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Memorandum

To: Sunny Becker, Washington State Department of Ecology

Copies: Scott Adamek and Ryan Roberts, City of Bothell

From: Kristin Anderson, Lynn Grochala, and Danielle Gallaher, Floyd|Snider

Date: June 13, 2024

Project No: City of Bothell-OnCall, Riverside HVOC Site

Re: Pre-Remedial Design Investigation Work Plan

This Pre-Remedial Design Investigation (PDI) Work Plan (PDI Work Plan) has been prepared on behalf of the City of Bothell (City) for the Riverside Halogenated Volatile Organic Compound (HVOC) Site (Site) located at NE 108th Street and Woodinville Drive in Bothell, Washington. See Figure 1 for a site map, showing the Site boundaries. This PDI Work Plan presents proposed additional sample collection to inform the design of the cleanup action for the Site. The results of the pre-design investigation described herein will be presented in a PDI Data Summary Report and incorporated in the Engineering Design Report (EDR) for a cleanup action at the Site.

1.0 SITE BACKGROUND AND CURRENT CONDITIONS

The Site is located on the eastern portion of King County Assessor's parcel 082605-9120, which is currently owned by the City. The Site is located in the easternmost portion of the City's Park at Bothell Landing administered by the Parks and Recreation Department and is currently utilized as a public, unpaved parking lot. The Site is bounded to the north by State Route (SR) 522 and to the south by the Sammamish River (refer to Figure 1).

The Site is defined by the extents of soil and groundwater contamination likely resulting from releases of tetrachloroethene (PCE) to the ground at a former machine shop that operated in the northeast portion of the current parking area from 1944 until 1973.

An interim action for the Site was approved by the Washington State Department of Ecology (Ecology) to temporarily address HVOC groundwater discharge to the Sammamish River using groundwater extraction. In 2013, the groundwater extraction system was installed by HWA Geosciences (HWA), consisting of four extraction wells (EW-1 through EW-4) that discharge to the sanitary sewer under a King County Industrial Waste discharge permit. In 2016, HWA installed two more extraction wells (EW-5 and EW-6) in closer proximity to the river. This system is still in operation. Kane Environmental, Inc. (Kane) replaced pumps in EW-1, EW-3, EW-4, and EW-6 in late 2023, and when Floyd|Snider took over management of the remediation system in early

2024, additional modifications and repairs were found to be needed due to a variety of pump and electrical issues. The remediation system is now operating with EW-2, EW-3, and EW-6 running. These extraction wells are located in the most highly contaminated area of the groundwater plume at the Site. EW-1 and EW-4 are not currently pumping and the pump installed in EW-5 has been stuck in the well casing and non-functional for several years. The layout of the groundwater extraction system is shown on Figure 1.

Following implementation of the interim action, further sampling was conducted at the Site by Kane to delineate soil and groundwater contamination and model potential contaminant migration. A Supplemental Remedial Investigation/Feasibility Study was completed for the Site in 2022 (Kane 2022) and a Cleanup Action Plan (CAP) was issued by Ecology in March 2023 as Exhibit B of the Agreed Order (AO) No. DE 21531 (Ecology 2023). The CAP defines the extent of HVOC contamination, contaminants of concern (COCs) and cleanup levels (CULs) for the Site. The COCs in soil and groundwater are PCE, trichloroethene, *cis*-1,2-dichloroethene, and vinyl chloride. Due to the proximity of the HVOC-contaminated groundwater to the Sammamish River, CULs were selected to be protective of surface water. The selected cleanup alternative summarized in the CAP is a combination of soil vapor extraction (SVE) in the presumed PCE source area near the former machine shop and site-wide groundwater treatment by bio-recirculation with an organic carbon amendment to promote anaerobic biodegradation of HVOCs.

As required by the AO, a draft PDI Work Plan to support engineering design for the cleanup action was submitted to Ecology by Kane in May 2023.

2.0 PURPOSE

This PDI Work Plan presents a revised scope for investigation to support design and implementation of cleanup at the Site. It provides details for additional proposed soil and groundwater data collection that will inform the design of the cleanup action. The following additional data collection objectives have been identified and will be detailed in this PDI Work Plan:

Hydrogeologic study: More hydrogeologic data are needed to inform the suitability of the conceptual bio-recirculation system design (or other variations of groundwater pump and treat systems) and any necessary adjustments to support engineering design, as well as to inform injection parameters such as rates and quantities of treatment materials.

HVOC distribution and geochemistry in groundwater: More recent data are needed to confirm the current horizontal extents of the HVOC plume, and additional data are needed to assess the vertical distribution and flux of HVOCs in groundwater, and geochemical parameters that will inform the efficient formulation and delivery of treatment materials.

HVOC distribution in soil: Additional data are needed to inform the likely mass of HVOCs in the vadose zone that would be targeted by SVE and to more precisely delineate the extent of HVOCs in the presumed source area to inform the design of soil treatment in the saturated zone.

Detailed discussion of the scope of the investigation and a proposed sampling and analysis plan is provided in the following sections. The additional data collection proposed in this PDI Work Plan will be conducted in accordance with Floyd|Snider's field sampling Standard Guidelines presented in Attachment 1 and the Quality Assurance Project Plan (QAPP) presented in Attachment 2. The QAPP provides details about the organization, objectives, and quality assurance (QA) and quality control procedures for field and laboratory activities developed for the Site, and provides details for sample nomenclature, handling, and preservation. All Site work will additionally follow the procedures outlined in the site-specific Health and Safety Plan (refer to Attachment 3) and Inadvertent Discovery Plan (refer to Attachment 4). A summary of existing HVOC data in Site groundwater and soil is presented in Tables 1 and 2, respectively.

3.0 PROPOSED PRE-DESIGN INVESTIGATION

Additional field investigations will be performed to support design of the cleanup action, including a focused hydrogeologic study, and additional groundwater and soil data collection and analyses.

3.1 Hydrogeologic Study Plan

The current conceptual design of the bio-recirculation system presented in the CAP includes a network of upgradient injection wells and downgradient extraction wells with an estimated radius of influence based on previous slug testing and pump testing data. However, the impacts of the current extraction system on groundwater flow patterns and gradients are not well defined and the impacts of recirculation of groundwater on horizontal and vertical gradients and plume stability have not been assessed. Current groundwater HVOC conditions for PCE and vinyl chloride, which demonstrate the distribution of the initial release and its breakdown products, as well as approximate groundwater flow direction, are shown on Figure 2. The proposed hydrogeologic study locations are shown on Figure 3 and the hydrogeologic study plan is presented in Table 3. For the purposes of this study, and as stated above, three of the six extraction wells will be running, including two upgradient and one downgradient. To better understand the flow of groundwater and impact of the extraction wells on horizontal gradients, groundwater elevations will be evaluated under a variety of pumping and static conditions, including the following:

- With all extraction wells pumping (EW-2, EW-3, and EW-6)
- With only upgradient extraction wells (EW-2 and EW-3) pumping
- Under baseline conditions (no pumping)

The scope of the hydrogeologic study will include collection of synoptic water levels at all monitoring well locations during three mobilizations. A monitoring well survey will also be performed concurrently with the initial mobilization.

To monitor the total flow being discharged to the sanitary sewer, all extraction wells are first routed through a shed (referred to herein as the remediation system shed) in which samples can be collected from each well and from a combined outlet prior to discharge. Run-dry controls dictate when each extraction well is pumping and automatically shut off to allow the well to recharge when the water level begins to draw down below the level of the pump inlet. The pumps may be manually shut off from the remediation system shed, when needed, for a brief period to allow for sufficient recharge prior to sampling described below.

HVOC samples from extraction wells EW-5 and EW-6 will first be collected via low-flow sampling at the wellhead while the extraction system is running to collect field water quality parameters and samples for HVOC analysis prior to the phased shut-off of the extraction wells. At the same time, HVOC samples will also be collected from downgradient monitoring well RMW-7 and upgradient monitoring well RMW-12. These samples will be used for comparison to natural baseline conditions at the downgradient edge of the plume. After sample collection at the downgradient extraction well, up to five pressure transducers will be placed in key monitoring wells adjacent to extraction wells, as shown on Figure 3. The pressure transducers will be set to log at 0.5-second intervals and allowed to equilibrate prior to beginning the first phased shut-off. The pump in EW-6 nearest to the river will be turned off, and water level recovery will be monitored manually at the extraction well and nearby monitoring wells every 15 minutes for up to 4 hours, or until no further changes are observed. The pressure transducers will be reset to log at 5-minute intervals for a 48-hour equilibration period following the first phase of shut-off.

During the second mobilization, the crew will collect a second round of synoptic water levels after EW-6 has been shut off for a minimum 48-hour equilibration period. Following water level collection, field water quality parameters will be collected from the remaining two extraction wells (EW-2 and EW-3) via low-flow sampling. The transducer logging interval will then be reset and extraction well pumps will be shut off in series with recovery monitored as described above.

After another 48-hour equilibration and transducer monitoring period, as described above, a third round of synoptic water levels will be collected concurrently with another sampling round for HVOCs at EW-5, EW-6, RMW-7, and RMW-12.

The PDI will then be paused to allow HVOC conditions to equilibrate without pumping prior to collecting groundwater data to define the current conditions. The equilibration period is the estimated time for groundwater to migrate from the upgradient extraction wells to the farthest downgradient monitoring well (RMW-7), a distance of approximately 60 feet. The seepage velocity of groundwater was estimated from previous slug testing data collected at the Site, where an average groundwater flow of 2.5 feet/day was established (HWA 2013). The resulting calculated equilibration period is 3 to 4 weeks. After this equilibration time, groundwater monitoring as discussed in the following sections will be conducted to establish current baseline groundwater HVOC and geochemical condition data.

3.2 Groundwater Current Conditions Sampling and Analysis Plan

The most recent comprehensive groundwater sampling event was completed in 2020 and may not be representative of current conditions after continued groundwater extraction between 2020 and 2024. HVOCs exceeding the CULs also need to be more precisely delineated in the down- and cross-gradient directions to support groundwater treatment design. Additionally, many of the existing monitoring points (including monitoring and extraction wells) are constructed with 15- or 20-foot screens that create uncertainty regarding the in situ depth where HVOC concentrations are most elevated in groundwater. Finally, geochemical data are needed to determine whether current conditions are favorable for anaerobic biodegradation of HVOCs and to inform the design of groundwater treatment materials to promote biodegradation.

Groundwater samples will be collected to document current HVOC concentrations and to further refine the lateral extent of HVOCs in groundwater exceeding CULs. These samples will be collected from existing monitoring wells, passive flux meters (PFMs), and temporary borings. The investigation plan, with a summary of available HVOC data in groundwater, is visually represented on Figure 3 and summarized in Table 3.

3.2.1 Monitoring Well Sampling

Groundwater samples will be collected for HVOC analysis at all 16 existing Site monitoring and extraction wells using the low-flow methodology in accordance with the Standard Guideline procedures presented in Appendix A. In addition, groundwater samples from a subset of seven key locations (refer to Figure 3) throughout the HVOC plume and one off-site upgradient well will be analyzed for the following monitored natural attenuation parameters:

- Total and dissolved calcium, iron, and manganese
- Total organic carbon
- Nitrate and nitrite
- Sulfate
- Sulfide
- Dissolved gases (ethene, ethane, and methane)
- Alkalinity
- Ferrous Iron

In addition, the following parameters will be measured in the field using a water quality meter and documented prior to sample collection:

- Temperature
- Total dissolved solids

- pH
- Oxidation–reduction potential
- Dissolved oxygen
- Conductivity
- Turbidity

Groundwater samples will be submitted to OnSite Environmental, Inc., an accredited laboratory, and laboratory analysis will be performed in accordance with the methods presented in the QAPP (refer to Attachment 2).

3.2.2 Passive Flux Meter Installation, Retrieval, and Sample Analyses

PFMs are devices installed in monitoring wells to measure the vertical profile of contaminant flux through the groundwater table. PFMs are constructed from a long outer mesh liner filled with a mixture of sorbent and tracer material that are placed into monitoring wells and later retrieved for analysis after a set amount of time. The chosen sorbent material in the PFM, typically activated carbon for measurement of HVOCs, adsorbs to the passing contaminants in groundwater while the tracer chemicals are leached away at a steady rate based on the groundwater flow. After the PFM is retrieved and tested for the cumulative concentration of HVOCs adsorbed and the concentration of tracer chemical remaining, the time-averaged flux of HVOCs through the vertical profile of the groundwater table can be calculated.

PFMs will be installed in monitoring wells RMW-12 and RMW-7, as shown on Figure 3 and summarized in Table 3, immediately following low-flow sampling. These wells were selected based on their locations within the known HVOC plume extents, including near the presumed PCE source area and near the toe of the plume where elevated vinyl chloride is present. The selected wells are constructed with 10-foot screened intervals (15 to 25 feet below ground surface [bgs]), and the screens are generally situated below the groundwater table; therefore, two 5-foot PFM sections will be installed per location to sample the full groundwater vertical profile. PFMs will be left in these wells for approximately 2 weeks, then retrieved for collection and analyses of sorbent media samples. The extraction system will be turned on during PFM deployment to capture the greatest possible HVOC fluxes through transmissive zones. Samples of the PFM media will be collected from 2-foot intervals within saturated screen interval and analyzed for HVOCs and Darcy flux (used to determine groundwater flow velocity). Procedures for installing, retrieving, and sampling the PFMs are included in the manufacturer's PFM Protocol Manual, provided in Attachment 5. PFM samples will be analyzed by EnviroFlux, Inc.

3.2.3 Reconnaissance Sampling

Groundwater samples will be collected from temporary soil borings using retractable direct-push or temporary polyvinyl chloride screens, following the installation and sampling procedures presented in the Standard Guidelines (refer to Attachment 1). Angled borings may be

implemented to collect samples in locations with limited access. Up to eight direct push borings will be advanced for collection of groundwater reconnaissance samples to delineate the current extent of the HVOC plume exceeding CULs, as shown on Figure 3 and summarized in Table 4, including the following:

- Two borings to determine current groundwater HVOC conditions in the upgradient direction to the north (GWB-1, GWB-2), where groundwater reconnaissance sampling last completed in 2009 found moderately elevated HVOCs within the current SR-522 right of way, with samples for HVOC analysis collected from the 15- to 25-foot interval.
- Four borings at the presumed downgradient edge of the plume to inform the extent of potential groundwater treatment (GWB-3 through GWB-6), with samples for HVOC analysis collected from the 15- to 20-, 20- to 25-, and 25- to 30-foot intervals.
- One boring to vertically delineate HVOCs within the plume downgradient of the source area (GWB-7), with samples collected from the 35- to 40- and 40- to 45-foot intervals.
- Up to three additional contingency borings to delineate cross-gradient HVOCs to the west and east (GWB-8, GWB-9, and GWB-10) if deemed necessary after a review of the updated baseline groundwater sample results. At these cross-gradient locations, a groundwater sample would be collected from the same interval as the closest adjacent monitoring well screen.

A summary of sample locations, sample depths, and analysis plans is presented in Table 4. Laboratory analysis will be performed in accordance with the methods presented in the QAPP (refer to Attachment 2).

