	<2.00	<5.20	<0.800	**<0.0212***	**11.2**	**34.1**	**112**	<6.00	--	--	
MW-25	10/11/2023	212.97	17.28	0	195.69	354 J3	269	312	**5.12**	<1.00	<0.424	<3.82	<0.236	**<0.420***	**41**	**51.6**	**13.3**	<2.99	--	--	
MW-25	12/26/2023	212.97	16.04	0	196.93	**990**	119 J	<83.3	**23.7**	<1.00	0.480 J	<3.82	<0.236	**<0.420***	**18.8**	**46.9**	**112**	<2.99	--	<2.48	
MW-25	3/7/2024	212.97	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Unable to access
MW-25	6/14/2024	212.97	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Unable to access, parked over
MW-25	9/11/2024	212.97	16.86	0	196.11	751	129 J	83.6 J	**13.6**	0.243	0.137	<0.191	<0.0118	**<0.0210***	**25.5**	**34.8**	**64.6**	<2.99	--	<0.124	
MW-27	12/26/2019	214.43	17.32	0	197.11	**3600**	**5300**	190 J	**6.5**	2	140	38	<0.44	<0.0020	0.53 J	**830**	**18**	<2.7	--	--	
MW-27	2/18/2020	214.43	16.46	0	197.97	**3860**	**7010**	172 J	**7.9**	<10.3	116	30.3	<0.102	<0.0024	<4.98	**1050**	**11.4**	<1.9	--	--	
MW-27	4/29/2020	214.43	16.64	0	197.79	**3320**	--	--	4.95	<6.95	<3.43	<4.35	<2.53	<0.00536	**<7.5**	**1170**	**12.6**	<2.9	--	--	
MW-27	9/2/2020	214.43	16.77	0	197.66	**2470**	--	--	4	<5.00	131	8.45	<1.00	**<0.0200***	2.5	**346**	**5.7**	<6.00	--	--	
MW-27	12/8/2020	214.43	16.78	0	197.65	**2550**	--	--	2.53	<5.00	64.8	6.5	<1.00	**<0.0200***	3.9	**638**	**9.85**	<6.00	--	--	
MW-27	3/2/2021	214.43	15.83	0	198.6	**2120**	--	--	1.55	<5.00	38.6	9.15	<1.00	**<0.0200***	2.5	**281**	**3.53**	<2.00	--	--	
MW-27	6/17/2021	214.43	17.27	0	197.16	**2580**	--	--	2.3	<5.00	51.1	<6.50	<1.00	**<0.0200***	<2.50	**748**	**7.72**	<2.00	--	--	
MW-27	9/22/2021	214.43	17.69	0	196.74	**1460**	--	--	2.02	<5.00	45.9	<6.50	<1.00	**<0.0200***	<2.50	**455**	**7.12**	<2.00	--	--	
MW-27	12/14/2021	214.43	17.14	0	197.29	**2100**	--	--	1.78	<1.25	30.3	<4.78	<0.295	<0.00536	<0.700	**534**	**5.98**	4.58 B	--	--	
MW-27	3/31/2022	214.43	16.93	0	197.5	**2030**	--	--	2.65	<1.25	14	<4.78	<0.295	<0.00536	<0.700	**1110**	**16.3**	<0.849	--	--	
MW-27	6/13/2022	214.43	16.82	0	197.61	**2160 [2240]**	--	--	2.05 [2.02]	1.43 J [0.380]	9.40 [9.87]	<4.78 [1.08]	<0.295 [<0.0118]	<0.00536 [<0.00584]	<0.700 [0.166]	**762 [842]**	**7.57 C3 [9.29 C3]**	<0.849 [<0.849]	<0.849 [<0.849]	--	
MW-27	8/18/2022	214.53	16.25	0	198.28	**2140**	--	--	**7.9**	1.93 J	152	15.9	<0.295	**<0.525***	**324**	**1010**	**<0.682***	<0.849	<0.849 [<0.849]	--	
MW-27	1/4/2023	214.53	17.8	0	196.73	**4790**	--	--	4.23	2.63 J	69.4	37.3	<0.295	**<0.525***	<0.700	**23.7**	**3.03**	<0.849	--	--	
MW-27	3/15/2023	214.53	17.04	0	197.49	**6410**	--	--	12.8	6.3	314	46.3	<0.295	**<0.525***	**21.2**	**181**	**<0.682***	<0.849	--	--	
MW-27	6/20/2023	214.53	17.95	0	196.58	<100	**5570**	<500	3.14	2.46	73.9	9.51	<0.200	**<0.0216***	<0.500 C4	**6.97 C4**	**4.09**	9.09 B	--	--	
MW-27	10/11/2023	214.53	17.99	0	196.54	**8290 J3**	**4100 J3**	<83.3	2.84	1.3	56.5	2.36	<0.0590	**<0.105***	0.190 J	**75.6**	**5.63**	3.16 J	--	--	
MW-27	12/26/2023	214.53	17.9	0	196.63	**2490**	**2380**	<83.3	2.2	1.58	14.1	3.2	<0.0590	**<0.105***	0.645	**255**	**12.9 C5 J3**	10	--	2.00 B J	
MW-27	3/7/2024	214.53	17.02	0	197.51	**993**	**3840**	168 J	2.47	0.415 J	4.15	<0.955	<0.0590	**<0.105***	<0.140 J4	**606**	**13.4 C5 J4**	<2.99	--	<0.620	
MW-27	6/14/2024	214.53	17.32	0	197.21	**1530**	**521**	123 J	3.5	<1.00	3.96	<3.82	<0.236	**<0.420***	1.54 J	**883**	**15.5**	<2.99	--	<2.48	
MW-27	9/11/2024	214.53	17.7	0	196.83	**992**	**649**	<83.3	3.2	0.451	4.41	0.342	<0.0118	**<0.0210***	2.35	**639**	**18.2**	<2.99	--	<0.124	
MW-28	12/26/2019	214.44	17.3	0	197.14	**2800**	**2200**	160 J	**8.1**	1.1 J	170	38	<0.44	<0.0020	**410**	**1800**	**12**	<2.7	--	--	
MW-28	2/18/2020	214.44	16.4	0	198.04	**3960**	**3020**	152 J	**14.6**	2.82	295	153	<0.102	<0.0024	**64.3**	**158**	**2.17**	<1.9	--	--	

Table 1 - Summary of Groundwater Gauging and Select Analytical Results
Former Chevron Station 90129
4700 Brooklyn Avenue Northeast, Seattle, Washington

Well	Date	Top of Casing (ft NAVD 88)	Static Depth to Water (ft bTOC)	LNAPL Thickness (ft)	Groundwater Elevation (ft NAVD 88)	GRO (µg/L)	DRO (µg/L)	HRO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	EDB (µg/L)	PCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)	Total Lead (µg/L)	2-Methylnaphthalene (µg/L)	Naphthalene (µg/L)	Comments/Remarks
Model Toxics Control Act (MTCA) Method A Cleanup Levels (CULs) in µg/L						**800/1000**	**500**	**500**	**5**	**1000**	**700**	**1000**	**20**	**0.01**	**5**	**5**	**0.2**	**15**		**160**	
MW-28	4/29/2020	214.44	16.57	0	197.87	**3670**	--	--	**10.4**	<1.39	224	58.3	<0.505	<0.00536	**238**	**713**	**4.01**	3.05 J	--	--	
MW-28	9/2/2020	214.44	16.69	0	197.75	**2830**	--	--	**13.5**	1.88	259	48.8	<0.200	**<0.0200***	**212**	**325**	**2.62**	<6.00	--	--	
MW-28	12/8/2020	214.44	16.78	0	197.66	**3350**	--	--	**7.97**	1.27	166	35.8	<0.200	**<0.0200***	**301**	**638**	**0.5**	<6.00	--	--	
MW-28	3/2/2021	214.44	15.8	0	198.64	**2470**	--	--	**5.52**	1.02	137	24.9	<0.200	**<0.0200***	**298**	**902**	**2.58**	<2.00	--	--	
MW-28	6/17/2021	214.44	17.27	0	197.17	**3680**	--	--	**14.6**	3.45 J	195	26.3	<2.00	**<0.0200***	**348**	**615**	**<5.00***	<2.00	--	--	
MW-28	9/22/2021	214.44	17.7	0	196.74	**4400**	--	--	**17.3**	3.98 J	284	19.9	<0.800	**<0.0200***	**136**	**449**	**4.36**	<2.00	--	--	
MW-28	12/14/2021	214.44	17.19	0	197.25	**3540**	--	--	**5.78**	1.86 J	136	14.3	<0.236	<0.00536	**75.3**	**571**	**<0.546***	3.13 B	--	--	
MW-28	3/31/2022	214.44	16.95	0	197.49	**2590**	--	--	4.8	1.26 J	133	15.6	<0.236	<0.00536	**261 C5**	**1120**	**2.22**	<0.849	--	--	
MW-28	6/13/2022	214.44	16.83	0	197.61	**2460**	--	--	4.54	1.42 J	96.5	13	<0.236	<0.00541	**97.6**	**623**	**<0.546 C3***	<0.849	--	--	
MW-28	8/18/2022	214.58	17.03	0	197.55	**2100**	--	--	**6.12**	1.64 J	129	10.4	<0.236	**<0.420***	**309**	**1030**	**2.94**	<0.849	--	--	
MW-28	1/4/2023	214.58	17.84	0	196.74	**5740**	--	--	**14.2**	7.08	382	75.8	<0.236	**<0.420***	**49**	**91.6**	**1.14 J**	<0.849	--	--	
MW-28	3/15/2023	214.58	16.82	0	197.76	**6400**	--	--	**11.5**	5.6	300	38.4	<0.236	**<0.420***	**22.2**	**178**	**<0.546***	<0.849	--	--	
MW-28	6/20/2023	214.58	18.02	0	196.56	**4030**	**2060**	<250	**7.64**	3.05	254	16.7	<0.200	**<0.0228***	**11.1**	**423 C4**	**<0.500***	6.33 B	--	--	
MW-28	10/11/2023	214.58	18.14	0	196.44	**3490 J3**	**1580 J3**	<83.3	**9.65**	4.45 J	206	16.3	<0.590	**<1.05***	**31.5**	**700**	**<1.36***	<2.99	--	--	
MW-28	12/26/2023	214.58	17.67	0	196.91	**3450**	**1100**	<83.3	3.7	<2.50	102	10.6 J	<0.590	**<1.05***	**83.8**	**1060**	**<1.36 J3***	<2.99	--	19.9 B J	
MW-28	3/7/2024	214.58	16.98	0	197.6	**2260**	**1730**	<83.3	2.8	<2.50	131	30.9	<0.590	**<1.05***	**19.7 C5 J4**	**783**	**<1.36 J4***	<2.99	--	<6.20	
MW-28	6/14/2024	214.58	17.39	0	197.19	**1470**	**757**	<83.3	4.35	<2.50	86.1	<9.55	<0.590	**<1.05***	**123 C5**	**1340**	**<1.36***	<2.99	--	<6.20	
MW-28	9/11/2024	214.58	17.8	0	196.78	**1800**	**602**	83.8 J	4.67	1.36	120	2.22	<0.0118	**<0.0210***	**117**	**1100**	**2.23**	<2.99	--	0.879	
MW-29	12/26/2019	217.26	19.63	0	197.63	<100	<76	<110	<0.53	<0.39	<0.50	<0.75	<0.44	<0.0020	<0.41	<0.85	**<0.22***	<2.7	--	--	
MW-29	2/18/2020	217.26	19.55	0	197.71	95.4 BJ	<66	155 J	<0.089	<0.412	<0.158	<0.316	<0.102	<0.0024	<0.199	<0.153	<0.118	<1.9	--	--	
MW-29	4/29/2020	217.26	19.62	0	197.64	92.5 BJ	--	--	<0.941	<0.278	<0.137	<0.174	<0.101	<0.00536	<0.300	0.216	**<0.234***	<2.9	--	--	
MW-29	9/3/2020	217.26	20.22	0	197.04	46.6 BJ	--	--	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	0.0440 J	<0.0400	<0.100	<6.00	--	--	
MW-29	12/9/2020	217.26	19.61	0	197.65	<100	--	--	<0.0400	<0.200	<0.100	<0.260	<0.0400	**<0.0200***	<0.100	<0.0400	<0.100	<6.00	--	--	
MW-29	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Well abandoned to accommodate construction of on-site building
MW-30	8/18/2022	210.23	15.35	0.00	194.88	43.1 BJ	--	--	0.0220 J	0.0810 J	<0.0212	<0.191	<0.0118	**<0.0210***	2.24	0.172	**0.996**	<0.849	--	--	
MW-30	1/4/2023	210.23	16.00	0.00	194.23	<31.6	--	--	0.104	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	1.39	0.066	**7.85**	<0.849	--	--	
MW-30	3/15/2023	210.23	15.38	0.00	194.85	202 B	--	--	0.195	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	1.11	<0.0160	**10.4**	<0.849	--	--	
MW-30	6/20/2023	210.23	16.15	0.00	194.08	80.2 J	121 J	117 J	0.216	0.0780 J	<0.100	<0.260	0.0190 J	**<0.0232***	1.17	0.064	**4.88**	<6.00	--	--	
MW-30	10/11/2023	210.23	16.34	0.00	193.89	46.8 J J3	82.2 J J3	<83.3	0.283	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	2.25	0.0360 J	**9.53**	<2.99	--	--	
MW-30	12/26/2023	210.23	16.45	0.00	193.78	80.8 J	112 J	<83.3	0.231	<0.0500	<0.0212	<0.191	0.0150 J	**<0.0210***	1.79	0.075	**7.32 C5 J3**	6.35	--	<0.124	
MW-30	3/7/2024	210.23	16.04	0.00	194.19	<31.6	<66.7	<83.3	0.092	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	3.17	0.178	**1.51 C5 J4**	<2.99	--	<0.124	
MW-30	6/14/2024	210.23	15.78	0.00	194.45	64.8 B J	<66.7	87.2 J	<0.0160	<0.0500	<0.0212	<0.191	<0.0118	**<0.0210***	**6.23 C5**	0.352	<0.0273	<2.99	--	<0.124	Gauged late, parked over
MW-30	9/11/2024	210.23	15.94	0.00	194.29	<31.6	<66.7	91.7 J	0.0250 J	0.0600 J	<0.0212	<0.191	<0.0118	**<0.0210***	4.91	0.323	<0.0273	15	--	<0.124	
MW-31	6/13/2022	212.21	--	--	--	594	--	--	**37.7**	0.3	0.0450 J	<0.191	<0.0118	<0.00536	0.0760 J	**60.8**	**32.0 C3**	<0.849	--	--	
MW-31	8/18/2022	212.21	15.72	0.00	196.49	599	--	--	**40.3**	<1.00	0.700 J	<3.82	<0.236	**<0.420***	**9.28**	**213**	**41**	<0.849	--	--	
MW-31	1/4/2023	212.21	16.18	0.00	196.03	721	--	--	**46.3**	<1.00	<0.424	<3.82	<0.236	**<0.420***	**9.6**	**305**	**34.2**	<0.849	--	--	
MW-31	3/15/2023	212.21	15.6	0.00	196.61	**1170 [1280]**	--	--	**45.8 [49.5]**	<1.00 [0.405]	<0.424 [0.170]	<3.82 [<0.191]	<0.236 [0.0190 J]	**<0.420* [<0.0210]**	**7.90 [8.81]**	**252 [232]**	**37.9 [43.3]**	<0.849 [<0.849]	--	--	
MW-31	6/20/2023	212.21	16.2	0.00	196.01	721	85.8 J	121 J	**34.1**	<4.00	1.52 J	<5.20	<0.800	**<0.0226***	**6.54**	**194**	**32.2**	3.20 B J	--	--	
MW-31	10/11/2023	212.21	16.16	0.00	196.05	635 J3	72.4 J J3	99.7 J	**37.9**	<1.00	<0.424	<3.82	<0.236	**<0.42***	3.08	**205**	**25.1**	<2.99	--	--	
MW-31	12/26/2023	212.21	16.07	0.00	196.14	605	193 J	159 J	**24.1**	<1.00	<0.424	<3.82	<0.236	**<0.420***	**5.9**	**106**	**18.6**	4.44 J	--	<2.48	
MW-31	3/7/2024	212.21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Unable to access
MW-31	6/14/2024	212.21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Unable to access, parked over
MW-31	9/11/2024	212.21	16.31	0.00	195.9	521	72.7 J	132 J	**24.4**	0.211	<0.530	<0.191	<0.0118	**<0.0210***	4.05	**125**	**28.6**	**41.2**	--	<0.124	
TB-1	10/11/2023	--	--	--	--	--	--	--	<0.0941	<0.278	<0.137	<0.174	--	--	--	--	--	--	--	--	
TB-1	12/26/2023	--	--	--	--	--	--	--	<0.0941	<0.278	<0.137	<0.174	--	--	--	--	--	--	--	--	
TB-1	3/7/2024	--	--	--	--	--	--	--	<0.0941	0.323 J	<0.137	0.271 J	--	--	--	--	--	--	--	--	
TB-1	6/14/2024	--	--	--	--	--	--	--	<0.0941	<0.278	<0.137	<0.174	--	--	--	--	--	--	--	--	
TB-1	9/11/2024	--	--	--	--	--	--	--	<0.0941	<0.278	<0.137	<0.174	--	--	--	--	--	--	--	--	

Notes:

Analytical results are presented in micrograms per liter (µg/L)

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

BOLD values are greater than their respective MTCA Method A CUL

***BOLD** values are non-detect below the laboratory MDL, but the MDL is greater than the MTCA Method A CUL

If LNAPL is present, GWE is corrected according to the following formula: (TOC - DTW) + (0.8 x NAPL)

Well TOC for 08/18/2022 used as per the updated survey on 06/05/2022

EDB result for 08/18/2022 as per U.S. Environmental Protection Agency (EPA) method 8260D.

Due to weather delays, January 2023 analytical data represents the fourth quarter 2022 groundwater sampling event.