3.3 Supplemental Soil Sampling and Analysis Plan

The conceptual design of the SVE system presented in the CAP includes treatment of vadose zone soil in the presumed source area to the depth of the water table, which is encountered at approximately 8 feet bgs on the northern portion of the Site and deepens to approximately 16 feet bgs on the southern portion of the Site. The depth to water table varies by approximately 2 to 5 feet seasonally at individual well locations. There are limited soil data in the target SVE treatment zone, and additional data are needed to determine the potential mass of HVOCs that may be mobilized and recovered by SVE. Additionally, more precise horizontal and vertical delineation of HVOCs in the saturated zone within the source area is needed for design to determine the extent of soil to be targeted by treatment. Soil grain size data are also needed to inform injection rates and quantities of groundwater treatment materials. Soil HVOC conditions and proposed soil investigation are shown on Figure 4, and the proposed soil investigation plan is summarized in Table 5.

Collection of additional HVOC data in soil is proposed to update current conditions and refine current understanding of the lateral and vertical extent of soil with HVOC concentrations

exceeding CULs. The proposed soil quality assessment includes 11 direct-push borings for collection of soil samples to delineate HVOCs, which may act as a continued source of groundwater contamination. The soil borings will be logged and sampled in accordance with the Standard Guidelines presented in Attachment 1. Soil samples will additionally be screened for field indications of potential HVOC contamination including odors, staining, and/or elevated headspace volatile concentrations measured using a photoionization detector (PID). The investigation plan, with a summary of available HVOC data in soil, is visually represented on Figure 4.

- Source Area:
    - Five borings will be advanced to the east, west, and north of the estimated source area extents to horizontally and vertically delineate PCE (SB-1 through SB-5); up to five soil samples will be collected at 3-foot intervals between approximately 13 and 28 feet bgs from these borings, with two samples designated for initial analysis and the remaining samples archived pending results of the initial analysis. Archived samples will be analyzed as needed to delineate HVOC results exceeding CULs during initial analysis.
    - One boring will be advanced in the center of the presumed source area to 40 feet bgs (SB-6). This boring will be sampled at 2-foot intervals between 10 and 40 feet to achieve a detailed vertical profile of soil PCE concentrations and qualitative grain size. Samples will additionally be collected from four representative intervals for laboratory grain size analysis to serve as calibration of qualitative grain size results.
- Downgradient of Source Area:
    - Four borings will be advanced downgradient of the source area between the source area and the previous soil boring at RMW-14, where PCE concentrations exceeding CULs were also detected (SB-7 through SB-10). Up to four samples will be collected from these borings at 3-foot intervals between approximately 16 to 28 feet bgs, with one sample designated for laboratory analysis and the remaining samples archived pending results of the initial analysis. Archived samples will be analyzed as needed to delineate HVOC results exceeding CULs during initial analysis.
    - South of RWM-14, one boring will be advanced (SB-11) and a soil sample collected between 21 and 23 feet bgs for immediate analysis to confirm the downgradient extent of HVOCs.

A summary of sample locations, sample depths, and analysis is presented in Table 5. Although the above presents the anticipated sampling program necessary to delineate the horizontal and vertical extents of HVOC exceedances sufficient for engineering design, field indicators such as odor or elevated volatile measured using a PID will also be used to determine the appropriate sample depths to delineate HVOC contamination. Additional samples may be collected above or

below the intervals described in this summary if needed to delineate field indications of contamination. If strong indications of contamination are observed, indicating that a previously unidentified additional area of HVOC source material may be present, step-out borings may also be advanced at the discretion of the field team. Laboratory analysis will be performed in accordance with the methods presented in the QAPP (refer to Attachment 2).

4.0 SCHEDULE AND REPORTING

The PDI field work will begin immediately upon Ecology approval of this PDI Work Plan, contingent on subcontractor availability. Completion of the scope of the PDI field work, including equilibration periods for hydrogeologic study, groundwater baseline sampling, and PFM deployment, is expected to take approximately 6 to 8 weeks. Laboratory analysis and data QA review will continue after completion of field sampling activities.

Within 30 days of receiving final validated PDI data, a summary of the key findings of the PDI will be presented to Ecology in draft materials such as figures and tables and discussed in a scheduled meeting. A draft PDI Data Report will be prepared for Ecology review within 90 days of approval of the PDI Work Plan in accordance with the schedule of deliverables presented in the AO (refer to Exhibit C of the AO). A final PDI Data Report will be submitted within 30 days of receipt of Ecology's comments on the draft PDI Data Report.

The EDR for the cleanup action will be prepared at the direction of Ecology, following the meeting to review and discuss key findings of the PDI. If Ecology determines that any components of the conceptual cleanup action design require revision that would warrant amendments to the CAP and AO, then those revisions will trigger the preparation of the draft EDR. If significant revisions to the conceptual design are not required, the schedule for the draft and final EDR will be coordinated with Ecology concurrent with the submittal of the draft PDI Data Report.

5.0 REFERENCES

HWA Geosciences Inc. (HWA). 2013. *Interim Action Work Plan, Bothell Riverside Site, Bothell, Washington*. Prepared for City of Bothell. 7 January.

Kane Environmental, Inc. (Kane). 2022. Supplemental Remedial Investigation & Feasibility Study, Riverside HVOC Site, Bothell, Washington. Prepared for City of Bothell. 22 February.

Washington State Department of Ecology (Ecology). 2023. *Agreed Order No. DE 21531*. March.

6.0 LIST OF ATTACHMENTS

Table 1 Summary of Groundwater Data

Table 2 Summary of Soil Data

Table 3 Monitoring Well Sampling Plan

Table 4	Reconnaissance Groundwater Sampling Plan
Table 5	Soil Sampling Plan
Figure 1	Site Map
Figure 2	Groundwater HVOC Conditions
Figure 3	Groundwater Investigation Plan
Figure 4	Soil HVOC Conditions and Investigation Plan
Attachment 1	Floyd|Snider Standard Guidelines
Attachment 2	Quality Assurance Project Plan
Attachment 3	Health and Safety Plan
Attachment 4	Inadvertent Discovery Plan
Attachment 5	Passive Flux Meter Protocol Manual

Tables

Table 1
Summary of Groundwater Data

		Analyte	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
		CAS No.	127-18-4	79-01-6	156-59-2	156-60-5	75-01-4
		CUL [1]	4.9	0.38	16	--	0.02
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L
Sample Name	Sample Date	Depth/ Screen					
BC-3							
BC-3D-092008	9/5/2008	15–25 ft	110	120	46	1.0 U	*1.0 U*
BC-3D-092009	9/15/2009		130	120	49	1.0 U	*1.0 U*
BC-3D-122009	12/16/2009		170	130	48	1.0 U	*1.0 U*
BC-3-052013	5/24/2013		25	11	4.0		*0.20 U*
BC-3-062014	6/24/2014		11	4.0	0.75		*0.20 U*
BC-3D-122014	12/19/2014		7.7	2.1	0.44	0.20 U	*0.20 U*
BC-3D-062015	6/23/2015		3.8	0.90	0.20 U	0.20 U	*0.20 U*
BC-3D-122015	12/8/2015		5.3	1.3	0.29	0.20 U	*0.20 U*
BC-3D-062016	6/29/2016		3.7	0.93	0.20 U	0.20 U	*0.20 U*
BC-3D-122016	12/21/2016		5.9	1.5	0.57	0.20 U	*0.20 U*
BC-3-062017	6/28/2017		6.8	1.9	0.80		*0.20 U*
BC-3-092019	9/27/2019		4.3	1.0	0.34	0.20 U	*0.20 U*
BC-3-022020	2/4/2020		5.2	1.3	0.43	0.20 U	0.020 U
BC-3-052020	5/6/2020		6.7	1.7	0.52	0.20 U	0.020 U
EW-1							
EW-1-042014	4/4/2014	12.5–32.5 ft	17	3.0	1.2		*0.20 U*
EW-1-062014	6/25/2014		27	8.1	6.5		*0.20 U*
EW-1-122014	12/19/2014		21	2.6	0.82	0.20 U	*0.20 U*
EW-1-032015	3/18/2015		2.8	0.27	0.20 U	0.20 U	*0.20 U*
EW-1-062015	6/23/2015		22	2.0	0.95	0.20 U	*0.20 U*
EW-1-092015	9/11/2015		41	2.2	0.79	0.20 U	*0.20 U*
EW-1-032016	3/31/2016		22	2.8	2.5	0.20 U	*0.20 U*
EW-1-062016	6/29/2016		24	4.2	4.5	0.20 U	*0.20 U*
EW-1-092016	9/30/2016		20	2.0	2.3	0.20 U	*0.20 U*
EW-1-012017	1/5/2017		1.1	0.20 U	0.20 U	0.20 U	*0.20 U*
EW-1-042017	4/5/2017		13	1.2	0.85		*0.20 U*
EW-1-062017	6/29/2017		8.9	0.77	0.70		*0.20 U*
EW-1-102017	10/10/2017		15	0.81	0.50		*0.20 U*
EW-2							
EW-2-042014	4/4/2014	15–35 ft	13	2.8	1.5		
EW-2-062014	6/25/2014		28	3.8	1.5		*0.20 U*
EW-2-092014	9/22/2014		66	16	12		*0.40 U*
EW-2-122014	12/19/2014		44	12	12	0.40 U	*0.40 U*
EW-2-032015	3/18/2015		22	6.5	4.3	0.20 U	*0.20 U*
EW-2-062015	6/23/2015		8.6	2.4	1.8	0.20 U	*0.20 U*
EW-2-092015	9/11/2015		6.5	0.62	0.40	0.20 U	*0.20 U*
EW-2-122015	12/8/2015		16	2.6	2.4	0.20 U	*0.20 U*
EW-2-032016	3/31/2016		16	4.0	3.7	0.20 U	*0.20 U*
EW-2-062016	6/29/2016		17	4.1	3.2	0.20 U	*0.20 U*
EW-2-092016	9/30/2016		21	6.2	5.6	0.20 U	*0.20 U*
EW-2-012017	1/5/2017		24	3.6	1.7	0.20 U	*0.20 U*
EW-2-042017	4/5/2017		11	3.2	2.2		*0.20 U*
EW-2-062017	6/29/2017		16	4.8	3.6		*0.20 U*
EW-2-102017	10/10/2017		3.0	0.45	0.23		*0.20 U*
EW-2-092019	9/27/2019		16	4.7	3.2	0.20 U	*0.20 U*
EW-2-022020	2/5/2020		26	7.9	6.2	0.20 U	0.39
EW-3							
EW-3-042014	4/4/2014	14–34 ft	49	14	7.2		0.61
EW-3-062014	6/25/2014		41	14	12		*0.40 U*
EW-3-092014	9/22/2014		190	59	33		1.1
EW-3-122014	12/19/2014		21	6.4	6.0	0.20 U	*0.20 U*
EW-3-032015	3/18/2015		140	46	29	1.0 U	*1.0 U*
EW-3-062015	6/23/2015		87	24	9.0	0.40 U	*0.40 U*
EW-3-092015	9/11/2015		81	28	14	0.40 U	*0.40 U*
EW-3-122015	12/8/2015		33	11	7.8	0.20 U	0.38
EW-3-032016	3/31/2016		72	21	16	0.40 U	0.64
EW-3-062016	6/29/2016		79	24	14	0.40 U	0.43
EW-3-092016	9/30/2016		50	18	10	0.20 U	0.63
EW-3-012017	1/5/2017		95	30	20	0.40 U	0.46
EW-3-042017	4/5/2017		150	57	30		1.3
EW-3-062017	6/29/2017		270	79	59		1.4
EW-3-102017	10/10/2017		69	25	16		0.41
EW-3-052020	5/7/2020		25	23	11	0.20 U	0.023

Table 1
Summary of Groundwater Data

Analyte			Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
CAS No.			127-18-4	79-01-6	156-59-2	156-60-5	75-01-4
CUL [1]			4.9	0.38	16	--	0.02
Unit			µg/L	µg/L	µg/L	µg/L	µg/L
Sample Name	Sample Date	Depth/ Screen					
EW-4							
EW-4-062014	6/25/2014	11–31 ft	1.7	**1.8**	1.1		**0.38**
EW-4-092014	9/22/2014		**45**	**10**	7.4		**0.87**
EW-4-122014	12/19/2014		1.2	**1.6**	1.1	0.20 U	**0.27**
EW-4-032015	3/18/2015		**15**	**4.8**	3.2	0.20 U	*0.20 U*
EW-4-062015	6/23/2015		0.85	**2.8**	1.7	0.20 U	**0.37**
EW-4-092015	9/11/2015		1.8	**2.1**	0.92	0.20 U	**0.28**
EW-4-122015	12/8/2015		0.20 U	**1.6**	2.9	0.20 U	**0.85**
EW-4-032016	3/31/2016		0.20 U	**2.5**	2.0	0.20 U	**0.31**
EW-4-062016	6/29/2016		0.20 U	**1.2**	3.5	0.20 U	**0.61**
EW-4-092016	9/30/2016		0.20 U	**0.88**	4.0	0.20 U	**0.75**
EW-4-012017	1/5/2017		0.33	**3.2**	1.8	0.20 U	**0.29**
EW-4-042017	4/5/2017		0.20	**3.0**	1.7		**0.25**
EW-4-062017	6/29/2017		0.20	**0.90**	2.6		**0.24**
EW-5							
EW-5D-012017	1/5/2017	15–35 ft	**5.0**	**4.0**	9.4	0.20 U	**2.5**
EW-5D-042017	4/5/2017		**6.9**	**5.2**	15		**3.8**
EW-5D-062017	6/29/2017		**8.6**	**3.8**	10		**0.49**
EW-5D-102017	10/10/2017		0.36	**0.94**	8.6		**1.8**
EW-6							
EW-6D-012017	1/5/2017	15–35 ft	2.4	**0.54**	0.20 U	0.20 U	*0.20 U*
EW-6D-042017	4/5/2017		2.1	**0.94**	1.2		*0.20 U*
EW-6D-062017	6/29/2017		0.56	**0.63**	2.0		**0.31**
EW-6D-102017	10/10/2017		**20**	**7.2**	**18**		**0.46**
EW-6D-092019	9/27/2019		4.7	**1.4**	4.2	0.20 U	*0.20 U*
EW-6D-022020	2/5/2020		3.1	**1.0**	4.0	0.20 U	**0.16**
EW-6D-052020	5/7/2020		**12**	**5.3**	7.6	0.20 U	**0.36**
RMW-4							
RMW-4D-122014	12/19/2014	15–25 ft	0.79	0.33	0.20 U	0.20 U	*0.20 U*
RMW-4D-062015	6/23/2015		0.52	**0.72**	0.20 U	0.20 U	*0.20 U*
RMW-4D-122015	12/8/2015		2.2	**0.56**	0.20 U	0.20 U	*0.20 U*
RMW-4D-062016	6/29/2016		3.6	**0.46**	0.20 U	0.20 U	*0.20 U*
RMW-4D-122016	12/21/2016		4.3	**0.51**	0.20 U	0.20 U	*0.20 U*
RMW-4-062017	6/28/2017		3.9	**0.49**	0.20 U		*0.20 U*
RMW-4-092019	9/26/2019		2.5	**0.45**	0.20 U	0.20 U	*0.20 U*
RMW-4-012020	1/31/2020		3.7	**0.54**	0.20 U	0.20 U	0.020 U
RMW-4-052020	5/4/2020		3.2	**0.82**	0.20 U	0.20 U	0.020 U
RMW-5							
RMW-5-052013	5/24/2013	12–22 ft	1.7	0.20 U	0.20 U		*0.20 U*
RMW-5-062014	6/24/2014		1.4	**0.40**	0.20 U		*0.20 U*
RMW-5D-122014	12/19/2014		1.3	0.32	0.22	0.20 U	*0.20 U*
RMW-5D-062015	6/23/2015		0.66	0.36	0.20 U	0.20 U	*0.20 U*
RMW-5D-122015	12/8/2015		1.6	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-5D-062016	6/29/2016		1.1	0.31	0.20 U	0.20 U	*0.20 U*
RMW-5D-122016	12/22/2016		1.0	0.20 U	0.23	0.20 U	*0.20 U*
RMW-5-062017	6/29/2017		2.0	0.20 U	0.20 U		*0.20 U*
RMW-5-092019	9/26/2019		2.1	**0.39**	0.22	0.20 U	*0.20 U*
RMW-5-012020	1/31/2020		2.5	0.21	0.20 U	0.20 U	**0.024**
RMW-5-052020	5/4/2020		2.3	0.20 U	0.20 U	0.20 U	0.020 U
RMW-6							
RMW-6D-092009	9/14/2009	15–25 ft	0.20 U	0.27	3.6	0.20 U	**5.3**
RMW-6-052013	5/24/2013		0.20 U	0.20 U	2.7		**3.4**
RMW-6-062014	6/24/2014		0.34	**0.60**	0.42		*0.20 U*
RMW-6D-122014	12/19/2014		0.47	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-6D-062015	6/23/2015		0.20 U	**1.4**	0.88	0.20 U	*0.20 U*
RMW-6D-122015	12/8/2015		0.20 U	**2.7**	1.0	0.20 U	*0.20 U*
RMW-6D-062016	6/29/2016		0.20 U	**2.5**	1.3	0.20 U	*0.20 U*
RMW-6D-122016	12/21/2016		0.20 U	**0.39**	0.50	0.20 U	*0.20 U*
RMW-6-062017	6/29/2017		0.20 U	**0.41**	0.30		*0.20 U*
RMW-6-092019	9/26/2019		0.20 U	**1.7**	3.8	0.20 U	**0.57**
RMW-6-012020	1/31/2020		0.20 U	**0.52**	2.5	0.20 U	**0.70**
RMW-6-052020	5/4/2020		0.20 U	**0.45**	1.5	0.20 U	**0.21**