Abbreviations:

TOC = Top of Casing
DTW = Depth to water in feet below TOC
GWE = Groundwater elevation in feet relative to NAVD88
-- = Not applicable, not available, or not analyzed
MTCA = Model Toxics Control Act Cleanup
CUL = Cleanup Level
PCE = Tetrachloroethene
TCE = Trichloroethene
EDB = 1,2-Dibromoethane (Ethylene dibromide)
MTBE = Methyl tert-butyl ether
TPH-GRO = Total Petroleum Hydrocarbons as Gasoline Range Organics
TPH-DRO = Total Petroleum Hydrocarbons as Diesel Range Organics
TPH-HRO = Total Petroleum Hydrocarbons as Heavy Oil Range Organics
EPA = U.S. Environmental Protection Agency
LNAPL - Light Non-Aqueous Phase Liquid
TB = Trip Blank

Analytical Methods:

Samples analyzed by NWTPH-Gx
  GRO = Total Petroleum Hydrocarbons as Gasoline Range Organics,
Samples analyzed by NWTPH-Dx
  DRO = Total Petroleum Hydrocarbons as Diesel Range Organics
  HRO = Total Petroleum Hydrocarbons as Heavy Oil Range Organics
Samples analyzed by USEPA Method 8260B/8260D
  BTEX = benzene, toluene, ethylbenzene, and total xylenes
  MTBE = Methyl tert-butyl ether
  EDB = 1,2-Dibromoethane (ethylene dibromide)
  PCE = tetrachloroethene
  TCE = trichloroethene
  Vinyl chloride
Samples analyzed by USEPA Method 6010D/6020B
  Dissolved lead
  Total lead

Laboratory Qualifiers:

< = Not detected at or above the Method Detection Limit (MDL)
J = Estimated value; result is greater than the laboratory Method Detection Limit (MDL) but less than the Reported Detection Limit (RDL) or Reporting Limit (RL) or Limit of Quantification (LOQ)
B = The same analyte is found in the associated laboratory blank
C3 = The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
C4 = The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Data is likely to show a low bias concerning the result.
C5 = The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.
J3 = The associated batch QC was outside the established quality control rar
J4 = The associated batch QC was outside the established quality control range for accuracy.

Table 2 - Sampling and Analysis Plan
Former Chevron Station 90129
4700 Brooklyn Avenue NE, Seattle, Washington

Analytes/Field Data	Example Method	Baseline[a]	Wells	Performance Monitoring[b]	Wells
Primary Geochemical Parameters					
Depth to water	Electronic interface probe	X	MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-25, MW-27, MW-28, MW-30, MW-31	X	MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-25, MW-27, MW-28, MW-30, MW-31
pH	YSI or similar	X		X	
ORP/redox (pre/post-purge)	YSI or similar	X		X	
Dissolved oxygen (pre/post-purge)	YSI or similar	X		X	
Conductivity	YSI or similar	X		X	
Turbidity	YSI or similar	X		X	
Temperature	YSI or similar	X		X	
COCs					
TPH-GRO	NWTPH-Gx	X	MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-25, MW-27, MW-28, MW-30, MW-31	X	MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-25, MW-27, MW-28, MW-30, MW-31
TPH-DRO and TPH-HRO	NWTPH-Dx	X		X	
VOCs	USEPA Method 8260B	X		X	
EDB	USEPA Method 8011	X		X	
Lead	USEPA Method 6000 series	X		X	
Secondary Geochemical Parameters					
Sulfate	USEPA Method 9056A	X	MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-25, MW-27, MW-28, MW-30, MW-31	X	MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-25, MW-27, MW-28, MW-30, MW-31
Sulfide	SM Method 4500S2 D	X		X	
Nitrate	USEPA Method 9056A	X		X	
Nitrite	USEPA Method 9056A	X		X	
Total Kjeldahl Nitrogen	USEPA Method 351.2	X		X	
Dissolved Iron	USEPA Method 6010D	X		X	
Dissolved Manganese	USEPA Method 6010D	X		X	
Total Manganese	USEPA Method 6010D	X		X	
Total Iron	USEPA Method 6010D	X		X	
Methane	USEPA Method RSK175	X		X	
Alkalinity	USEPA Method 2320B	X		X	
Total Organic Carbon	USEPA Method 9060A	X		X	

Notes:

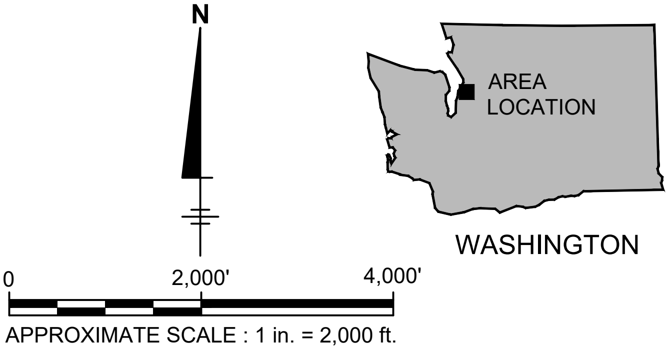
[a] Baseline monitoring will be performed on a quarterly basis for 1 year.
[b] Performance monitoring will be performed semi-annually for the second and third years and annually for subsequent years.

Acronyms and Abbreviations:

COC = constituent of concern
EDB = ethylene dibromide
MTBE = methyl tertiary butyl ether
ORP = oxidation-reduction potential
SGC = silica gel cleanup
SM = Standard Method
TPH-DRO = total petroleum hydrocarbons as diesel-range organics
TPH-GRO = total petroleum hydrocarbons as gasoline-range organics
TPH-HRO = total petroleum hydrocarbons as heavy oil-range organics
USEPA = United States Environmental Protection Agency
VOCs = volatile organic compounds
YSI = Yellow Springs Instruments

Figures

SOURCE: BASE MAP USGS 7.5. MIN. TOPO. QUAD., SEATTLE NORTH, WA 2020.