Table 1
Summary of Groundwater Data

Analyte			Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
CAS No.			127-18-4	79-01-6	156-59-2	156-60-5	75-01-4
CUL [1]			4.9	0.38	16	--	0.02
Unit			µg/L	µg/L	µg/L	µg/L	µg/L
Sample Name	Sample Date	Depth/ Screen					
RMW-7							
RMW-7D-092009	9/15/2009	15–25 ft	**50**	**120**	**190**	2.0	**22**
RMW-7-052013	5/24/2013		**9.0**	**33**	**65**		**9.3**
RMW-7-042014	4/4/2014		0.75	**3.8**	**35**		**8.3**
RMW-7-062014	6/25/2014		**5.2**	**24**	**80**		**9.9**
RMW-7-092014	9/22/2014		1.0 U	**3.2**	**170**		**47**
RMW-7D-122014	12/19/2014		2.9	**8.9**	**150**	1.4	**34**
RMW-7D-032015	3/18/2015		0.40 U	**1.5**	**57**	0.64	**20**
RMW-7D-062015	6/23/2015		0.40 U	**3.1**	**95**	1.2	**9.6**
RMW-7D-092015	9/11/2015		4.2	**23**	**110**	1.4	**14**
RMW-7D-122015	12/8/2015		3.5	**8.7**	**85**	0.87	**9.0**
RMW-7D-032016	3/31/2016		1.5	**6.8**	**84**	0.91	**35**
RMW-7D-062016	6/29/2016		2.3	**14**	**65**	0.68	**12**
RMW-7D-092016	9/30/2016		2.4	**7.8**	**89**	1.0 U	**13**
RMW-7D-122016	12/22/2016		1.1	**4.1**	**88**	0.93	**24**
RMW-7-042017	4/5/2017		1.2	**2.4**	12		**0.86**
RMW-7-062017	6/28/2017		1.3	**1.9**	**33**		**1.9**
RMW-7-102017	10/10/2017		1.0	**2.3**	**47**		**25**
RMW-7-092019	9/27/2019		0.51	**4.1**	**33**	0.39	**27**
RMW-7-022020	2/3/2020		0.20 U	0.22	16	0.28	**26**
RMW-7-052020	5/5/2020		0.32	**0.88**	**20**	0.31	**28**
RMW-8							
RMW-8D-092009	9/15/2009	20–30 ft	0.46	**2.6**	1.3	0.36	*0.20 U*
RMW-8D-Dup-092009	9/15/2009		0.48	**2.6**	1.3	0.36	*0.20 U*
RMW-8D-122009	12/16/2009		0.91	**3.0**	1.4	0.40	*0.20 U*
RMW-8D-052013	5/24/2013		0.50	**0.85**	0.44		*0.20 U*
RMW-8D-062014	6/24/2014		0.20 U	0.20 U	0.20 U		*0.20 U*
RMW-8D-122014	12/19/2014		0.70	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-8D-062015	6/23/2015		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-8D-122015	12/8/2015		0.20 U	**0.39**	0.47	0.20 U	*0.20 U*
RMW-8D-062016	6/29/2016		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-8D-122016	12/22/2016		0.31	**0.66**	0.37	0.20 U	*0.20 U*
RMW-8D-062017	6/28/2017		0.20 U	0.20 U	0.20 U		*0.20 U*
RMW-8D-092019	9/27/2019		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-8D-022020	2/3/2020		0.20 U	**0.40**	0.28	0.20 U	0.020 U
RMW-8D-052020	5/6/2020		0.20 U	0.20 U	0.20 U	0.20 U	0.020 U
RMW-9							
RMW-9D-092009	9/15/2009	20–30 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-9D-122009	12/16/2009		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-9D-052013	5/24/2013		0.20 U	0.20 U	0.20 U		*0.20 U*
RMW-9R							
RMW-9RD-122014	12/19/2014	20–30 ft	0.79	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-9D-062015	6/23/2015		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-9D-122015	12/8/2015		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-9D-062016	6/29/2016		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-9D-122016	12/22/2016		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-9RD-062017	6/29/2017		0.20 U	0.20 U	0.20 U		*0.20 U*
RMW-9RD-092019	9/27/2019		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-9RD-022020	2/4/2020		0.20 U	0.20 U	0.20 U	0.20 U	0.020 U
RMW-9RD-052020	5/7/2020		0.20 U	0.20 U	0.20 U	0.20 U	0.020 U
RMW-10D							
RMW-10D-092009	9/15/2009	32–42 ft	0.24	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-10D-122009	12/16/2009		0.35	0.27	0.20 U	0.20 U	*0.20 U*
RMW-10D-Dup-122009	12/16/2009		0.28	0.23	0.20 U	0.20 U	*0.20 U*
RMW-10D-052013	5/24/2013		0.20 U	0.20 U	0.20 U		*0.20 U*
RMW-10D-062014	6/24/2014		0.20 U	0.20 U	0.20 U		*0.20 U*
RMW-10D-122014	12/19/2014		0.69	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-10D-062015	6/23/2015		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-10D-122015	12/8/2015		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-10D-062016	6/29/2016		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-10D-122016	12/21/2016		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-10D-062017	6/28/2017		0.20 U	0.20 U	0.20 U		*0.20 U*
RMW-10D-092019	9/27/2019		0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RMW-10D-022020	2/4/2020		0.20 U	0.20 U	0.20 U	0.20 U	0.020 U
RMW-10D-052020	5/5/2020		0.20 U	0.20 U	0.20 U	0.20 U	0.020 U

Table 1
Summary of Groundwater Data

		Analyte	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
		CAS No.	127-18-4	79-01-6	156-59-2	156-60-5	75-01-4
		CUL [1]	4.9	0.38	16	--	0.02
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L
Sample Name	**Sample Date**	**Depth/ Screen**					
RMW-12							
RMW-12D-072016	7/25/2016	15–25 ft	**120**	**19**	14	1.0 U	*1.0 U*
RMW-12D-122016	12/21/2016		**61**	**14**	**21**	0.34	**1.6**
RMW-12D-062017	6/28/2017		**130**	**27**	**29**		*1.0 U*
RMW-12D-092019	9/27/2019		**15**	**3.1**	6.5	0.20 U	**0.87**
RMW-12D-022020	2/4/2020		**13**	**3.7**	6.1	0.20 U	**2.8**
RMW-12D-052020	5/6/2020		**19**	**4.6**	5.4	0.20 U	**0.50**
RMW-13							
RMW-13D-072016	7/25/2016	15–25 ft	0.20 U	0.20 U	1.8	0.20 U	**0.24**
RMW-13D-122016	12/22/2016		0.20 U	0.20 U	1.2	0.20 U	*0.20 U*
RMW-13D-062017	6/28/2017		0.20 U	0.20 U	0.50		*0.20 U*
RMW-13D-092019	9/27/2019		0.20 U	0.20 U	0.97	0.20 U	*0.20 U*
RMW-13D-022020	2/3/2020		0.20 U	0.20 U	0.31	0.20 U	**0.095**
RMW-13D-052020	5/5/2020		0.20 U	0.20 U	0.30	0.20 U	**0.060**
RMW-14							
RMW-14D-052020	5/5/2020	15–25 ft	**15**	**5.6**	4.0	0.20 U	**0.15**
CDM-B14							
CDM-B14-W	4/3/2009	9–9 ft	**5.9**	**0.54**	0.33	0.20 U	*0.20 U*
CDM-B15							
CDM-B15-W	4/3/2009	10–10 ft	3.9	**1.8**	1.4	0.20 U	*0.20 U*
CDM-B16							
CDM-B16-W	4/3/2009	13–13 ft	0.21	0.20 U	0.20 U	0.20 U	*0.20 U*
CDM-B17							
CDM-B17-W	4/2/2009	11–11 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
RB-25							
RB-25-102018	10/24/2018	15–25 ft	**200**	**88**	**92**		**1.0**
RB-26							
RB-26-102018	10/24/2018	15–25 ft	2.4	**1.6**	3.5		0.020 U
RB-27							
RB-27-102018	10/24/2018	15–25 ft	**29**	**19**	7.1		**1.0**
RB-28							
RB-28-102018	10/24/2018	10–20 ft	**15**	**6.4**	4.7		**0.34**
RB-29							
RB-29-102018	10/24/2018	15–25 ft	2.6	**1.0**	1.4		0.020 U
RB-30							
RB-30-102018	10/24/2018	15–25 ft	0.56	**1.3**	8.1		**0.28**
RB-31							
RB-31-102018	10/25/2018	15–25 ft	**63**	**11**	**43**		**13**
RB-32							
RB-32-102018	10/25/2018	15–25 ft	**110**	**44**	**76**		0.020 U
UCCB-5							
UCCB5-15-GW	3/22/2017	10–20 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB5-32-GW	3/22/2017	29–34 ft	4.2	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB5-43-GW	3/22/2017	40–45 ft	1.5	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB-6							
UCCB6-9-GW	3/23/2017	7–12 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB6-22-GW	3/23/2017	20–25 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB6-36-GW	3/23/2017	33–38 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB-7							
UCCB7-17-GW	3/23/2017	14–19 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB7-28-GW	3/23/2017	25–30 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB7-38-GW	3/23/2017	35–40 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB-9							
UCCB9-18-GW	3/22/2017	15–20 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB9-31-GW	3/22/2017	28–33 ft	0.61	0.20 U	0.20 U	0.20 U	*0.20 U*
UCCB9-41-GW	3/23/2017	39–44 ft	0.20 U	0.20 U	0.20 U	0.20 U	*0.20 U*

Notes:

All results are rounded to two significant figures.

-- Not established.

Italic Analyte was not detected at a reporting limit greater than the CUL.

RED/BOLD Analyte was detected at a concentration greater than the CUL.

1 CULs are established in the Cleanup Action Plan (Exhibit B of Ecology 2023).

Abbreviations:

CAS Chemical Abstracts Service

CUL Cleanup level

ft Feet

µg/L Micrograms per liter

Qualifier:

U Analyte was not detected at the associate reporting limit.

Table 2
Summary of Soil Data

Analyte			Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
CAS No.			127-18-4	79-01-6	156-59-2	156-60-5	75-01-4
CUL [(1)]			0.05	0.03	160	--	0.67
Unit			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample Name	**Sample Date**	**Sample Depth**					
EW-5D-18	10/11/2016	18–18 ft	0.00092 U	0.00092 U	0.0015	0.00092 U	0.00092 U
EW-5D-21	10/11/2016	21–21 ft	0.00081 U	0.00081 U	0.0023	0.00081 U	0.0020
EW-6D-19	10/12/2016	19–19 ft	0.00070 U	0.00070 U	0.00070 U	0.00070 U	0.00070 U
EW-6D-21	10/12/2016	21–21 ft	0.0038	0.0052	0.050	0.0014 U	0.0028
RMW-12D-5'	9/22/2016	5–5 ft	0.00088 U	0.00088 U	0.00088 U	0.00088 U	0.00088 U
RMW-12D-12.5'	9/22/2016	12.5–12.5 ft	0.012	0.0061	0.0029	0.00091 U	0.00091 U
RMW-12D-17.5'	9/22/2016	17.5–17.5 ft	0.024	0.0025	0.0011	0.00099 U	0.00099 U
RMW-12D-22.5'	9/22/2016	22.5–22.5 ft	**0.59**	0.0058	0.0010 U	0.0010 U	0.0010 U
RMW-13D-5'	9/22/2016	5–5 ft	0.00092 U	0.00092 U	0.00092 U	0.00092 U	0.00092 U
RMW-13D-12.5'	9/22/2016	12.5–12.5 ft	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U
RMW-13D-17.5'	9/22/2016	17.5–17.5 ft	0.00096 U	0.00096 U	0.0014	0.00096 U	0.00096 U
RMW-13D-22.5'	9/22/2016	22.5–22.5 ft	0.0010 U	0.0010 U	0.0010 U	0.0010 U	0.0010 U
RMW-14:6ft	4/27/2020	6–6 ft	0.00077 U	0.00077 U	0.00077 U	0.00077 U	0.00077 U
RMW-14:11.5ft	4/27/2020	11.5–11.5 ft	0.0073	0.00080 U	0.00080 U	0.00080 U	0.00080 U
RMW-14:15ft	4/27/2020	15–15 ft	0.00093	0.00075 U	0.00075 U	0.00075 U	0.00075 U
RMW-14:20ft	4/27/2020	20–20 ft	0.0012	0.00074 U	0.00074 U	0.00074 U	0.00074 U
RMW-14:21.5ft	4/27/2020	21.5–21.5 ft	**0.13**	**0.27**	0.029	0.0012	0.0017
RMW-14:26ft	4/27/2020	26–26 ft	0.0014	0.00087	0.00086 U	0.00086 U	0.00086 U
CDM-B15-10	4/3/2009	10–10 ft	0.027	0.0017 U	0.0017 U	0.0017 U	0.0017 U
CDM-B16-13	4/3/2009	13–13 ft	0.0041	0.0010 U	0.0010 U	0.0010 U	0.0010 U
R-3-8	2/12/2008	8–8 ft	0.0057 U				
R-4-8	2/12/2008	8–8 ft	0.0090				
RB-25-13	10/24/2018	13–13 ft	**0.46**	**0.052**	0.0016 U		0.0016 U
RB-26-8.5	10/24/2018	8.5–8.5 ft	0.00094 U	0.00094 U	0.00094 U		0.00094 U
RB-27-10	10/24/2018	10–10 ft	0.0011 U	0.0011 U	0.0011 U		0.0011 U
RB-28-10	10/24/2018	10–10 ft	0.0017	0.00078 U	0.00078 U		0.00078 U
RB-29-8	10/24/2018	8–8 ft	0.00082 U	0.00082 U	0.00082 U		0.00082 U
RB-30-9	10/24/2018	9–9 ft	0.00077 U	0.00077 U	0.00077 U		0.00077 U
RB-31-7.75	10/24/2018	7.75–7.75 ft	0.0010 U	0.0010 U	0.0010 U		0.0010 U
RB-32-15	10/24/2018	15–15 ft	0.00080 U	0.00080 U	0.00080 U		0.00080 U
KSB-1:12ft	2/24/2020	12–12 ft	0.00099 U	0.00099 U	0.00099 U	0.00099 U	0.0014 U
KSB-1:15ft	2/24/2020	15–15 ft	0.0013 U	0.0013 U	0.0014	0.0013 U	0.0018 U
KSB-1:23ft	2/24/2020	23–23 ft	0.0052	0.00094 U	0.00094 U	0.00094 U	0.0013 U
KSB-2:12ft	2/24/2020	12–12 ft	0.0017	0.00096 U	0.00096 U	0.00096 U	0.0013 U
KSB-2:18.75ft	2/24/2020	18.75–18.75 ft	0.0051	0.0012	0.00093 U	0.00093 U	0.00093 U
KSB-2:25ft	2/24/2020	25–25 ft	**0.055**	0.0020	0.00088 U	0.00088 U	0.0012 U
KSB-3:11.5ft	2/24/2020	11.5–11.5 ft	0.0074	0.00095 U	0.00095 U	0.00095 U	0.0013 U
KSB-3:19ft	2/24/2020	19–19 ft	**0.058**	0.029	0.033	0.0010 U	0.0048
KSB-3:25.5ft	2/24/2020	25.5–25.5 ft	**1.0**	0.0061	0.00090 U	0.00090 U	0.0013 U
KSB-4:12ft	2/24/2020	12–12 ft	0.021	0.00089 U	0.00089 U	0.00089 U	0.0013 U
KSB-4:23.5ft	2/24/2020	23.5–23.5 ft	0.0028	0.00085 U	0.00085 U	0.00085 U	0.0012 U
KSB-4:30ft	2/24/2020	30–30 ft	**0.13**	0.0018	0.00096 U	0.00096 U	0.0013 U
KSB-5:8ft	2/24/2020	8–8 ft	0.0011	0.00085 U	0.00085 U	0.00085 U	0.0012 U
KSB-5:11.5ft	2/24/2020	11.5–11.5 ft	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0046
KSB-5:13ft	2/24/2020	13–13 ft	0.00097 U	0.00097 U	0.0012	0.00097 U	0.00097 U
KSB-6:15.5ft	2/24/2020	15.5–15.5 ft	**1.5**	**0.30**	0.020	0.0014 U	0.0014 U
KSB-6:24ft	2/24/2020	24–24 ft	0.0010 U	0.0010 U	0.0010 U	0.0010 U	0.0010 U
KSB-7:11ft	2/24/2020	11–11 ft	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
KSB-7:17ft	2/24/2020	17–17 ft	**0.17**	0.011	0.00095 U	0.00095 U	0.00095 U
KSB-7:22ft	2/24/2020	22–22 ft	0.00081 U	0.00081 U	0.00081 U	0.00081 U	0.00081 U
UCCB5-36.0	3/22/2017	36–36 ft	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U
UCCB6-25.5	3/23/2017	25.5–25.5 ft	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U
UCCB7-20.0	3/23/2017	20–20 ft	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U
UCCB9-35.5	3/22/2017	35.5–35.5 ft	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U

Notes:

All results are rounded to two significant figures.

-- Not established.

RED/BOLD Analyte was detected at a concentration greater than the CUL.

1 CULs are established in the Cleanup Action Plan (Exhibit B of Ecology 2023).

Abbreviations:

CAS Chemical Abstracts Service

CUL Cleanup level

ft Feet

mg/kg Milligrams per kilogram

Qualifier:

U Analyte was not detected at the associate reporting limit.

Table 3
Monitoring Well Sampling Plan

Well Location	HVOC Analysis (1)	MNA Parameter Analysis (1)	PFM Deployment	Transducer Deployment
EW-1	X			
EW-2	X			
EW-3	X	X		
EW-4	X			
EW-5	X			
EW-6	X			
RMW-4	X			
RMW-5	X	X		
RMW-6	X	X		
RMW-7	X	X	X	X
RMW-8	X			
RMW-9R	X	X		
RMW-10D	X			X
RMW-12	X	X	X	
RMW-13	X	X		X
RMW-14	X	X		X
BC-3				X

Note:

1 Refer to Attachment 2, Table 3.1 for list of analytes. MNA parameters include metals and conventionals.

Abbreviations:

HVOC Halogenated volatile organic compound
MNA Monitored natural attenuation
PFM Passive flux meter

Table 4
Reconnaissance Groundwater Sampling Plan

Sample Location	Sample Depths (feet)	Sample Interval Length (feet)	Total Samples (1)
GWB-1	15–25	10	1
GWB-2	15–25	10	1
GWB-3	15–30	5	3
GWB-4	15–30	5	3
GWB-5	15–30	5	3
GWB-6	15–30	5	3
GWB-7	35–45	10	2
GWB-8 (2)	15–25	10	1
GWB-9 (2)	17–27	10	1
GWB-10 (2)	20–30	10	1

Notes:

1 All samples will be analyzed for HVOCs.

2 Contingency sample will be collected if needed to delineate HVOCs at adjacent monitoring well(s).

Abbreviation:

HVOC Halogenated volatile organic compound

Table 5
Soil Sampling Plan

Soil Sample Location	Sample Depths (feet)	Sample Interval Length (feet)	Total Samples	HVOCs—Analyze Immediately (1)	HVOCs—Archive (2)	Qualitative Grain Size	Laboratory Grain Size
SB-1	13-28	3	5	2	3	--	--
SB-2	13-28	3	5	2	3	--	--
SB-3	13-28	3	5	2	3	--	--
SB-4	13-28	3	5	2	3	--	--
SB-5	13-28	3	5	2	3	--	--
SB-6	10-40	2	15	15	--	15	4
SB-7	16-28	3	4	1	3	--	--
SB-8	16-28	3	4	1	3	--	--
SB-9	16-28	3	4	1	3	--	--
SB-10	16-28	3	4	1	3	--	--
SB-11	21-23	2	1	1	0	--	--

Notes:

-- No sample.

1 Samples for immediate HVOC analysis will be selected on the basis of field indications of contamination including staining, odor, and elevated headspace volatiles measured with a PID.

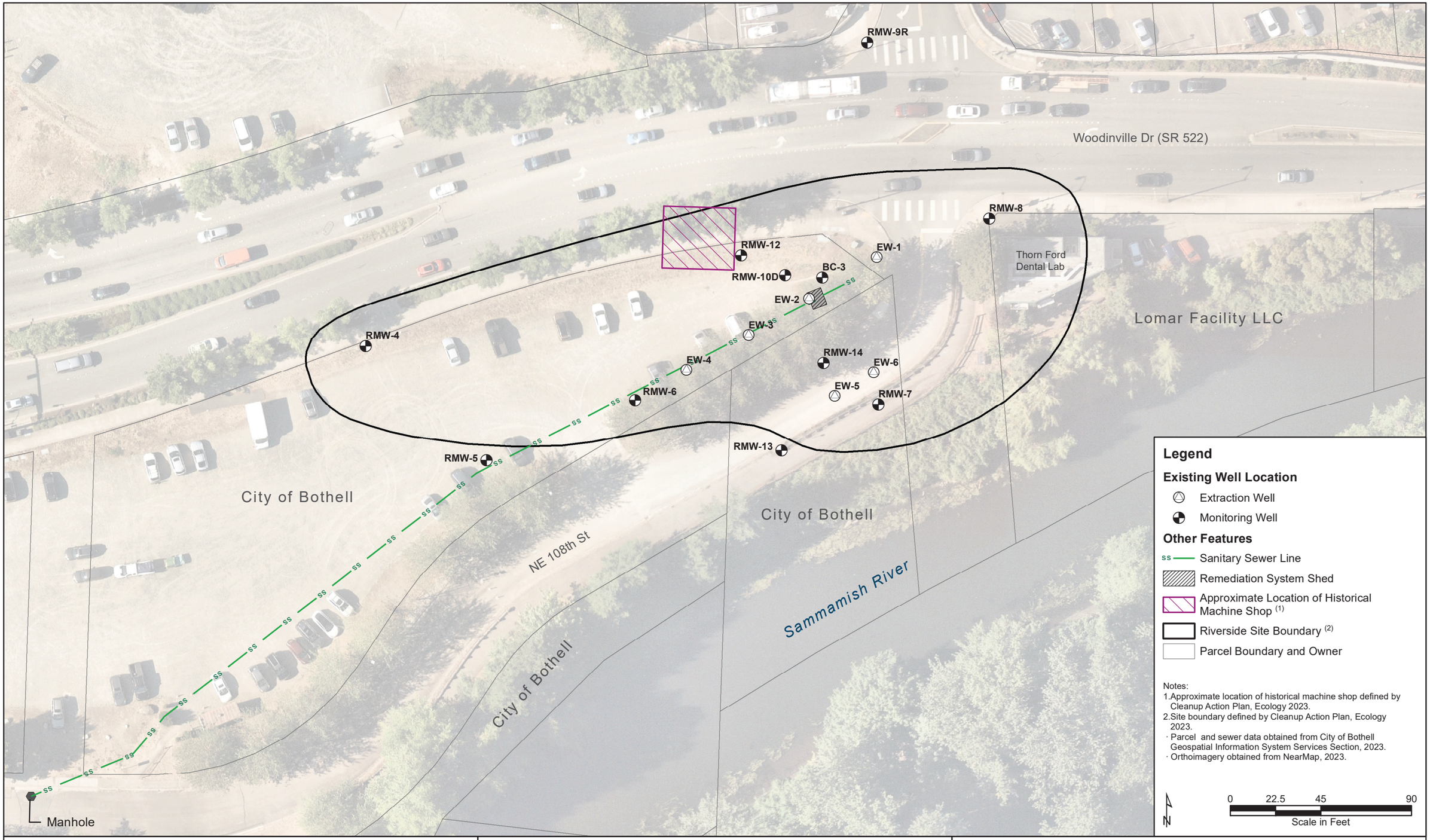
2 Archived samples will be analyzed as needed to vertically delineate any detected HVOC concentrations exceeding cleanup levels during the initial round of analysis.

Abbreviations:

HVOC Halogenated volatile organic compound

PID Photoionization detector

Figures



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Pre-Remedial Design Investigation Work Plan
Riverside HVOC Site
Bothell, Washington

Figure 1
Site Map

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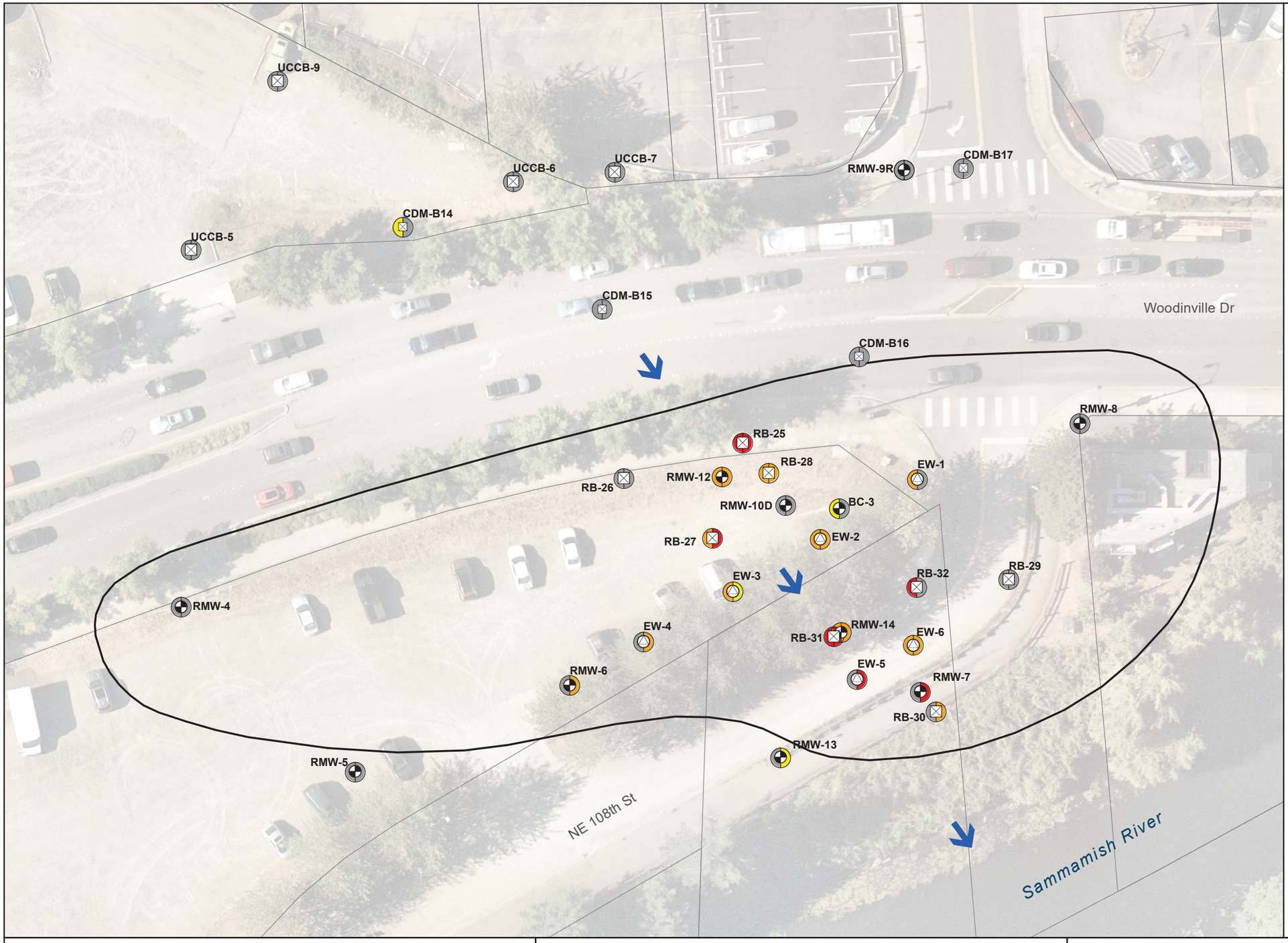
3/28/2024



Legend

Groundwater Sample Result (1)

PCE Result	Vinyl Chloride Result
ND or ≤ CUL	ND or ≤ CUL
> CUL – < 2x CUL	> CUL – < 5x CUL
≥ 2xCUL – < 10x CUL	≥ 5xCUL – < 50x CUL
≥ 10x CUL	≥ 50x CUL

Existing Sample Location

- Monitoring Well
- Extraction Well
- Reconnaissance Boring (2017–2018)
- Reconnaissance Boring (2009)

Other Features

- Groundwater Flow Direction
- Riverside Site Boundary (2)
- Parcel Boundary

Cleanup Levels
Tetrachloroethene (PCE) = 4.9 µg/L
Vinyl chloride = 0.02 µg/L

Notes:
1. HVOC results shown are the maximum detected concentrations during the three most recent sampling events at each well location; most wells were sampled in 2019–2020, however EW-1, EW-4, and EW-5 were last sampled in 2017.
2. Site boundary defined by Cleanup Action Plan, Ecology 2023.
   · Parcel data obtained from City of Bothell Geospatial Information System Services Section, 2023.
   · Orthoimagery obtained from NearMap, 2023.