FORMER CHEVRON STATION 90129
4700 BROOKLYN AVENUE NE
SEATTLE, WA 98105

SITE LOCATION MAP

AECOM

FIGURE
1

CITY:EMERYVILLE, CA DIV/GROUP:ENVCAD DB:A.REYES
C:\Users\PadureanuO\AECOM\Chevron North America - Chevron 300\Project Documents\WA Non-PLIA\90129 - Seattle\900_CAD_GIS\910_CAD\GWMR 1Q2025\GEN-F01-SITE LOCATION.dwg LAYOUT: 1 SAVED: 4/24/2025 12:53 PM ACADVER: 24.2S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ----
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CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
C:\Users\PadureanuO\AECOM\Chevron North America - Chevron 300\Project Documents\WA Non-PLIA\90129 - Seattle\900_CAD_GIS\910_CAD\GWMR 3Q2024\GEN-F02-SITE PLAN.dwg LAYOUT: 3 SAVED: 5/5/2025 6:51 PM ACADVER: 24.2S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ----
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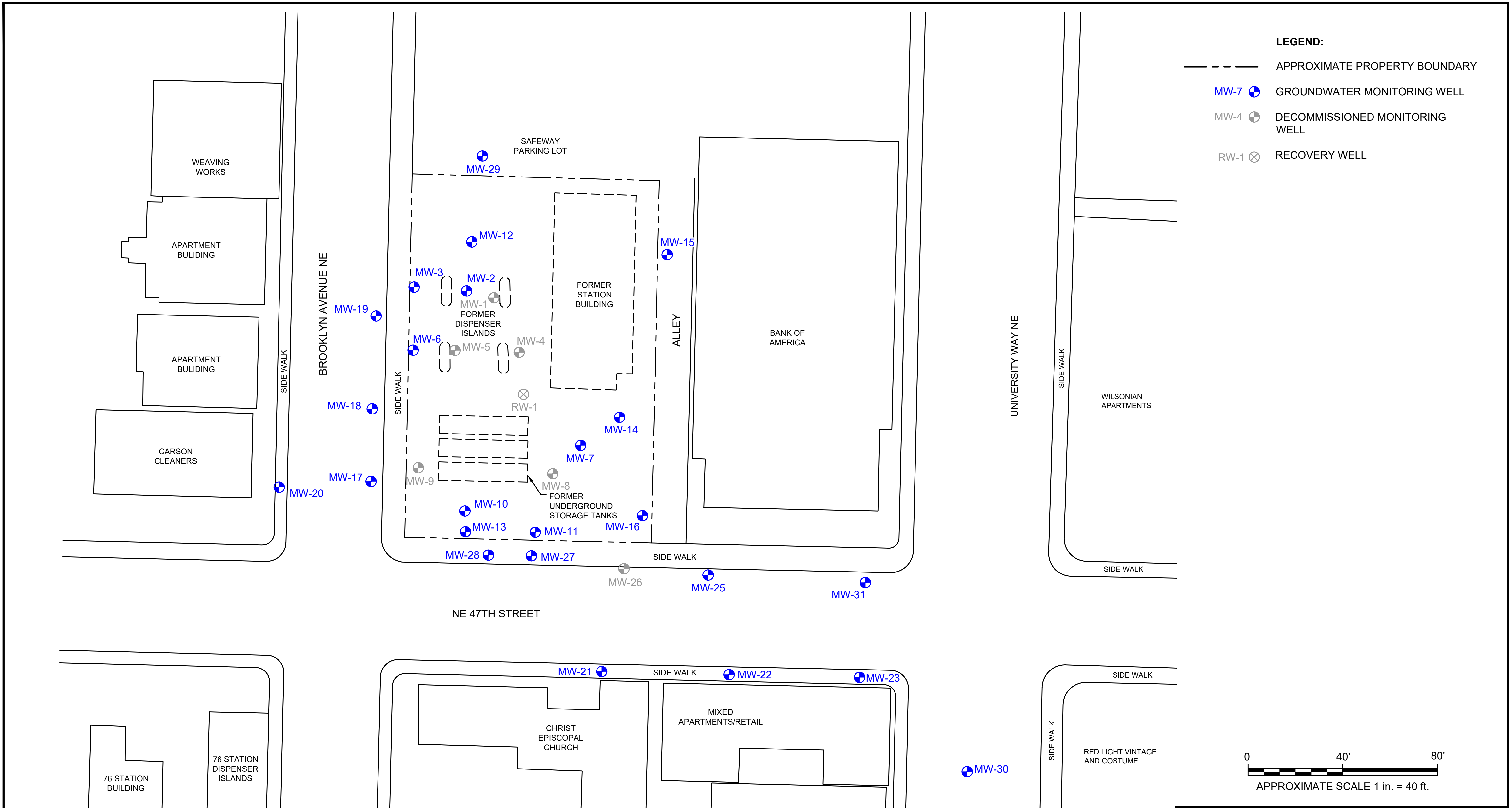
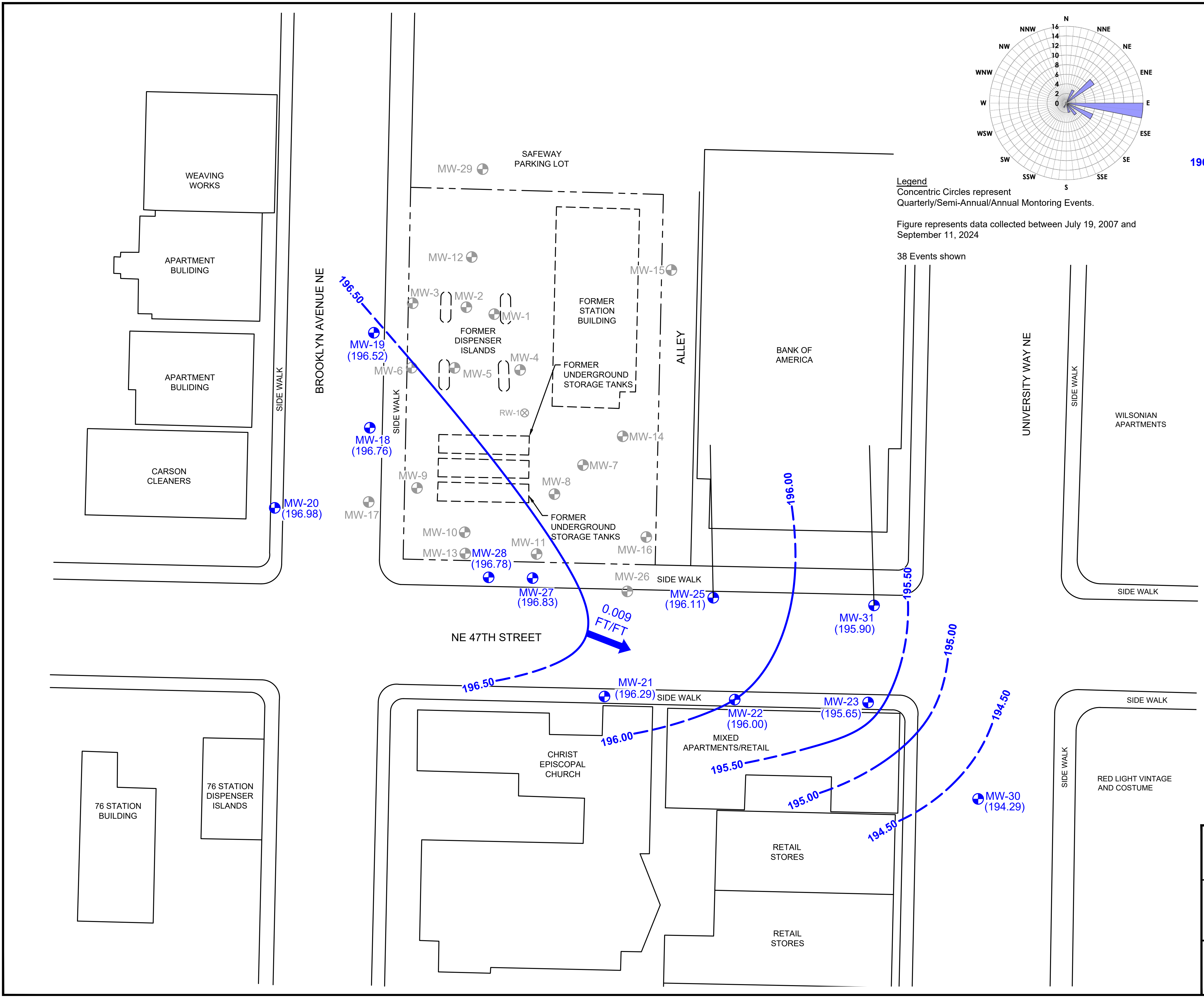


FORMER CHEVRON STATION 90129
4700 BROOKLYN AVENUE NE
SEATTLE, WA 98105

SITE PLAN

AECOM

FIGURE
2



Legend
Concentric Circles represent Quarterly/Semi-Annual/Annual Montoring Events.

Figure represents data collected between July 19, 2007 and September 11, 2024

38 Events shown

LEGEND:

— — —	APPROXIMATE PROPERTY BOUNDARY
MW-7 ◕	GROUNDWATER MONITORING WELL
MW-4 ◕	DECOMMISSIONED MONITORING WELL
RW-1 ⊗	RECOVERY WELL
(196.98)	GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
196.50 — —	GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL)
⬅	GROUNDWATER FLOW DIRECTION
0.009 FT/FT	APPROXIMATE HYDRAULIC GRADIENT (FEET PER FOOT)

N

0 40' 80'
APPROXIMATE SCALE 1 in. = 40 ft.

FORMER CHEVRON STATION 90129
4700 BROOKLYN AVENUE NE
SEATTLE, WA 98105

GROUNDWATER ELEVATION CONTOUR MAP, Q3 2024

AECOM

FIGURE
3

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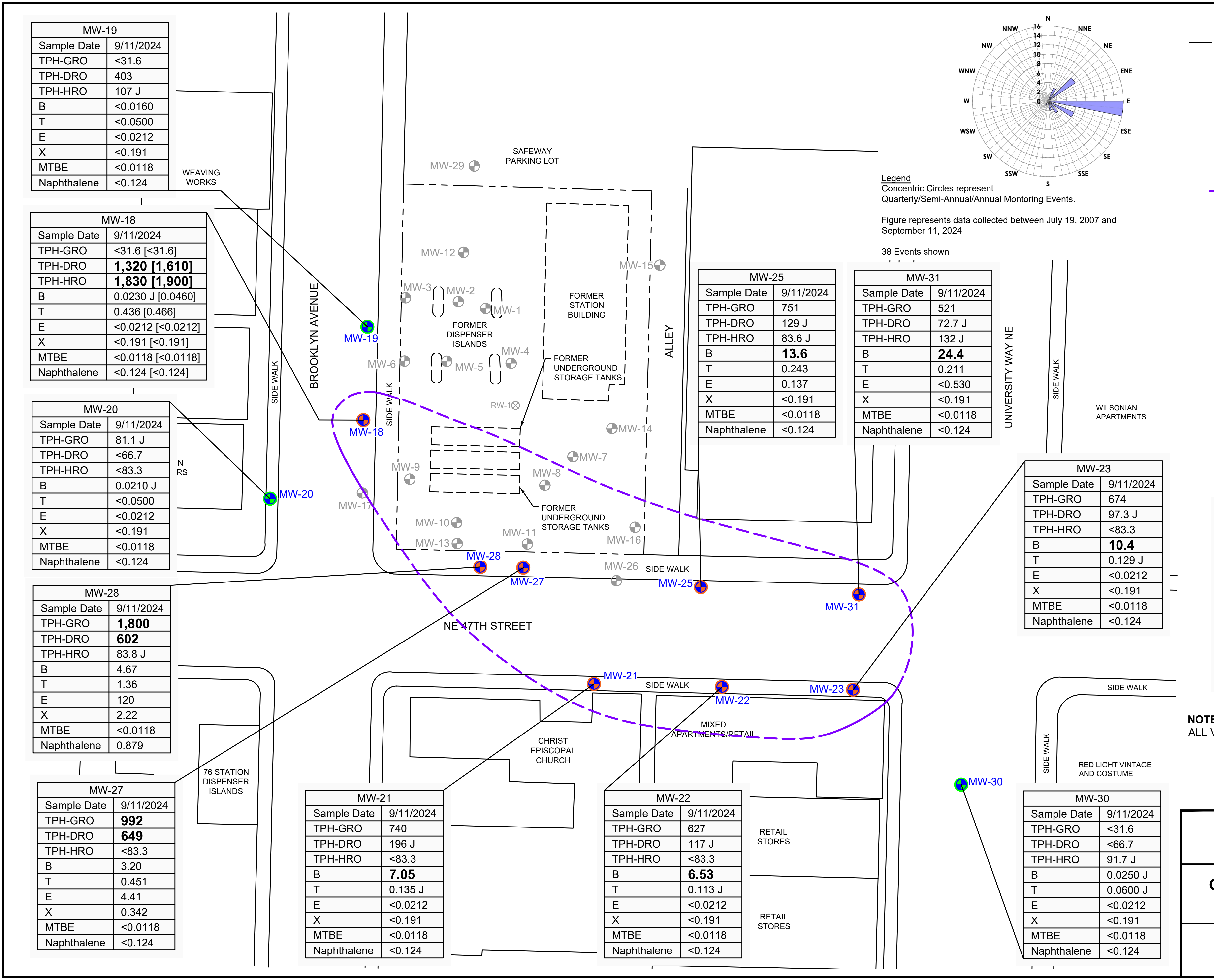

Legend
Concentric Circles represent
Quarterly/Semi-Annual/Annual Montoring Events.