Abbervations:
CUL = Cleanup level
HVOC = Halogenated volatile organic compound
µg/L = Micrograms per liter
MNA = Monitored natural attenuation
ND = Non-detect
PFM = Passive flux meter

N

0 17.5 35 70
Scale in Feet

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Pre-Remedial Design Investigation Work Plan
Riverside HVOC Site
Bothell, Washington

Figure 2
Groundwater HVOC Conditions

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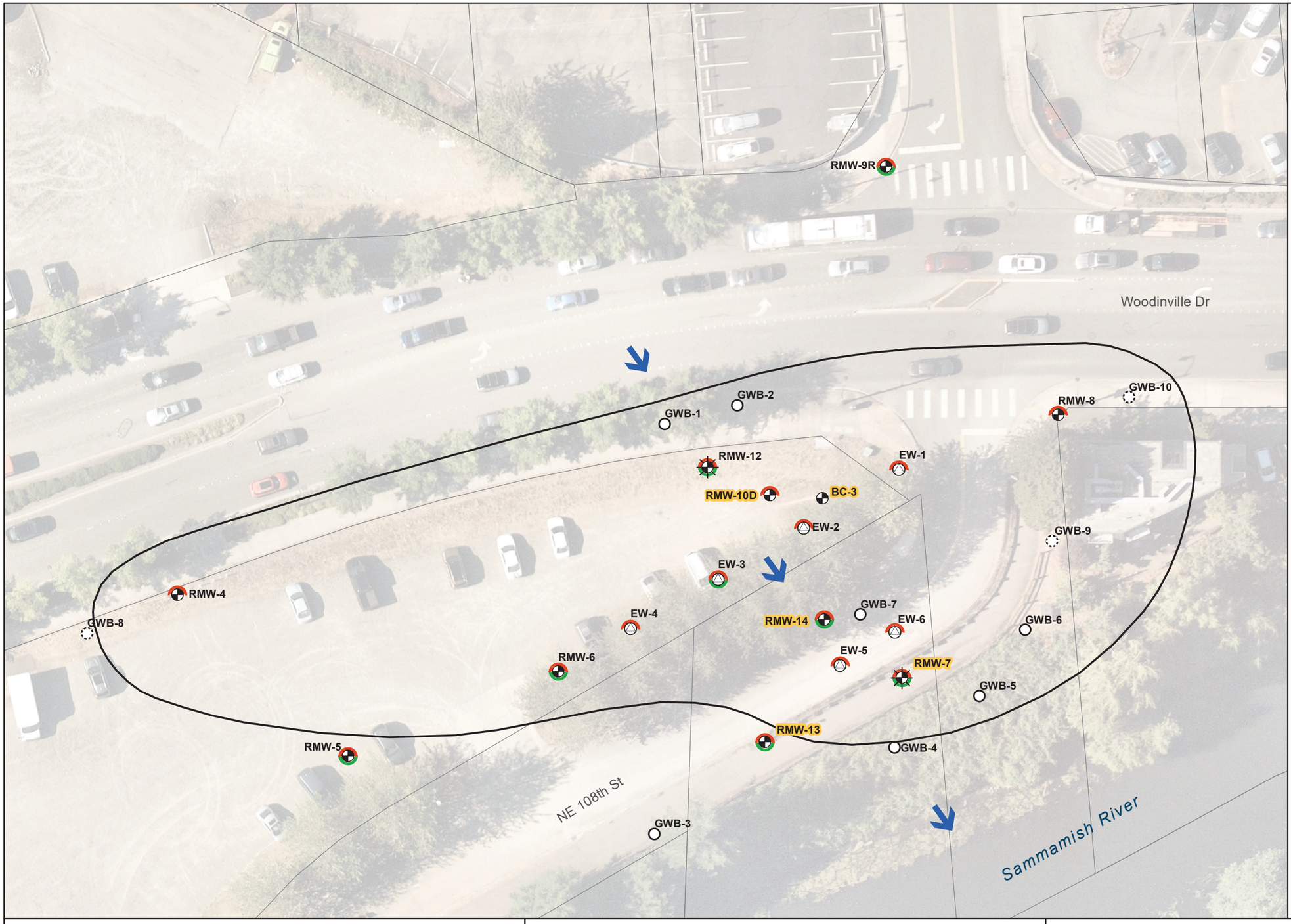
3/28/2024



Legend

Existing Well Location

- Monitoring Well
- Extraction Well

Proposed Investigation

- Groundwater Reconnaissance Boring - HVOC Analysis
- Groundwater Contingency Reconnaissance Boring - HVOC Analysis
- HVOC Analysis
- MNA Parameters Analysis
- PFM Deployment
- RMW-14 Transducer Deployment

Other Features

- Groundwater Flow Direction
- Riverside Site Boundary (1)
- Parcel Boundary

Notes:
1.Site boundary defined by Cleanup Action Plan, Ecology 2023.
· Parcel data obtained from City of Bothell Geospatial Information System Services Section, 2023.
· Orthoimagery obtained from NearMap, 2023.

Abbervations:
CUL = Cleanup level
HVOC = Halogenated volatile organic compound
µg/L = Micrograms per liter
MNA = Monitored natural attenuation
PFM = Passive flux meter

N

0 17.5 35 70
Scale in Feet

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Pre-Remedial Design Investigation Work Plan
Riverside HVOC Site
Bothell, Washington

Figure 3
Groundwater Investigation Plan

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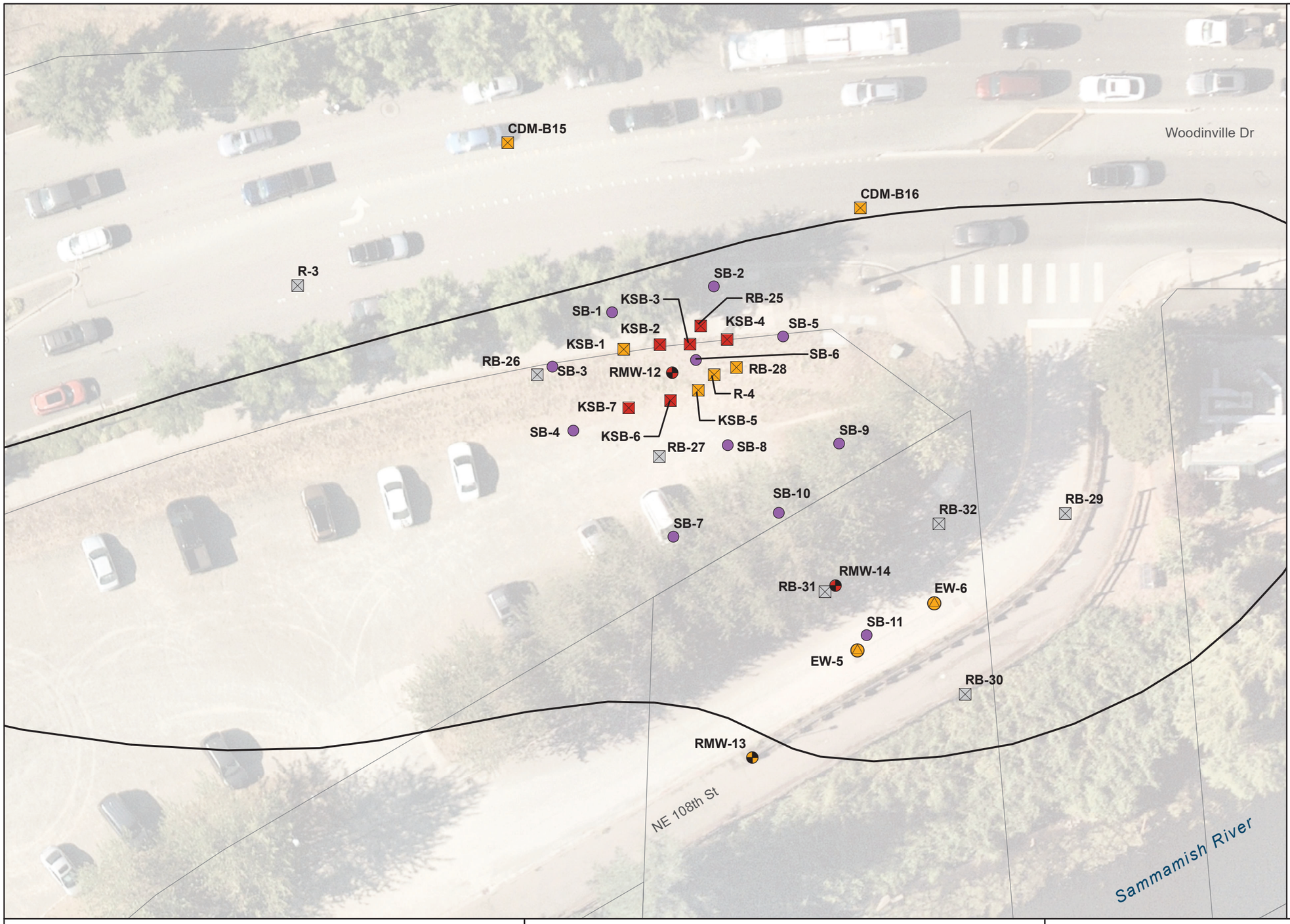
3/28/2024



Legend

Existing Sample Location Type

- Soil Boring
- Extraction Well Boring
- Monitoring Well Boring

HVOC Results

- Non-detect
- One or More HVOCs Detected, All Results Less Than CULs
- One or More Results Exceeds CUL

Proposed Investigation

- Soil Sample Location

Other Features

- Riverside Site Boundary (1)
- Parcel Boundary

Cleanup Levels
Tetrachloroethene (PCE) = 0.05 mg/kg
Trichloroethene (TCE) = 0.03 mg/kg
cis-1,2-Dichloroethene = 160 mg/kg
Vinyl chloride = 0.67 mg/kg

Notes:
1. Site boundary defined by Cleanup Action Plan, Ecology 2023.
· Parcel data obtained from City of Bothell Geospatial Information System Services Section, 2023.
· Orthoimagery obtained from NearMap, 2023.

Abbervations:
CUL = Cleanup level
HVOC = Halogenated volatile organic compound
mg/kg = Milligrams per kilogram

N

0 12.5 25 50
Scale in Feet

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Pre-Remedial Design Investigation Work Plan
Riverside HVOC Site
Bothell, Washington

Figure 4
Soil HVOC Conditions and Investigation Plan

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3/28/2024

Attachment 1
Floyd|Snider Standard Guidelines

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F|S STANDARD GUIDELINE

Low-Flow Groundwater Sample Collection

DATE/LAST UPDATE: December 2022

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline provides details necessary for collecting representative groundwater samples from monitoring wells using low-flow methods. These guidelines are designed to meet or exceed guidelines set forth by the Washington State Department of Ecology (Ecology). Low-Flow sampling provides a method to minimize the volume of water that is purged and disposed from a monitoring well, and minimizes the impact that purging has on groundwater chemistry during sample collection.

2.0 Equipment and Supplies

Groundwater Sampling Equipment and Tools

- For wells with head less than 25 feet:
  - Peristaltic pump with fully charged internal battery or standalone battery and appropriate connectors
- For wells with head greater than 25 feet:
  - Bladder pump and controller, as well as an air cylinder, or air compressor (with extension cord if near an electrical outlet; with battery and appropriate connectors or generator if not near an outlet)

    OR

  - Low-flow submersible pump and controller (with extension cord if near an electrical outlet; with battery and appropriate connectors or generator if not near an outlet)
- Multi-parameter water quality meter
- Water level meter
- Polyethylene tubing, Teflon tubing, or similar (assume polyethylene unless otherwise specified in SAP) and tubing weights (for wells deeper than approximately 10 feet)
- Silicone tubing
- Filters (if field filtering)
- Tools for opening wells and drums (1/2-inch, 9/16-inch, 5/8 and 15/16-inch sockets ratchet, screwdriver, hammer/rubber mallet, bung wrench; any other necessary tools if non-standard monuments have been used)
- Well keys
- Tube cutters, razor blade, or scissors
- 5-gallon buckets, lids, and clamp
- Decontamination supplies: Alconox (or similar), distilled or deionized water, spray bottles, and paper towels
- Bailer or hand pump to drain well box if full of stormwater
- Trash bags

Lab Equipment

- Sample jars/bottles
- Coolers
- Chain-of-Custody Forms
- Labels
- Ice
- Ziploc bags

Paperwork

- Field notebook with site maps
- Table of well construction details and/or well logs, if available
- Sampling forms (enclosed)
- Purge water plan
- Rite-in-the-Rain pens, paper, and permanent markers

- Site-Specific Health and Safety Plan (HASP) and F|S Accident Prevention Plan (APP)
- List of emergency contacts for the Site or facility
- Safety Data Sheets (SDS) binder
- Sampling and Analysis Plan (SAP) and/or Quality Assurance Project Plan (QAPP) (including tables of analytes and bottle types)

Safety Equipment

- PPE:
  - Waterproof boots (safety toed, depending on site)
  - Safety vest
  - Safety glasses
  - Rain gear
  - Nitrile gloves
  - Work gloves
- First Aid kit
- Emergency kit (fire extinguisher, road flares)
- Traffic barricades or cones

3.0 Standard Procedures

Low-flow groundwater sampling consists of purging groundwater within the well casing at a rate equal to or less than the flow rate of representative groundwater from the surrounding aquifer into the well screen. The flow rate will depend on the hydraulic conductivity of the aquifer and the drawdown, with the goal of minimizing drawdown within the monitoring well. Field parameters are monitored during purging and groundwater samples are collected after field parameters have stabilized. Deviations from these procedures should be approved by the Project Manager and fully documented.

3.1 OFFICE PREPARATION

First, meet with the PM to identify the key objectives of the groundwater sampling effort. This may include the order of wells to be sampled (e.g., if using non-dedicated equipment, wells may need to be sampled in order of least contaminated to most contaminated), whether any wells require redevelopment at least 24-hours prior to sampling, and/or key stabilization parameters (e.g., elevated turbidity may require purging beyond 30 minutes, even if the readings are within 10%).

Conduct a kick-off meeting with the sampling team to discuss site health and safety protocols, data quality objectives, and any site-specific special considerations or sampling procedures.

3.2 TAILGATE SAFETY MEETING

Conduct a tailgate safety meeting prior to beginning work at the site. Emergency evacuation procedures, rally points, and onsite communication protocols should be discussed at the first tailgate meeting and repeated if new personnel join the field team onsite.

The safety meeting should cover the hazards specific to groundwater sampling. Typical hazards include the following:

- Chemical hazards (refer to HASP for site chemical exposure hazards)
- Site hazards
  - Traffic hazards onsite (e.g., truck traffic, heavy machinery)
  - Biological hazards (e.g., spiders or wasps within well monuments)
- Physical hazards associated with lifting and carrying heavy equipment and repeated bending while sampling
- Cuts and abrasions associated with using blades and tools
- Electrical hazards (make sure all wires/cables are in good condition and connections to battery or outlet are secure)
- Heat stress and cold stress

Record the meeting attendees and topics discussed on the front page of the tailgate safety meeting form (included as an attachment to the HASP). All attendees should sign the form.

3.3 OTHER HEALTH AND SAFETY GUIDELINES

The following are additional health and safety guidelines that should be followed in the field. These guidelines are intended to supplement the guidelines and requirements identified in the HASP and are not intended to replace the HASP.

- Review and sign the HASP prior to going into the field.
- Conduct a tailgate safety meeting prior to beginning work at the site as discussed in Section 3.2
- When moving between monitoring wells or switching to different tasks (e.g., transitioning from sampling to cooler QC prior to lab pickup), assess any additional hazards that may be associated with the new location or task. Record additional hazards noted and corrective actions to address those hazards on the Daily Tailgate Safety Meeting and Debrief Form (included as an attachment to the HASP).
- Record near misses and incidents on the Near Miss and Incident Reporting Form (included as an attachment to the HASP) and conduct management/client notifications according to the protocols detailed in the HASP.

3.4 CALIBRATION OF WATER QUALITY METERS

All multi-parameter water quality meters to be used will be calibrated prior to each sampling event. Calibration procedures are outlined in each instrument's specific user manual.

3.5 MONITORING, MAINTENANCE, AND SECURITY

Prior to sampling, depth to water and total depth measurements will be collected and recorded for accessible monitoring wells onsite (or an appropriate subset for larger sites). Check for an existing measuring point (notch or visible mark on top of casing). If a measuring point is not observed, a measuring point should be established on the north side of the casing. The conditions of the well box and bolts will also be observed, and deficiencies will be recorded on the sampling forms or logbook (i.e., missing or stripped bolt). The following should also be recorded:

- Condition of the well box, lid, bolts, locks, and gripper cap, if deficiencies
- Condition of gasket if deficient and if water is present in the well box
- Note any obstructions or kinks in the well casing
- Note any equipment in the well casing, such as transducers, bailers, or tubing
- Condition of general area surrounding the well, such as subsidence, potholes, or if the well is submerged within a puddle.

Replace any missing or stripped bolts and redevelop wells if needed.

3.6 LOW-FLOW PURGING METHOD AND SAMPLING PROCEDURES

Groundwater samples will be collected using low-flow purging and sampling procedures consistent with Ecology guidelines and the U.S. Environmental Protection Agency (USEPA) standard operating procedures (USEPA 1996). The following describes the Low-Flow purging and sampling procedures for collecting groundwater samples using a peristaltic pump. If the water level is greater than approximately 20 to 25 feet below ground surface (bgs), Grundfos or Geotech submersible pumps or bladder pumps can be used since their pumping rates can be adjusted to low-flow levels. Submersible pumps are preferable to bladder pumps in situations where less than 5 feet of water column are present in the well casing.

- Place the peristaltic pump and water quality equipment near the wellhead. Slowly lower new poly tubing down into the well casing approximately to the middle of the well screen. When sampling wells with a bottom screen depth greater than approximately 10 feet, it is important to measure the length of tubing prior to placement as longer lengths of tubing are more likely to get caught or otherwise obstructed and feel like it has reached the well bottom; this issue can be mitigated by using decontaminated stainless steel tubing weights. If the depth of the well screen is not known, lower the appropriate length of tubing to the bottom of the well, making sure that the tubing has not been caught on the slotted well casing, and then raise the tubing 3 to 5 feet off the bottom of the casing (limit this distance to 2 feet for wells with total depth less than 10 feet). Document the estimated depth of the tubing

placement within the well. Connect the tubing to the peristaltic pump using new flex tubing and connect the discharge line to the flow-through cell of the water quality meter. The discharge line from the flow cell should be directed to a bucket to contain the purged water.

- If using a low-flow submersible pump, connect the pump head to dedicated or disposable tubing. If using a bladder pump, connect both the air intake and water discharge ports to decontaminated or disposable tubing, using the manufacturer's instructions to ensure a secure connection. Lower the pump with tubing into the well as described above and connect the water discharge tubing directly to the flow-through cell.
- Measure the depth to water to the nearest 0.01 foot with a decontaminated water level meter and record the information on a sampling form.
- Start pumping the well at a purge rate of 0.1 to 0.2 liters per minute and slowly increase the rate. Purge rate is adjusted using a speed control knob or arrows on peristaltic and low-flow submersible pumps. The purge rate for bladder pumps is controlled by the air compressor, which first pressurizes the pump chamber in order to compress the flexible bladder and force water through the discharge line, and then vents the chamber in order to allow the bladder to refill with water.
    - A good rule of thumb is to pressurize to 10 psi + 0.5 psi/foot of tubing depth and begin with 4 discharge/refill cycles per minute; using greater air pressure and accelerating the pump cycles will increase the purge rate.
- Check the water level. If the water level is dropping, lower the purge rate. Maintain a steady flow with no or minimal drawdown (less than 0.33 feet according to USEPA 2002). Maintaining a drawdown of less than 0.33 feet may not be feasible depending on hydrogeological conditions. If possible, measure the discharge rate of the pump with a graduated cylinder or use a stopwatch when filling sampling jars (500 milliliters [mL] polyethylene or glass ambers) to estimate the rate. When purging water through a flow cell, the maximum flow rate for accurate water quality readings is about 0.5 liters per minute (L/minute).
- The discharge tubing should be connected to the flow cell immediately upon initial water discharge, unless the discharge water is visibly turbid or flocculant is observed. Monitor and record water quality parameters every three to five minutes after one tubing volume (including the volume of water in the flow cell) has been purged.
    - One foot of ¼-inch interior diameter tubing holds about 10 mL of water, and flow-through cells typically hold less than 200 mL of water; one volume should be purged after about 5 minutes at a flow rate of 0.1 L/minute.
- Water-quality indicator parameters that will be monitored and recorded during purging include:
    - pH
    - Specific conductivity

  - Dissolved oxygen
  - Temperature
  - Turbidity
  - Oxidation reduction potential (ORP)

- Continue purging until temperature, pH, turbidity, and specific conductivity are approximately stable (when measurements are within 10 percent) for three consecutive readings, or 30 minutes have elapsed. Because these field parameters (especially dissolved oxygen and ORP) may not reach the stabilization criteria, collection of the groundwater sample will be based on the professional judgment of field personnel at the time of sampling. A minimum of 5 water quality readings should be collected prior to sampling.
- The water sample can be collected once the criteria above have been met.
- If drawdown in the well cannot be maintained at 0.33 feet or less, reduce the flow or turn off the pump for 15 minutes and allow for recovery. If the water quality parameters have stabilized, and if at least two tubing volumes and the flow cell volume have been purged, then sample collection can proceed when the water level has recovered, and the pump is turned back on. This should be noted on the sampling form.
- To collect the water sample, maintain the same pumping rate. After the well has been purged and the sample bottles have been labeled, the groundwater sample will be collected by directly filling the laboratory-provided bottles from the pump discharge line prior to passing through the flow cell. All sample containers should be filled with minimum disturbance by allowing the water to flow down the inside of the bottle or vial. When collecting a volatile organic compound (VOC) sample, fill to the top to form a meniscus over the mouth of the vial prior to placing the cap to eliminate air bubbles. Be careful not to overflow preserved bottles/pre-cleaned Volatile Organic Analyte (VOA) vials.
- If sampling for filtered metals, collect these samples last and fit an in-line filter at the end of the discharge line. Take note of the flow direction arrow on the filter prior to fitting, invert filter to eliminate air bubbles, and allow minimum of 0.5 to 1 liter of groundwater to pass through the filter prior to collecting the sample.
- Sample labels will clearly identify the project name, sampler's initials, sample location and unique sample ID, analysis to be performed, date, and time. After collection, place samples a cooler maintained at a temperature of approximately 4 to 6 degrees Celsius (°C) using ice (if required). Complete the chain-of-Custody forms. Upon transfer of the samples to the laboratory, the Chain-of-Custody Form will be signed by the persons transferring custody of the sample containers to document change in possession.
- When sample collection is complete at a designated location, remove and properly dispose of the non-dedicated tubing. In most cases, this waste is considered solid waste and can be disposed of as refuse. Close and lock the well.

4.0 Decontamination

All reusable equipment that comes into contact with groundwater should be decontaminated using the processes described in this section prior to moving to the next sampling location.

Water Level Meter: The water level indicator and tape will be decontaminated between sampling locations and at the end the day by spraying the entire length of tape that came in contact with groundwater with an Alconox (or similar)/clean water solution followed by a thorough rinse with distilled or deionized water.

Water Quality Sensors and Flow-Through Cell: Distilled water or deionized water will be used to rinse the water quality sensors and flow-through cell. No other decontamination procedures are recommended since they are sensitive equipment. After the sampling event, the water quality meters will be cleaned and maintained according to the specific manual.

Submersible Pump (if applicable): Decontaminating the pump requires running the pump in three progressively cleaner grades of water.

1. Fill a bucket with approximately 4 gallons of an Alconox (or similar)/clean water solution to sufficiently cover the pump. Place the pump and the length of the power cord (if applicable) that was in contact with water into the bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.
2. Fill a second bucket containing approximately 4 gallons of clean water to sufficiently cover the pump. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.
3. Fill a third bucket with approximately 4 gallons of distilled or deionized water to sufficiently cover the pump. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

The soap/water solution may be reused; however, rinse water should be collected for disposal as described in Section 5.0 below. When done for the day, dry the exterior of the pump and cord with clean towels to the extent practical prior to storage.

Bladder Pump: Clean the inside and outside of the pump body with an Alconox (or similar)/clean water solution, followed by a thorough rinse with distilled or deionized water. The outside of the air supply line that came in contact with groundwater may also be cleaned with Alconox (or similar) solution and re-used; bladders and water discharge lines must be replaced after each sample is collected.

5.0 Investigation-Derived Waste (IDW)

Unless otherwise specified in the project work plan, water generated during groundwater sampling activities will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal. This includes purge water and decontamination waste water.

The approach to handling and disposal of these materials for a typical cleanup site is as follows.

For IDW that is containerized, such as purge water, 55-gallon drums (or other smaller sized drums) approved by the Washington State Department of Transportation will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., "purge water"), the dates on which the wastes were placed in the container, the owner's name and contact information for the field person who generated the waste, and the site name.

IDW containerized within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal. Refer to the FS Special Condition Standard Guideline for Investigation Derived Waste for additional information regarding proper profiling and disposal of wastewater generated by groundwater sampling.

Disposable sampling materials and incidental trash such as tubing, paper towels and gloves/other disposable used in sample processing will be placed in heavy-duty garbage bags or other appropriate containers and disposed of as trash in the municipal collection system unless otherwise specified in the SAP.

6.0 Field Documentation

Groundwater sampling activities will be documented in field sampling forms and/or field notebooks, and Chain-of-Custody Forms. Information recorded will, at a minimum, include personnel present (including subcontractors or client representatives), purpose of field event, weather conditions, sample collection date and times, sample analytes, depths to water, water quality parameters, well box/lid conditions, amount of purged water generated, and any deviations from the SAP. Photographs of damaged well casings or well boxes should be taken.

At the end of the day, complete and review the second page of the tailgate safety meeting form detailing additional hazards, corrective actions, near-misses or incidents. Any incidents that result in equipment damage or field staff injuries should be reported immediately to the PM.

7.0 Demobilization

Upon returning to the office, ensure that all equipment is property cleaned and put away in the field room. Equipment with rechargeable batteries should be plugged in as appropriate. It is

preferable to dispose of trash on-site, but any trash left in the field vehicle should be disposed as regular trash at Two Union Square.

If rented equipment or sample coolers will be placed at the front desk for pickup, clearly label each item with the company picking it up, anticipated pickup time frame, and your contact information so front desk staff can contact you if there are any questions. Notify front desk staff if any items require a signature at pickup.

Within one week of returning from the field, the field lead for the event should review field notes, sampling forms and tailgate safety meeting forms with the PM. Following PM review and approval, field notes will be scanned and saved to the project folder. Hard copies should be filed. The PM will provide copies of near miss and incident reports to the Safety Program Manager.

8.0 References

U.S. Environmental Protection Agency (USEPA). 1996. Low-Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, Revision 2. Region 1. July 30, 1996.

_____. 2002. Groundwater Sampling Guidelines for Superfund and CAR Project Managers. Office of Solid Waste and Emergency Response. EPA 542.S-02-001. May 2002.

Enclosures: Groundwater or Surface Water Sample Collection Form

Record of Revisions:

Revisions	Date
Added health and safety information, reviewed EPA guidance, and added revisions table.	12/9/2022

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project:_____ Date of Collection: _____

Task:_____ Field Personnel: _____

Purge Data

Well ID: _____ Secure: ☐ Yes ☐ No Ecology Tag #: _____ Casing Type/Diameter/Screened Interval _____

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) _____ Stripped (#) _____ Other Damage: _____

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal): _____

Depth of water (from TOC):_____Time: _____

Total Depth (from log or field measurement): _____

After 5 minutes of purging (from top of casing): _____

Begin purge (time): _____End purge (time): _____

Volume purged:_____ Purge water disposal method_____

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (_____)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments

Sampling Data

Sample No: _____ Location and Depth: _____

Date Collected (mo/dy/yr):_____ Time Collected: _____ Weather:_____

Type: ☐ Ground Water ☐ Surface Water Other: _____ Sample: ☐ Filtered ☐ Unfiltered Filter Type:_____

Sample Collected with: ☐ Bailer ☐ Pump Other: _____ Type: ☐ Peristaltic ☐ Bladder ☐ Submersible Other: _____

Water Quality Instrument Data Collected with: Type: ☐ YSI ProDSS ☐ Tudbidity Meter ☐ Other: _____

Sample Decon Procedure: Sample collected with: ☐ decontaminated <u>all</u> tubing; ☐ disposable tubing ☐ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): _____

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes

QC samples

Duplicate Sample No: _____ Duplicate Time: _____ MS/MSD: ☐ Yes ☐ No

Signature: _____ **Date:** _____

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F|S STANDARD GUIDELINE

Groundwater Sample Collection with a Direct-Push (i.e., Geoprobe) Drill Rig

DATE/LAST UPDATE: December 2022

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline provides details necessary for collecting representative groundwater samples using a direct-push drill rig. These guidelines are designed to meet or exceed guidelines set forth by the Washington State Department of Ecology (Ecology).