Figure represents data collected between July 19, 2007 and
September 11, 2024

38 Events shown

MW-19	
Sample Date	9/11/2024
TPH-GRO	<31.6
TPH-DRO	403
TPH-HRO	107 J
B	<0.0160
T	<0.0500
E	<0.0212
X	<0.191
MTBE	<0.0118
Naphthalene	<0.124

MW-18	
Sample Date	9/11/2024
TPH-GRO	<31.6 [<31.6]
TPH-DRO	**1,320 [1,610]**
TPH-HRO	**1,830 [1,900]**
B	0.0230 J [0.0460]
T	0.436 [0.466]
E	<0.0212 [<0.0212]
X	<0.191 [<0.191]
MTBE	<0.0118 [<0.0118]
Naphthalene	<0.124 [<0.124]

MW-20	
Sample Date	9/11/2024
TPH-GRO	81.1 J
TPH-DRO	<66.7
TPH-HRO	<83.3
B	0.0210 J
T	<0.0500
E	<0.0212
X	<0.191
MTBE	<0.0118
Naphthalene	<0.124

MW-28	
Sample Date	9/11/2024
TPH-GRO	**1,800**
TPH-DRO	**602**
TPH-HRO	83.8 J
B	4.67
T	1.36
E	120
X	2.22
MTBE	<0.0118
Naphthalene	0.879

MW-27	
Sample Date	9/11/2024
TPH-GRO	**992**
TPH-DRO	**649**
TPH-HRO	<83.3
B	3.20
T	0.451
E	4.41
X	0.342
MTBE	<0.0118
Naphthalene	<0.124

MW-25	
Sample Date	9/11/2024
TPH-GRO	751
TPH-DRO	129 J
TPH-HRO	83.6 J
B	**13.6**
T	0.243
E	0.137
X	<0.191
MTBE	<0.0118
Naphthalene	<0.124

MW-31	
Sample Date	9/11/2024
TPH-GRO	521
TPH-DRO	72.7 J
TPH-HRO	132 J
B	**24.4**
T	0.211
E	<0.530
X	<0.191
MTBE	<0.0118
Naphthalene	<0.124

MW-23	
Sample Date	9/11/2024
TPH-GRO	674
TPH-DRO	97.3 J
TPH-HRO	<83.3
B	**10.4**
T	0.129 J
E	<0.0212
X	<0.191
MTBE	<0.0118
Naphthalene	<0.124

MW-21	
Sample Date	9/11/2024
TPH-GRO	740
TPH-DRO	196 J
TPH-HRO	<83.3
B	**7.05**
T	0.135 J
E	<0.0212
X	<0.191
MTBE	<0.0118
Naphthalene	<0.124

MW-22	
Sample Date	9/11/2024
TPH-GRO	627
TPH-DRO	117 J
TPH-HRO	<83.3
B	**6.53**
T	0.113 J
E	<0.0212
X	<0.191
MTBE	<0.0118
Naphthalene	<0.124

MW-30	
Sample Date	9/11/2024
TPH-GRO	<31.6
TPH-DRO	<66.7
TPH-HRO	91.7 J
B	0.0250 J
T	0.0600 J
E	<0.0212
X	<0.191
MTBE	<0.0118
Naphthalene	<0.124

LEGEND:

— — —	APPROXIMATE PROPERTY BOUNDARY
MW-7 ◕	GROUNDWATER MONITORING WELL
MW-4 ◕	DECOMMISSIONED MONITORING WELL
RW-1 ⊗	RECOVERY WELL
🟠	CONCENTRATIONS OBSERVED AT LEAST ONCE ABOVE MTCA METHOD A CULs
🟢	CONCENTRATIONS OBSERVED BELOW MTCA METHOD A CULs
— — —	Q3 2024 MTCA SITE BOUNDARY MAP FOR GROUNDWATER (DASHED WHERE INFERRED)
BOLD	VALUES ARE GREATER THAN THEIR RESPECTIVE MTCA METHOD A CULs
<1.00	NOT DETECTED AT OR ABOVE THE LABORATORY METHOD DETECTION LIMIT (MDL).
J	ESTIMATED VALUE; RESULT IS ≥ THE MDL AND < THE REPORTED DETECTION LIMIT
[ ]	DUPLICATE SAMPLE RESULTS
MTCA	MODEL TOXICS CONTROL ACT
CULs	CLEANUP LEVELS

WELL IDENTIFICATION Analyte		MTCA Method A CULs
TPH-GRO	TOTAL PETROLEUM HYDROCARBONS AS GASOLINE RANGE ORGANICS	800/1,000
TPH-DRO	TOTAL PETROLEUM HYDROCARBONS AS DIESEL RANGE ORGANICS	500
TPH-HRO	TOTAL PETROLEUM HYDROCARBONS AS HEAVY RANGE ORGANICS	500
B	BENZENE	5
T	TOLUENE	1,000
E	ETHYLBENZENE	700
X	TOTAL XYLENES	1,000
MTBE	METHYL TERT-BUTYL ETHER	20
NAPHTHALENE		160

NOTE:
ALL VALUES REPORTED IN MICROGRAMS PER LITER (µg/L)

0 40' 80'
APPROXIMATE SCALE 1 in. = 40 ft.

FORMER CHEVRON STATION 90129
4700 BROOKLYN AVENUE NE
SEATTLE, WA 98105

GROUNDWATER MTCA BOUNDARY
Q3 2024

AECOM

FIGURE
4

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PLOTSTYLETABLE: ---- PLOTTED: 5/9/2025 10:03 AM BY: PADUREANU, OANA

Appendix A Monitoring Well Sampling Procedures

Monitoring Well Sampling

Procedure 3-14

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the actions to be used during monitoring well sampling activities and establishes the method for sampling groundwater monitoring wells for water-borne contaminants and general groundwater chemistry. The objective is to obtain groundwater samples that are representative of aquifer conditions with as little alteration to water chemistry as possible.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 Depending upon the site-specific contaminants, various protective programs must be implemented prior to sampling the first well. All **Field Sampling Personnel** responsible for sampling activities must review the project-specific Health and Health Plan (HASP) paying particular attention to the control measures planned for the well sampling tasks. Conduct preliminary area monitoring of sampling wells to determine the potential hazard to **Field Sampling Personnel**. If significant contamination is observed, minimize contact with potential contaminants in both the vapor phase and liquid matrix using appropriate personal protective equipment (PPE).

2.2 Observe standard health and safety practices according to the project-specific HASP. Suggested minimum protection during well sampling activities includes inner disposable vinyl gloves, outer chemical-protective nitrile gloves, and rubberized steel-toed boots. Half-face respirators and cartridges and Tyvek® suits may be necessary depending on evaluation for PFAS and on the contaminant concentrations. Refer to the project-specific HASP for the required PPE.

2.3 The following safety precautions should be observed to minimize physical hazards associated with monitoring well sampling:

- To avoid lifting injuries associated with pump and bailers retrieval, use the large muscles of the legs, not the back.
- Stay clear of all moving equipment, and avoid wearing loose fitting clothing.
- When using tools for cutting purposes, cut away from yourself. The use of appropriate, task-specific cutting tools is recommended.
- To avoid slip/trip/fall conditions as a result of pump discharge, use textured boots/boot cover bottoms.
- To avoid heat/cold stress as a result of exposure to extreme temperatures and PPE, drink electrolyte replacement fluids (1 to 2 cups per hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
- Be aware of restricted mobility due to PPE.

3.0 Terms and Definitions

None.

4.0 Interferences

4.1 Potential interferences could result from cross-contamination between samples or sample locations. Minimization of the cross-contamination will occur through the following:

- The use of clean sampling tools at each location as necessary; and
- Avoidance of material that is not representative of the media to be sampled.

5.0 Training and Qualifications

5.1 Qualifications and Training

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 Responsibilities

5.2.1 The **Field Team Coordinator** is responsible for ensuring that monitoring well sampling activities comply with this procedure. The **Field Team Coordinator** is responsible for ensuring that **Field Personnel** involved in monitoring well sampling shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The **Project Manager** is responsible for ensuring overall compliance with this procedure.

5.2.3 All **Field Personnel** are responsible for the implementation of this procedure.

6.0 Equipment and Supplies

6.1 If sampling for PFAS, the sampler must take additional care to ensure no cross-contamination occurs from sampling equipment. Reference the Field Sampling Plan (FSP) for best practices regarding sampling equipment when necessary.

6.2 Purging and Sampling Equipment

- Pump (peristaltic, portable bladder, submersible)
- Polyethylene bladders (for portable bladder pumps)
- Bladder pump controller (for portable bladder pumps)
- Air compressor (for portable bladder pumps)
- Nitrogen cylinders (for portable bladder pumps)
- 12-volt power source
- Polyethylene inlet and discharge tubing
- Silicone tubing appropriate for peristaltic pump head
- High density polyethylene (HDPE) bailer appropriately sized for well
- Disposable bailer string (polypropylene)
- Individual or multi-parameter water quality meter(s) with flow-through cell to measure temperature, pH, specific conductance, dissolved oxygen (DO), oxidation reduction potential (ORP), and/or turbidity
- Turbidity meter
- Water level meter
- Oil/water interface probe

6.3 General Equipment

- Sample kit (i.e., bottles, labels, preservatives, custody records and tape, cooler, wet ice)
- Sample chain-of-custody (COC) forms
- Sample Collection Records
- Sample packaging and shipping supplies
- Fine-tipped Sharpie® marker
- Deionized water supply
- Polyethylene water dispenser bottles
- HDPE flow measurement cup or bucket
- 5-gallon buckets
- Instrument calibration solutions
- Stopwatch or watch
- Disposable, powderless Nitrile gloves
- Cotton towels
- Trash bags
- Zipper-lock (e.g., Ziploc brand) bags
- Equipment decontamination supplies (e.g., Alconox®, Liquinox®, NOT Decon 90™)
- Health and safety supplies (as required by the HASP)
- Well keys or combinations
- Monitoring well location map(s)
- Field project logbook/ballpoint pen

7.0 Calibration or Standardization

7.1 Field instruments will be calibrated daily according to the requirements of the FSP and/or manufacturer's specifications for each piece of equipment. Equipment will be checked daily with the calibration solutions at the end of use of the equipment. Calibration records shall be recorded in the field logbook or appropriate field form.