2.0 Equipment and Supplies

Groundwater Sampling Equipment and Tools

- For wells with head less than 25 feet:
  - Peristaltic pump with fully charged internal battery or standalone battery and appropriate connectors (typically provided by driller; confirm prior to mobilization)
- For wells with head greater than 25 feet:
  - Submersible pump (and controller if low-flow; with extension cord if near an electrical outlet; with battery and appropriate connectors or generator if not near an outlet)

- Peristaltic pump and internal battery or standalone battery with appropriate connectors (typically provided by driller; confirm prior to mobilization)
- Water level meter
- Multi-parameter water quality meter (if applicable)
- Polyethylene tubing, Teflon tubing, or similar (assume polyethylene unless otherwise specified in SAP) and tubing weights (for wells deeper than approximately 10 feet)
- Silicone tubing
- Filters (if field filtering)
- Tools for opening drums (15/16-inch socket, ratchet, screwdriver, hammer/mallet, bung wrench)
- Tube cutters, razor blade, or scissors
- 55-gallon drum and clamp (or 5-gallon drum) and labels
- 5-gallon bucket and lid
- Decontamination supplies: Alconox (or similar), distilled or deionized water, spray bottles, and paper towels
- Trash bags

Lab Equipment

- Sample jars/bottles
- Coolers
- Chain-of-Custody Forms
- Labels
- Ice
- Ziploc bags

Paperwork

- Field notebook with site maps and previous boring logs, if available
- Sampling forms (enclosed)
- Purge water plan
- Rite-in-the-Rain pens, paper, and permanent markers
- Site-Specific Health and Safety Plan (HASP), Tailgate Safety Meeting Forms (for each day you expect to be on site), and F|S Accident Prevention Plan (APP)
- Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP), or other similar work plan

- List of emergency contacts for the Site or facility
- Safety Data Sheets (SDS) binder

Safety Equipment

- PPE:
  - Safety-toed boots
  - Safety vest
  - Hard hat
  - Nitrile gloves
  - Safety glasses
  - Hearing protection
  - Rain gear
  - Work gloves
- Traffic barricades or cones
- Vehicle emergency kit (road flares, fire extinguisher, etc.)
- First Aid Kit

3.0 Standard Procedures

The following sections describe the procedure for sampling groundwater using direct-push methods. Before entering the field, project considerations including the target aquifer or depth for sampling and screen placement (i.e., across or within the water table) should be discussed with the Project Manager. Any deviations from these procedures should be approved by the Project Manager and fully documented. Groundwater sampling from a direct-push boring consists of purging and sampling water within the borehole with a peristaltic pump. Direct-push drilling activities will typically follow Floyd|Snider Standard Guidelines for Soil Sampling.

3.1 TAILGATE SAFETY MEETING

Conduct a tailgate safety meeting prior to beginning work at the Site. Emergency evacuation procedures, rally points, and onsite communication protocols should be discussed at the first tailgate meeting and repeated if new personnel join the field team onsite.

The safety meeting should cover the hazards specific to direct-push groundwater sampling. Typical hazards of this type of sampling include:

- Drilling with a direct-push rig
  - Buried utilities
  - Pinch points

  - Hot exhaust and fire hazards
  - Overhead equipment
  - Moving heavy equipment such as direct-push rods
  - Loud noise
- Well point purging and sampling
  - Lifting heavy buckets and coolers
  - Splash hazards from water/mud
  - Sharp blades
  - Electrical hazards when working with exposed battery contacts
- Site Hazards
  - Traffic
  - Slips, trips and falls (uneven terrain, wet ground, equipment on site, etc.)
  - Biological (insects, animals, plants)
- Chemical hazards (refer to HASP for Site COCs)

Record the meeting attendees and topics discussed on the front page of the tailgate safety meeting form. All attendees should sign the form. The drilling crew may have an additional safety meeting template and meeting form to cover more specific hazards related to operation of and working around the drill rig.

3.2 OTHER HEALTH AND SAFETY GUIDELINES

The following are additional health and safety guidelines that should be followed in the field. These guidelines are intended to supplement the guidelines and requirements identified in the HASP and are not intended to replace the HASP.

- Review and sign the HASP prior to going into the field.
- Conduct a tailgate safety meeting prior to beginning work at the site as discussed in Section 3.1
- When moving between well points or switching to different tasks (e.g., transitioning from sampling to cooler QC prior to lab pickup), assess any additional hazards that may be associated with the new location or task. Record additional hazards noted and corrective actions to address those hazards on the Daily Tailgate Safety Meeting and Debrief Form (included as an attachment to the HASP).
- Record near misses and incidents on the Near Miss and Incident Reporting Form (included as an attachment to the HASP) and conduct management/client notifications according to the protocols detailed in the HASP.

3.3 CALIBRATION OF WATER QUALITY METERS

Water quality meters used during groundwater sampling (if applicable) will be calibrated prior to each sampling event. Calibration procedures are outlined in each instrument's specific user manual.

3.4 PURGING AND SAMPLING PROCEDURES

Once the direct-push drilling activities have reached the desired depth, a new polyvinyl chloride (PVC) or decontaminated stainless-steel casing and screen is temporarily installed in the borehole by the driller. Record the depth-to-water and total depth of the well to calculate the volume (this is calculated by multiplying the area inside the casing by the height of water in the casing).

- The maximum depth to water that can be sampled in a temporary well point using a peristaltic pump is approximately 20 to 25 feet bgs. For wells with 25 feet or less of head, slowly lower new polyethylene or Teflon tubing down the temporary casing and use a peristaltic pump to purge and collect groundwater samples. When sampling temporary well points with a bottom screen depth greater than approximately 10 feet, it is important to measure the length of tubing prior to placement as longer lengths of tubing are more likely to get caught or otherwise obstructed and feel like it has reached the bottom; this issue can be mitigated by using decontaminated stainless steel tubing weights.
- For temporary well points with more than 25 feet of head, connect a submersible pump to a discharge line of appropriate length to situate the pump within the lower half of the water column. Slowly lower the decontaminated submersible pump with a discharge line into the monitoring well and note any restrictions. If the connection of the polyethylene tubing to the pump outlet does not feel secure, use a small hose clamp to reinforce the connection. A small piece of silicone tubing maybe used to connect a pump outlet and polyethylene tubing of different diameters.
- The discharge line should be directed to a 55-gallon drum (or 5-gallon drum or bucket), provided by the drilling subcontractor to contain the purge water generated. Purging will continue until the groundwater is visually clear (if achievable) or at least 3 well volumes have been removed. Collect water quality parameters, if applicable, either by lowering the quality instrument into the well or placing the instrument into a container filled with purge water. The following water-quality parameters may be collected prior to sampling:
    - pH
    - Specific conductivity
    - Dissolved oxygen
    - Temperature
    - Turbidity
    - Oxidation Reduction Potential (ORP)

After the well has been purged and the sample bottles have been labeled, the groundwater sample will be collected by directly filling the laboratory-provided bottles from the pump discharge line. All sample containers should be filled with minimum disturbance by allowing the water to flow down the inside of the bottle or vial. When collecting a volatile organic compound (VOC) sample, fill to the top to form a meniscus over the mouth of the vial prior to placing the cap in order to eliminate air bubbles. Do not overfill preserved sample jars or pre-cleaned Volatile Organic Analyte (VOA) sampling vials.

If sampling for dissolved analytes (such as metals), collect these samples last and with attention to the flow direction arrow, fit an in-line filter at the end of the discharge line, invert filter to minimize air bubbles and allow a minimum of 0.5 to 1 liter of groundwater to pass through the filter prior to collecting the sample.

Sample labels will clearly identify the project name, sampler's initials, sample location and unique sample ID, analysis to be performed, date, and time. Upon collection, place samples in a cooler maintained at a temperature of approximately 4 to 6 degrees Celsius (°C) using ice (if required). Complete the chain-of-Custody forms. Upon transfer of the samples to the laboratory, the Chain-of-Custody Form will be signed by the persons transferring custody of the sample containers to document change in possession.

When sample collection is completed at a designated location, remove and properly dispose of the tubing and temporary well screen and casing or decontaminate reusable tubing and well screens. In most cases, this waste is considered solid waste and can be disposed of as refuse.

4.0 Decontamination

Prior to moving to the next sampling location, all reusable equipment that has come into contact with groundwater should be decontaminated using the processes described in this section.

Water Level Meter: The water level indicator and tape will be decontaminated between direct-push sampling locations and at the end the day by spraying the entire length of tape that came in contact with groundwater with an Alconox (or similar)/water mixture followed by a thorough rinse with distilled or deionized water.

Water quality sensors and flow-through cell (if used): Use distilled or deionized water to rinse the water quality sensors and flow-through cell. No other decontamination procedures are recommended since the equipment is sensitive. After the sampling event, the water quality meters will be cleaned and maintained according to the specific manual.

Submersible Pump: Decontaminating the pump requires running the pump in three progressively cleaner grades of water.

1. Fill a bucket with approximately 4 gallons of an Alconox (or similar)/clean water solution to sufficiently cover the pump. Place the pump and the length of the power cord (and reusable tubing, if applicable) that was in contact with water into the bucket

and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

2. Fill a second bucket containing approximately 4 gallons of clean water to sufficiently cover the pump. Place the pump and cord (and reusable tubing, if applicable) into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.
3. Fill a third bucket with approximately 4 gallons of distilled or deionized water to sufficiently cover the pump. Place the pump and cord (and reusable tubing, if applicable) into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

The Alconox/water solution may be re-used; however, rinse water should be collected for disposal as described in Section 5.0 below. When done for the day, dry the exterior of the pump and cord with clean towels to the extent practical prior to storage: all decontaminated water (including Alconox solution) should be managed in accordance with Section 5.0 below.

All reusable equipment on the drill rig (such as casings and rods) that comes into contact with soil or groundwater will be decontaminated by the driller between locations. The drilling subcontractor will store all decontaminated water in labeled 55-gallon drums on-site for proper disposal unless otherwise specified.

5.0 Investigation-Derived Waste (IDW)

Unless otherwise specified in the project-specific work plan, water generated during groundwater sampling activities will be contained and stored in a designated area until it can be transported and disposed of off-site in accordance with applicable laws. This includes purge water and decontamination wash water.

The approach to handling and disposal of these materials for a typical cleanup site is as follows.

For IDW that is containerized, (such as purge water), 55-gallon drums (or other smaller sized drums) approved by the Washington State Department of Transportation will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “purge water”), the dates on which the wastes were placed in the container, the owner’s name, contact information for the field person who generated the waste, and the site name.

IDW containerized within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate, for disposal. Refer to the FS Special Condition Standard Guideline for Investigation Derived Waste for additional information regarding proper profiling and disposal of wastewater generated by groundwater sampling

Disposable sampling materials and incidental trash such as paper towels and gloves/other disposable PPE used in sample processing will be placed in heavy-duty garbage bags or other appropriate containers and disposed of as trash in the municipal collection system, unless otherwise specified in the SAP.

6.0 Field Documentation

Drilling and groundwater sampling activities will be documented in field sampling forms and/or notebooks and Chain-of-Custody Forms. Information recorded will at a minimum include personnel present (including subcontractors), purpose of field event, weather conditions, sample collection date and times, sample analytes, depths to water, water quality field measurements (if collected), amount of purged water generated, and any deviations from the SAP.

At the end of the day, complete and review the second page of the tailgate safety meeting form detailing additional hazards, corrective actions, near-misses or incidents. Any incidents that result to field staff injuries or have the potential to result in staff injuries should be reported immediately to the PM.

7.0 Demobilization

Upon returning to the office, ensure that all equipment is property cleaned and put away in the field room. Equipment with rechargeable batteries should be plugged in as appropriate. It is preferable to dispose of trash on-site, but any trash left in the field vehicle should be brought upstairs, labeled and placed in the front production room.

If equipment or sample coolers will be placed at the front desk for pickup, clearly label each item with the company picking it up and anticipated pickup time frame. Notify front desk staff if any items require a signature at pickup.

Within one week of returning from the field, the field lead for the event should review field notes, sampling forms and tailgate safety meeting forms with the PM. Following PM review and approval, field notes will be scanned and saved to the project folder. Hard copies should be filed. The PM will provide copies of near miss and incident reports to the Safety Program Manager.

Enclosures: Groundwater or Surface Water Sample Collection Form

Record of revisions:

Revisions	Date
Added health and safety information, reviewed EPA guidance, and added revisions table.	12/9/2022

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project:_____ Date of Collection: _____

Task:_____ Field Personnel: _____

Purge Data

Well ID: _____ Secure: ☐ Yes ☐ No Ecology Tag #: _____ Casing Type/Diameter/Screened Interval _____

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) _____ Stripped (#) _____ Other Damage: _____

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal): _____

Depth of water (from TOC):_____Time: _____

Total Depth (from log or field measurement): _____

After 5 minutes of purging (from top of casing): _____

Begin purge (time): _____End purge (time): _____

Volume purged:_____ Purge water disposal method_____

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (_____)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments

Sampling Data

Sample No: _____ Location and Depth: _____

Date Collected (mo/dy/yr):_____ Time Collected: _____ Weather:_____

Type: ☐ Ground Water ☐ Surface Water Other: _____ Sample: ☐ Filtered ☐ Unfiltered Filter Type:_____

Sample Collected with: ☐ Bailer ☐ Pump Other: _____ Type: ☐ Peristaltic ☐ Bladder ☐ Submersible Other: _____

Water Quality Instrument Data Collected with: Type: ☐ YSI ProDSS ☐ Tudbidity Meter ☐ Other: _____

Sample Decon Procedure: Sample collected with: ☐ decontaminated <u>all</u> tubing; ☐ disposable tubing ☐ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): _____

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes

QC samples

Duplicate Sample No: _____ Duplicate Time: _____ MS/MSD: ☐ Yes ☐ No

Signature: _____ **Date:** _____

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F|S STANDARD GUIDELINE

Soil Logging

DATE/LAST UPDATE: October 2019

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step by step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and should review and understand these procedures prior to going in the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

These soil logging standard guidelines should be used by the field staff performing subsurface investigations, such as a direct push or roto-sonic soil boring, installation of a monitoring well via hollow stem auger, or roto-sonic or mud rotary drilling. While many projects will not necessarily have a Licensed Geologist (LG) or Hydrogeologist (LHG) who reviews and stamps every boring log, it is important that the field staff discusses the soil logging needs for a particular investigation with the project geologist, the project manager, or whoever will ultimately be responsible for interpreting the findings of the field investigation. This discussion is in addition to field training and general knowledge about soil logging, and should happen prior to entering the field, with additional follow-up before drafting a final set of electronic logs, after the investigation is complete.