7.2 If readings are suspected to be inaccurate, the equipment shall be checked with the calibration solutions and/or re-calibrated.

8.0 Procedure

8.1 Preparation

8.1.1 Site Background Information

Establish a thorough understanding of the purposes of the sampling event prior to field activities. Conduct a review of all available data obtained from the site and pertinent to the water sampling. Review well history data including, but not limited to, well locations, sampling history, purging rates, turbidity problems, previously used purging methods, well installation methods, well completion records, well development methods, previous analytical results, presence of an immiscible phase, historical water levels, and general hydrogeologic conditions.

Previous groundwater development and sampling logs give a good indication of well purging rates and the types of problems that might be encountered during sampling, such as excessive turbidity and low well yield. They may also indicate where dedicated pumps are placed in the water column. To help minimize the potential for cross-contamination, well purging and sampling and water level measurement collection shall proceed from the least contaminated to the most contaminated well, as indicated by previous analytical results. This order may be changed in the field if conditions warrant it, particularly if dedicated sampling equipment is used. A review of prior sampling procedures and results may also identify which purging and sampling techniques are appropriate for the parameters to be tested under a given set of field conditions.

8.2 Groundwater Sampling Procedures

Groundwater sampling procedures at a site shall include:

1) An evaluation of the well security and condition prior to sampling
2) Decontamination of equipment
3) Measurement of well depth to groundwater
4) Assessment of the presence or absence of an immiscible phase
5) Assessment of purge parameter stabilization
6) Purging of static water within the well and well bore and
7) Obtaining a groundwater sample.

Each step is discussed in sequence below. Depending upon specific field conditions, additional steps may be necessary. As a rule, at least 24 hours should separate well development and well sampling events.

8.2.1 Well Security and Condition

At each monitoring well location, observe the conditions of the well and surrounding area. If required by the FSP, the following information may be noted on a Groundwater Sample Collection Record (Attachment 1) or in the field logbook:

- Condition of the well’s identification marker
- Condition of the well lock and associated locking cap
- Integrity of the well—well pad condition, protective outer casing, obstructions or kinks in the well casing, presence of water in the annular space, and the top of the interior casing; and
- Condition of the general area surrounding the well.

8.2.2 Decontamination of Equipment

Prior to sampling the first monitoring well and after each monitoring well sample is collected, all non-dedicated sampling equipment will be decontaminated following the procedure described in the FSP.

8.2.3 Measurement of Static Water Level Elevation

Before purging the well, measure static water levels in each well on site. If the well cap is not vented, remove the cap several minutes before measurement to allow water levels to equilibrate to atmospheric pressure.

Measure the depth to standing water and the total depth of the well to the nearest 0.01 foot to provide baseline hydrologic data, to calculate the volume of water in the well, and to provide information on the integrity of the well (e.g., identification of siltation problems). If not already present, mark an easily identified reference point for water level measurements that will become the measuring point for all water level measurements. This location and elevation must be surveyed.

The presence of light, non-aqueous phase liquids (LNAPLs) and/or dense, non-aqueous phase liquids (DNAPLs) in a well requires measurement of the elevation of the top and the bottom of the product, generally using an interface probe. Water levels in such wells must then be corrected for density effects to accurately determine the elevation of the water table.

At each location, measure water levels several times in quick succession to ensure that the well has equilibrated to atmospheric conditions prior to recording the measurement.

8.2.4 Detection of Immiscible Phase Layers

- Complete the following steps for detecting the presence of LNAPL and DNAPL before the well is purged for conventional sampling. These procedures may not be required for all wells. Consult the FSP prior to field deployment to determine if assessing the presence of LNAPL and/or DNAPL is necessary.
- Sample the headspace in the wellhead immediately after the well is opened for organic vapors using either a photoionization detector (PID) or an organic vapor analyzer and record the measurements.
- Lower an interface probe into the well to determine the existence of any immiscible layer(s), LNAPL and/or DNAPL, and record the measurements.
- Confirm the presence or absence of an immiscible phase by slowly lowering a clear bailer to the appropriate depth, then visually observing the results after sample recovery.
- In rare instances, such as when very viscous product is present, it may be necessary to utilize hydrocarbon- and water-sensitive pastes for measurement of LNAPL thickness. This is accomplished by smearing adjacent, thin layers of both hydrocarbon- and water-sensitive pastes along a steel measuring tape and inserting the tape into the well. An engineering tape showing tenths and hundredths of feet is required. Record depth to water, as shown by the mark on the water-sensitive paste, and depth to product, as shown by the mark on the product-sensitive paste. In wells where the approximate depth to water and product thickness are not known, it is best to apply both pastes to the tape over a fairly long interval (5 feet or more). Under these conditions, measurements are obtained by trial and error and may require several insertions and retrievals of the tape before the paste-covered interval of the tape encounters product and water. In wells where approximate depths of air-product and product-water interfaces are known, pastes may be applied over shorter intervals. Water depth measurements should not be used in preparation of water table contour maps until they are corrected for depression by the product.
- If the well contains an immiscible phase, it may be desirable to sample this phase separately. Section 8.2.6 presents immiscible phase sampling procedures. It may not be meaningful to conduct water sample analysis of water obtained from a well containing LNAPLs or DNAPLs (consult the **Project Manager)**.

8.2.5 Purging Equipment and Use

8.2.5.1 General Requirements

The water present in a well prior to sampling may not be representative of in situ groundwater quality and shall be removed prior to sampling. Handle all groundwater removed during sampling in accordance with the investigation-derived waste handling procedures in the FSP. Purging shall be accomplished by methods as indicated in the FSP or by those required by state requirements.

The purge rate should be low enough that substantial drawdown in the well does not occur during purging. In addition, a low purge rate will reduce the possibility of stripping volatile organic compounds (VOCs) from the water and will reduce the likelihood of increasing the turbidity of the sample due to mobilizing colloids in the subsurface that are immobile under natural flow conditions.

The field sampler shall ensure that purging does not cause formation water to cascade down the sides of the well screen. Wells should not be purged to dryness if recharge causes the formation water to cascade down the sides of the screen, as this will cause an accelerated loss of volatiles. This problem should be anticipated based on the results of either the well development task or historical sampling events. In general, place the intake of the purge pump in the middle of the saturated screened interval within the well to allow purging, and at the same time minimize disturbance/overdevelopment of the screened interval in the well. Water shall be purged from the well at a rate that does not cause recharge water to be excessively agitated unless an extremely slow recharging well is encountered where complete evacuation is unavoidable. During the well purging procedure, collect water level and/or product level measurements to assess the hydraulic effects of purging and increase or decrease purge rate as needed. If the well is purged dry, allow the well to recover sufficiently to provide enough water for the specified analytical parameters, and then sample it.

The groundwater pump will be connected in-line to a water quality meter. Every five minutes during purging, record the temperature, pH, specific conductivity, DO, ORP, and turbidity on the groundwater sample form. Purging shall be considered complete once three consecutive parameters have stabilized to the parameter-specific requirements detailed on the groundwater sample form (Attachment 1). Once these stability metrics have been met, sample the well.

8.2.5.2 Purging Equipment and Methods

Submersible Pump

A stainless-steel submersible pump may be utilized for purging both shallow and deep wells prior to sampling the groundwater for semivolatile and non-volatile constituents but ***is*** generally not preferred for VOCs unless there are no other options (e.g., well over 200 feet deep). For wells over 200 feet deep, the submersible pump is one of the few technologies available to feasibly accomplish purging under any yield conditions. For shallow wells with low yields, submersible pumps are generally inappropriate due to overpumpage of the wells (<1 gallon per minute), which causes increased aeration of the water within the well.

Steam clean or otherwise decontaminate the pump and discharge tubing prior to placing the pump in the well. The submersible pump shall be equipped with an anti-backflow check valve to limit the amount of water that will flow back down the drop pipe into the well. Place the pump in the middle of the saturated screened interval within the well and maintain it in that position during purging.

Bladder Pump

A stainless-steel bladder pump can be utilized for purging and sampling wells up to 200 feet in depth for volatile, semivolatile, and non-volatile constituents. Use of the bladder pump is most effective in low to moderate yield wells and ***is*** often the preferred method for low-flow sampling. When sampling for VOCs and/or semi-volatile organic compounds (SVOCs) and PFAS, polyethylene bladders and PFAS-free O-rings and pump accessories should be used.

Either compressed dry nitrogen or compressed dry air, depending upon availability, can operate the bladder pump. The driving gas utilized must be dry to avoid damage to the bladder pump control box. Decontaminate the bladder pump prior to use.

Centrifugal, Peristaltic, or Diaphragm Pump

A centrifugal, peristaltic, or diaphragm pump may be utilized to purge a well if the water level is relatively shallow. New or dedicated HDPE tubing is inserted into the midpoint of the saturated screened interval of the well. Water should be purged at a rate that satisfies low-flow requirements (i.e., does not cause drawdown). Centrifugal, peristaltic, and diaphragm pumps are generally discouraged for VOC sampling; however, follow methods allowed per the project-specific FSP or state requirements.

Air Lift Pump

Airlift pumps are not appropriate for purging or sampling.

Bailer

Avoid using a bailer to purge a well because it can result in overdevelopment of the well and create excessive purge rates. If a bailer must be used, the bailer should either be dedicated or disposable. An HDPE bailer with polypropylene string mounted on a reel is recommended for lowering the bailer in and out of the well.

Lower the bailer below the water level of the well with as little disturbance of the water as possible to minimize aeration of the water in the well. One way to gauge the depth of water on the reel is to mark the depth to water on the bailer wire with a stainless-steel clip. In this manner, less time is spent trying to identify the water level in the well.

8.2.6 Monitoring Well Sampling Methodologies

8.2.6.1 Sampling Light, Non-Aqueous Phase Liquids (LNAPL)

Collect LNAPL, if present, prior to any purging activities. The sampling device shall generally consist of a dedicated or disposable bailer equipped with a bottom-discharging device. Lower the bailer slowly until contact is made with the surface of the LNAPL and to a depth less than that of the immiscible fluid/water interface depth as determined by measurement with the interface probe. Allow the bailer to fill with LNAPL and retrieve it.

When sampling LNAPLs, never drop bailers into a well and always remove them from the well in a manner that causes as little agitation of the sample as possible. For example, the bailer should not be removed in a jerky fashion or be allowed to continually bang against the well casing as it is raised. Teflon bailers should always be used when sampling LNAPL. The cable used to raise and lower the bailer shall be composed of an inert material (e.g., stainless steel) or coated with an inert material (e.g., Teflon).

8.2.6.2 Sampling Dense, Non-Aqueous Phase Liquids (DNAPL)

Collect DNAPL prior to any purging activities. The best method for collecting DNAPL is to use a double-check valve, stainless steel bailer, or a Kemmerer (discrete interval) sampler. The sample shall be collected by slow, controlled lowering of the bailer to the bottom of the well, activation of the closing device, and retrieval.

8.2.6.3 Groundwater Sampling Methodology

The well shall be sampled when groundwater within it is representative of aquifer conditions, per the methods described in Section 8.2.5. Prior to sampling, the flow-through cell shall be removed and the samples collected directly from the purge tubing. Flow rates shall not be adjusted once aquifer conditions are met. Additionally, a period of no more than 2 hours shall elapse between purging and sampling to prevent groundwater interaction with the casing and atmosphere. This may not be possible with a slowly recharging well. Measure and record the water level prior to sampling in order to monitor drawdown when using low-flow techniques and gauge well volumes removed and recharged when using non-low-flow techniques.

Only use lab-provided, analyte-specific sample containers. When sampling for VOCs, sample containers are to be filled such that a positive meniscus forms on the top of the container with no overflow. No headspace may be present, which can be confirmed by tightly sealing the container and flipping it over. If a visible air bubble is present, add a small amount of the groundwater to the cap of the container and pour it gently onto the meniscus.

All samples are to be quickly placed into a cooler with ice. If samples are to be kept over several days, ice must be replenished as it melts, typically once a day.

Sampling equipment (e.g., especially bailers) shall never be dropped into the well, as this could cause aeration of the water upon impact. Additionally, the sampling methodology utilized shall allow for the collection of a groundwater sample in as undisturbed a condition as possible, minimizing the potential for volatilization or aeration. This includes minimizing agitation and aeration during transfer to sample containers, minimizing exposure to sunlight, and immediately placing the sample on ice once collected.

Sampling equipment shall be constructed of inert material. Equipment with neoprene fittings, polyvinyl chloride (PVC) bailers, Tygon® tubing, silicon rubber bladders, neoprene impellers, polyethylene, and Viton® are not acceptable when sampling for organics and PFAS. If bailers are used, an inert cable/chain (e.g., polypropylene string or stainless-steel wire or cable) shall be used to raise and lower the bailer. Dedicated equipment is highly recommended for all sampling programs.

Submersible Pump

The submersible pump must be specifically designed for groundwater sampling (i.e., pump composed of stainless steel and HDPE, sample discharge lines composed of HDPE) and must have a controller mechanism allowing the required low-flow rate. Adjust the pump rate so that flow is continuous and does not pulsate to avoid aeration and agitation within the sample discharge lines. Run the pump for several minutes at the low-flow rate used for sampling to ensure that the groundwater in the lines was obtained at the low-flow rate.

Bladder Pump

A gas-operated stainless steel bladder pump with adjustable flow control and equipped with a polyethylene bladder and HDPE tubing can be effectively utilized to collect a groundwater sample and is considered to be the best overall device for sampling inorganic and organic constituents. If only inorganics are being sampled, polyvinyl bladders and tubing may be used. Operate positive gas displacement bladder pumps in a continuous manner so that they minimize discharge pulsation that can aerate samples in the return tube or upon discharge.

When using a compressor, take several precautions. If the compressor is being powered by a gasoline generator, position the generator downwind of the well. Ground fault circuit interrupters (GFCIs) should always be used when using electric powered equipment. Do not connect the compression hose from the compressor to the pump controller until after the engine has been started.

When all precautions are completed and the compressor has been started, connect the compression hose to the pump controller. Slowly adjust the control knobs to discharge water in the shortest amount of time while maintaining a near constant flow. This does not mean that the compressor must be set to discharge the water as hard as possible. The optimal setting is one that produces the largest volume of purge water per minute (not per purge cycle) while maintaining a near constant flow rate.

Prior to sampling, adjust the flow rate (purge rate) to yield 100 to 300 milliliters (mL) per minute. Avoid settings that produce pulsating streams of water instead of a steady stream if possible. Operate the pump at this low-flow rate for several minutes to ensure that drawdown is not occurring. At no time shall the sample flow rate exceed the flow rate used while purging.

For those samples requiring filtration, it is recommended to use an in-line high-capacity filter after all non-filtered samples have been collected.

Peristaltic Pump

A peristaltic pump is a type of positive displacement pump that moves water via the process of peristalsis. The pump uses a flexible hose fitted inside a circular pump casing. A rotor with cams compresses the flexible tube as the rotor turns, which forces the water to be pumped to move through the tube. In peristaltic pumps, no moving parts of the pump are in contact with the water being pumped. Displacement is determined by tube size, so delivery rate can only be changed during operation by varying pump speed. Peristaltic pumps are simple and quite inexpensive for the flow rates they provide.

There are several methods available for transferring the sample into the laboratory containers. The selected method may vary based on state requirements and should be documented in the FSP. Samples typically can be collected directly from the discharge end of the HDPE tubing, after it has been disconnected from the flow through cell. For volatile analyses, the sampler should make sure that the pump is set such that a smooth laminar flow is achieved. In all cases, the project team should consult their local regulatory requirements and document the selected sample collection procedure in the project-specific Quality Assurance Project Plan (QAPP).

Bailer

A single- or double-check valve HDPE or stainless steel bailer equipped with a bottom discharging device can be utilized to collect groundwater samples. Bailers have a number of disadvantages, however, including a tendency to alter the chemistry of groundwater samples due to degassing, volatilization, and aeration; the possibility of creating high groundwater entrance velocities; differences in operator techniques resulting in variable samples; and difficulty in determining where in the water column the sample was collected. Therefore, use bailers for groundwater sampling only when other types of sampling devices cannot be utilized for technical, regulatory, or logistical reasons.

Dedicated or disposable bailers should always be used in order to eliminate the need for decontamination and to limit the potential of cross-contamination. Each time the bailer is lowered to the water table, lower it in such a way as to minimize disturbance and aeration of the water column within the well.

8.2.7 Sample Handling and Preservation

Many of the chemical constituents and physiochemical parameters to be measured or evaluated during groundwater monitoring programs are chemically unstable and require preservation. The U.S. Environmental Protection Agency (EPA) document entitled *Test Methods for Evaluating Solid Waste – Physical/Chemical Methods (SW-846)* (EPA 1997) includes a discussion of appropriate sample preservation procedures. In addition, SW-846 provides guidance on the types of sample containers to use for each constituent or common set of parameters. In general, check with specific laboratory or state requirements prior to obtaining field samples. In many cases, the laboratory will supply the necessary sample bottles and required preservatives. In some cases, **Field Sampling Personnel** may add preservatives in the field.

Improper sample handling may alter the analytical results of the sample. Therefore, transfer samples in the field from the sampling equipment directly into the container that has been prepared specifically for that analysis or set of compatible parameters as described in the project-specific FSP. It is not an acceptable practice for samples to be composited in a common container in the field and then split in the laboratory or poured first into a wide-mouth container and then transferred into smaller containers.

Collect groundwater samples and place them in their proper containers in the order of decreasing volatility and increasing stability. A preferred collection order for some common groundwater parameters is:

1. VOCs and total organic halogens (TOX)
2. Dissolved gases, total organic carbon (TOC), total fuel hydrocarbons
3. Semivolatile organics, pesticides
4. Total metals, general minerals (unfiltered)
5. Dissolved metals, general minerals (filtered)
6. Phenols
7. Cyanide
8. Sulfate and chloride
9. Nitrate and ammonia
10. Radionuclides

When sampling for VOCs, collect water samples in vials or containers specifically designed to prevent loss of VOCs from the sample. The analytical laboratory performing the analysis shall provide these vials. Collect groundwater from the sampling device in vials by allowing the groundwater to slowly flow along the sides of the vial. Sampling equipment shall not touch the interior of the vial. Fill the vial above the top of the vial to form a positive meniscus with no overflow. No headspace shall be present in the sample container once the container has been capped. This can be checked by inverting the bottle once the sample is collected and tapping the side of the vial to dislodge air bubbles. Sometimes it is not possible to collect a sample without air bubbles, particularly water that has high concentrations of dissolved gases. In these cases, the **Field Sampling Personnel** shall document the occurrence in the field logbook and/or sampling worksheet at the time the sample was collected. Likewise, the analytical laboratory shall note in the laboratory analysis reports any headspace in the sample container(s) at the time of receipt by the laboratory.

8.2.7.1 Special Handling Considerations

In general, samples for organic analyses should not be filtered. However, high turbidity samples for polychlorinated biphenyl (PCB) analysis may require filtering. Consult the project-specific QAPP for details on filtering requirements. Samples shall not be transferred from one container to another because this could cause aeration or a loss of organic material onto the walls of the container. TOX and TOC samples should be handled in the same manner as VOC samples.

When collecting total and dissolved metals samples, the samples should be collected sequentially. The total metals sample is collected from the pump unfiltered. The dissolved metals sample is collected after filtering with a 0.45-micron membrane in-line filter. Allow at least 500 mL of effluent to flow through the filter prior to sampling to ensure that the filter is thoroughly wetted and seated in the filter capsule. If required by the project-specific QAPP, include a filter blank for each lot of filters used and always record the lot number of the filters.

Because there is some evidence that PFOS may sorb onto glass fiber filters, it is preferred not to filter samples for PFAS analysis in the field or laboratory. Field filtration is generally prohibited unless specifically requested by a client. If filtering is required by client's and regulatory agency's request, it is recommended that the following be considered and discussed with the client and regulatory agency:

- Evaluate if filtered results are meaningful, and, therefore, if filtering in the field or laboratory is required;
- Consider use of low-flow sampling in the field to reduce the need for sample filtering;
- Consider use of a centrifuge in the laboratory to reduce the need for sample filtering; and
- If filtering is required, determine the nature of the filters used and do not use glass fiber filters.

8.2.7.2 Field Sampling Preservation

Preserve samples immediately upon collection. Ideally, sampling containers will be pre-preserved with a known concentration and volume of preservative. Certain matrices that have alkaline pH (greater than 7) may require more preservative than is typically required. An early assessment of preservation techniques, such as the use of pH strips after initial preservation, may therefore be appropriate. Guidance for the preservation of environmental samples can be found in the U.S. EPA *Handbook for Sampling and Sample Preservation of Water and Wastewater* (EPA 1982). Additional guidance can be found in other U.S. EPA documents (EPA 1992, 1996).

8.2.7.3 Field Sampling Log

A groundwater sampling log provided as Attachment 1 shall document the following:

- Identification of well
- Well depth
- Static water level depth and measurement technique
- Presence of immiscible layers and detection method
- Well yield
- Purge volume and pumping rate

- Time that the well was purged
- Sample identification numbers
- Well evacuation procedure/equipment
- Sample withdrawal procedure/equipment
- Date and time of collection
- Types of sample containers used
- Preservative(s) used
- Parameters requested for analysis
- Field analysis data
- Field observations on sampling event
- Name of sampler
- Weather conditions

9.0 Quality Control and Assurance

9.1 **Field Personnel** will follow specific quality assurance (QA) guidelines as outlined in the project-specific FSP. The goal of the QA program should be to ensure precision, accuracy, representativeness, completeness, and comparability in the project sampling program.

9.2 Quality control (QC) requirements for sample collection are dependent on project-specific sampling objectives. The project-specific FSP will provide requirements for sample preservation and holding times, container types, and sample packaging and shipment, as well as requirements for the collection of various QC samples such as trip blanks, field blanks, equipment rinse blanks, and field duplicate samples.

10.0 Data and Records Management

10.1 Records will be maintained in accordance with SOP 3-03, *Recordkeeping, Sample Labelling, and Chain-of-Custody*. Various forms are required to ensure that adequate documentation is made of the sample collection activities. These forms may include:

- Sample Collection Records;
- Non-water repellent field logbook;
- COC forms; and
- Shipping labels.

10.2 Sample collection records (Attachment 1) will provide descriptive information for the purging process and the samples collected at each monitoring well.

10.3 The field logbook is kept as a general log of activities and should not be used in place of the sample collection record.

10.4 COC forms are transmitted with the samples to the laboratory for sample tracking purposes.

11.0 Attachments or References

Attachment 1 – Groundwater Sampling Collection Record

ASTM Standard D5088. 2008. *Standard Practice for Decontamination of Field Equipment Used at Waste Sites.* ASTM International, West Conshohocken, PA. 2008. DOI: 10.1520/D5088-02R08. www.astm.org.

EPA (Environmental Protection Agency, United States). 1982. *Handbook for Sampling and Sample Preservation of Water and Wastewater.* EPA-600/4-82-029. Cincinnati: EPA Office of Research and Development, Environmental Monitoring and Support Laboratory.

EPA. 1992. *RCRA Groundwater Monitoring Draft Technical Guidance*. EPA/530/R-93/001. Office of Solid Waste. November.

EPA. 1996. *Ground Water Issue: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. EPA/540/S-95/504. Office of Solid Waste and Emergency Response. April.

EPA. 1997. *Test Methods for Evaluating Solid Waste, Physical/Chemical Method (SW-846)*. 3rd ed., Final Update IIIA. Office of Solid Waste. Online updates at: http://www.epa.gov/epaoswer/hazwaste/test/new-meth.htm.

SOP 3-03, *Recordkeeping, Sample Labelling, and Chain-of-Custody*.

Author	**Reviewer**	**Revisions (Technical or Editorial)**
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)
Ken O'Donnell, PG Geologist	Claire Mitchell, PE, PMP Senior Engineer	Rev 1 – PFAS sampling update (July 2019)
Rose Kelley, Environmental Scientist	Richard Purdy, Project Scientist	Rev 2 – Update & Review (June 2022)
Alex McLean, Geologist	Jennifer Ray, Environmental Engineering	Rev 3 – Update & Review (February 2025)

Attachment 1
Groundwater Sample Collection Record

Well ID:

Groundwater Sample Collection Record

Client: ______ Date: ______ Time: Start ______ am/pm
Project No: ______ Finish ______ am/pm
Site Location: ______
Weather Conds: ______ Collector(s): ______

1. WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length ______ **c.** Length of Water Column ______ (a-b)
b. Water Table Depth ______ **d.** Calculated Well Volume (see back) ______

Casing Diameter/Material ______

2. WELL PURGEABLE DATA

a. Purge Method: ______

b. Acceptance Criteria defined (see SAP or Work Plan)
- Minimum Required Purge Volume (@______ well volumes) ______
- Maximum Allowable Turbidity ______ NTUs
- Stabilization of parameters ______ %

c. Field Testing Equipment used:

	Make	Model	Serial Number

Time (min)	Volume Removed (gal)	Temp. (°C)	pH s.u.	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (m)	Color/Odor/etc.

(continued on back)

d. Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A - Explain below.

______

3. SAMPLE COLLECTION: Method: ______

Sample ID	Container Type	No. of Containers	Preservation	Analysis Req.	Time

Comments ______

______

______

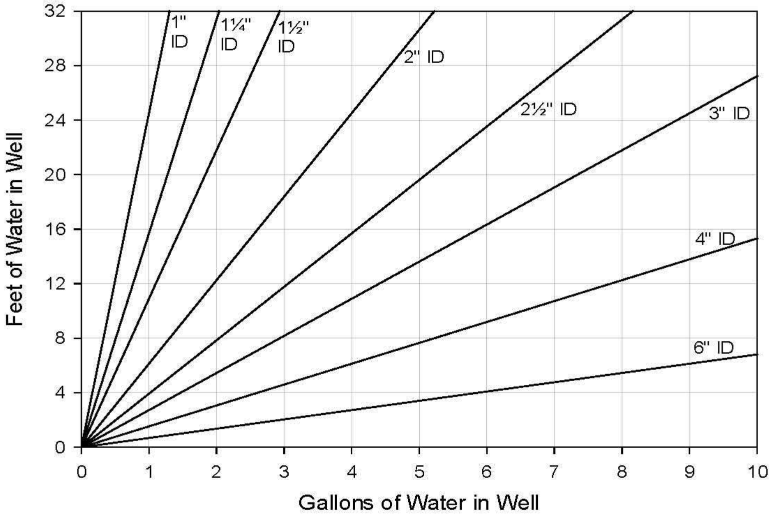
______

Signature ______ Date ______

Page 1 of 2

Purge Volume Computation

Well ID:



Volume / Linear Ft. of Pipe		
ID (in)	**Gallon**	**Liter**
¼	0.0025	0.0097
3/8	0.0057	0.0217
½	0.0102	0.0386
¾	0.0229	0.0869
1	0.0408	0.1544
1¼	0.0637	0.2413
1½	0.0918	0.3475
2	0.1632	0.6178
2½	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(continued from front)

Time (min)	Volume Removed (gal)	Temp. (°C)	pH s.u.	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (m)	Color/Odor/etc.

Signature____ Date ________________

AECOM
1111 3rd Avenue, Suite 16000
Seattle, Washington 98101
USA

T: 206.438.2700
aecom.com