2.0 Equipment and Supplies

Logging Equipment and Tools:

- 100-foot tape measure or measuring wheel
- Handheld Global Positioning System (GPS; optional)
- Unified Soil Classification System (USCS) Soil Classification Field Guide
- Soil logging kit containing:

  - Stainless steel spoons
  - Paint scraper or trowel
  - Small Ziploc bags
  - Small stainless steel bowls or black mining pans for sheen testing
  - Spray bottle filled with water
  - Paper towels (preferably white)
  - Engineers tape
  - Note cards
  - Optional items include:
    - Empty VOA vials or small glass jars
    - Munsell color chart
    - Sieves
    - White and grayscale color cards for photographs
- Plastic sheeting and duct tape or clamps to cover the sampling table
- Camera
- Trash bags
- Coolers
- Jars
- Labels
- Ice

Paperwork:

- Work Plan and/or Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP)
- Health and Safety Plan (HASP)
- Copies of figures showing previous boring locations and boring logs from previous investigations, if available
- Boring log forms (enclosed) appropriate for drilling method, printed in Rite in the Rain paper and/or bound field notebook
- Permanent markers and pencils

Personal Equipment:

- Steel-toed boots
- Hard hat
- Safety vest

- Safety glasses
- Nitrile gloves
- Ear plugs
- Rain gear
- Work gloves

3.0 Standard Procedures

3.1 OFFICE PREPARATION

First, meet with the project manager or field manager to identify the key information and goals of the soil boring investigation. These may include fill history, known or suspected sources of contamination and potential field indications of these contaminants, identification of specific units, or important geotechnical measurements. If possible, select a boring log template that is appropriate for the project needs.

Next, review the work plan and all available existing materials such as cross-sections or boring logs from previous investigations to familiarize yourself with the site geology. In addition (or alternatively if other information is not available), you may also review a geologic map of the area from a reputable source such as United States Geological Survey (USGS).

Finally, check the area of the site where drilling will occur for underground objects. At minimum, a OneCall locate request should be made at least one week in advance of drilling in order to give public utility locators time to mark known buried utility lines. All planned boring locations should be marked on the ground with white spray paint prior to making a locate request. In almost all cases, a private utility locator should also clear the area of drilling any underground objects using electromagnetic techniques. If drilling is to occur in close proximity to buried utilities, the work plan may specify use of an air knife or vacuum to clear the borehole to a depth below the utility lines.

3.2 COLLECTING SOIL SAMPLES FOR CLASSIFICATION

1. Before beginning drilling, record the following information on each log:
    a. Operator's name and company, equipment make/model, equipment measurements (i.e., sampler length and diameter, hammer weight and stroke if using hollow stem auger, boring diameter)
    b. Your name, date, project, boring name and approximate descriptive location (i.e., where is the soil boring relative to known site features). Include a description of the ground surface and whether or not coring was necessary, if coring was necessary, include core diameter, concrete thickness, and subcontractor information.

c. A small hand drawn map showing your location with measurements to a stationary reference point, or GPS coordinates (ideally, both). This is also a good place to note if you have had to move a boring location because of underground utilities, access issues, etc. It is important to note the reason for relocation and the direction and distance moved (i.e., moved 10 feet to the north due to presence of subsurface water line).

2. If you are using a hollow stem auger drilling method, it is important to communicate to the driller how often you would like a split spoon sample collected. Typically this would be continuous or every 5 feet but may be different depending on the project needs.
3. Note any feedback from the driller about the drilling conditions. This may include difficult drilling or rig chatter (usually caused by hard materials), heaving sands (usually caused by hydrostatic pressure on the borehole), caving, or hole instability.
4. For split spoon samples, record the number of hammer blows (blow counts) necessary to drive the sampler each 6-inch increment, as reported by the driller. If more than 50 blows are needed, record the distance that the sampler was driven in 50 blows (i.e., 2-inches in 50 blows). This is referred to as the standard penetration test.
5. Cover the sampling table with plastic sheeting. Lay an engineer's tape lengthwise across the sampling table. Once a sample has been collected, orient it on the table so that the top is aligned with the 0-foot mark on the tape.
6. Split open the sampler, core barrel liner, or sample collection bag. Record the depth interval that the sampler was driven and the depth interval of soil that was recovered. For split spoons or single-cased core barrels, such as Geoprobe direct-push rods, determine whether any loose 'slough' soil has been dislodged by the drilling equipment and deposited at the top of your core (AMS direct push rods are double cased and do not create slough). Do not include slough in the measurement of the soil recovered. Often the core will be filled with an uninterrupted column of soil that is shorter in length than the total drive interval. In such cases, record the recovery interval as it is situated in the core unless you are able to determine the actual depth where the soil sample originated. For the purposes of recording soil observations and collecting samples for analysis, assume that the recovered column of soil has been evenly compressed unless you are able to determine the interval(s) in which compression has occurred. Decompress the recovered soil when making further observations (e.g., if the recovered soil column is 80 percent of the length of the drive interval, assume 0.8 feet of recovered soil represent 1 foot of soil in situ).
7. Before further disturbing the soil, take volatile organic compound (VOC) measurements with a photoionization detector (PID), if using. Take measurements by making crevices in the soil with a spoon or scraper and inserting the PID probe into these openings. Alternatively, collect small spoonfuls of soil into Ziploc bag(s), seal the bag(s), gently shake the bag(s), and insert the PID probe through the top of the bag(s) and into the headspace once the soil vapor has been allowed to equilibrate with the

surrounding air (headspace method). The bag headspace screening method is typically more accurate and is useful at sites with low concentrations of VOCs, whereas the in-situ method is a faster and more qualitative method, best used at sites with higher VOC concentrations. If sampling for VOCs by the U.S. Environmental Protection Agency (USEPA) Method 5035, these soil samples should also be collected prior to disturbing the core. Soil sampling procedures using USEPA Method 5035 are described in detail in the Soil Sample Collection Standard Guideline.

8. Use a straight edge to scrape the soil level and expose the center of the core. Photograph the core alongside the measuring tape and an index card displaying the soil boring location/ID and depth interval.

3.3 SOIL CLASSIFICATION

Soils are described using the following characteristics: Color, consistency, MAJOR CONSTITUENT, minor constituent, geotechnical properties, moisture content, other observations (e.g. visual or olfactory indications of contamination). The USCS field guide is included in this guidance for reference. The steps below should help guide the logger in classifying soils according to the USCS.

1. Record the color of the soil. A descriptive color (i.e., light brown) or a color identified using the Munsell color chart are both valid.
2. Determine whether organic matter influences the properties of the material. If so, record as an organic soil.
3. If the soil is predominantly inorganic, identify whether the major constituent is coarse- or fine-grained. Coarse-grained soils include sands and gravels; fine-grained soils include silts and clays.
    a. For coarse grained soils, determine:
        i. Grain size(s) present including fine, medium, or coarse, and grain size distribution including well-graded (a mixture of fine to coarse grains) or poorly-graded (uniform in size). The USCS guide is helpful for determining grain sizes. If the major constituent is gravel, note its angularity using “rounded,” “sub-angular” or “angular.”
        ii. Minor constituent(s). If a minor constituent represents less than approximately 15% of the sample, note this as “with [minor constituent]” and optionally, whether it is “trace” (<5%) or “few” (5-15%). If a minor constituent represents more than 15% of the sample, use “[minor constituent]-y.” For example, a sand with 5% silt would be classified as a “SAND with trace silt” and sand with 30% silt would be classified as a “SILTY SAND.” For coarse-grained soils with fines between 5% and 15%, the USCS includes several dashed classifications, such as SW-SM. It is often helpful to record an estimated percentage for soil constituents to aid in classification according to the USCS.

b. For fine-grained soils, determine:

   i. Major constituent. To determine whether a material is silt or clay, a simple settling test may be performed in a glass vial or gloved hand by spraying a small amount of the sample with water. Silt particles will settle out of suspension in water within a few minutes, whereas clay particles will remain suspended for a longer period of time.

   ii. Minor constituent(s). As described above, determine the approximate percentage and record as "with [minor constituent]" or "[minor constituent]-y" as appropriate. It is often helpful to record an estimated percentage to aid in classification according to the USCS.

   iii. Geotechnical properties. Depending on project data needs, geotechnical properties may be optional but often provide helpful information. Geotechnical properties include plasticity (ranging from "non-plastic" to "highly plastic" as determined by a thread test) and consistency (ranging from "loose" to "very dense" for coarse-grained soils and "soft" to "hard" for fine-grained soils). When using split spoon samplers, blow counts recorded during the standard penetration test (also referred to as N-values) are used to determine consistency; when using direct-push or sonic drilling, consistency is described qualitatively.

4. Using the USCS guide and the description of the soil, determine the appropriate USCS symbol and record it on the log. If it is difficult to distinguish the major constituent of a soil, a borderline "/" symbol may be used to denote the two potential major constituents present. This is not the same as the USCS classifications that utilize a dash, such as SW-SM.

5. Determine whether contacts between stratigraphic units are abrupt, or gradational. Note abrupt contacts using a solid line and gradational contacts using a dotted line. If the contact between units is not visible and was missed between sample depths, a dashed line is used.

6. If the site or area geology is known, and you are confident in your identification of a specific stratum, note the geologic unit. At a site where the geology is uncertain, you may make some more general notes about the depositional environment, such as identifying probable estuarine deposits, colluvium, glacial till, etc.

7. Note the moisture content of the soil, using "dry," "moist," "wet," or "saturated." Mark the water table at the time of drilling on the log at the depth where saturated soil is first observed.

3.4 OTHER OBSERVATIONS

1. Record other materials observed in the sample. These may include minor amounts of rootlets or other plant matter, evidence of organisms such as shell fragments, and/or anthropogenic debris such as brick fragments, plastic, or metal debris.
2. Record potential indications of contamination. These may include odors, colored or black staining on soils, colored crystals, hydrocarbon sheens, or non-aqueous phase liquid (NAPL) product.
    a. To test for hydrocarbon sheen, put a small amount of soil in a bowl, saturate with water and swirl, noting whether a rainbow sheen appears on the surface of the water. Alternatively, place a small amount of water in the bottom of the bowl and a small amount of soil along the side, then tilt the bowl so that the water slowly touches the soil. If observed, note the color of the sheen and describe as slight (discontinuous on the water surface), moderate (continuous but spreading slowly) or high (rainbow sheen covering entire surface water).
    b. To test for the presence of NAPL, use a clean paper towel to blot the surface of the core and note the proportion of the towel that is saturated with oil (be sure to allow the towel to dry when blotting moist to wet soils to distinguish between saturation due to NAPL and due to water).
3. Note the final depth of the boring and any reasons for early termination of the boring (i.e., refusal).
4. If monitoring wells will be installed, follow the Standard Guidelines for monitoring well construction and well development.

4.0 Decontamination

All reusable equipment that comes into contact with soil should be decontaminated as follows prior to moving to the next sampling location.

Split spoons, stainless steel bowls and spoons, and any other tools used for soil classification must be decontaminated between boring locations. If collecting soil samples for chemical analysis, split spoons and any tools used for sample processing must be decontaminated between each sample; alternatively, disposable bowls and spoons may be used. Equipment decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an alconox (or similar)/clean water solution and a final rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, waste soils and other drilling materials generated during soil boring activities will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials is as follows. For investigation-derived waste (IDW) that is contained, such as waste soils, 55-gallon drums approved by the Washington State Department of Transportation (WSDOT) will be supplied by the driller and used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “soil cuttings”), the dates on which the wastes were placed in the container, the owner’s name, contact information for the field person who generated the waste, and the site name.

Whenever possible, IDW contained within drums will be characterized relative to applicable waste criteria using data from the sampling locations. Material that is designated for off-site disposal will be transported to an off-site facility that is permitted to accept the waste. Manifests will be used as appropriate for disposal.

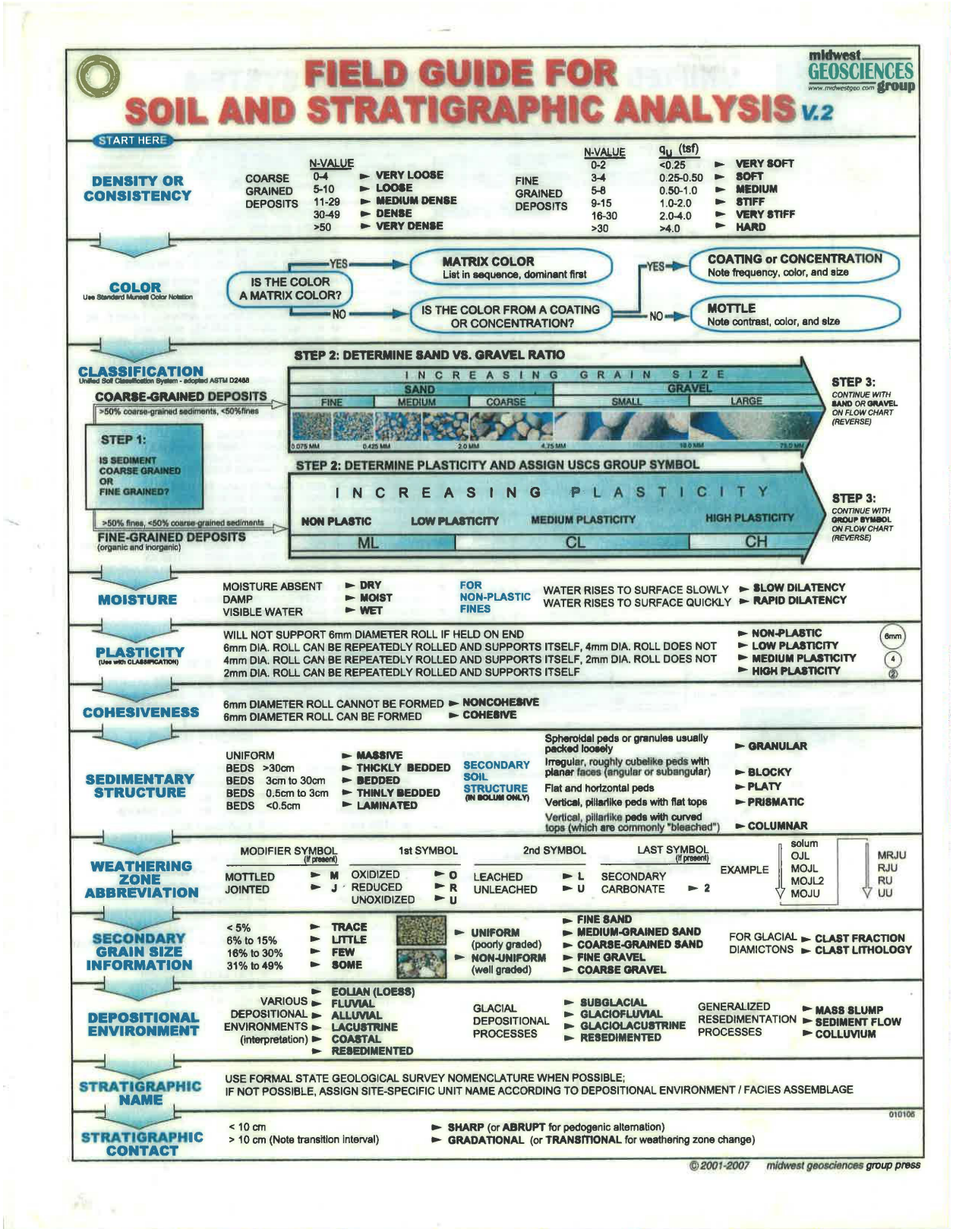
Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy duty garbage bags or other appropriate containers and disposed of as solid waste in the municipal collection system (i.e., site dumpster).

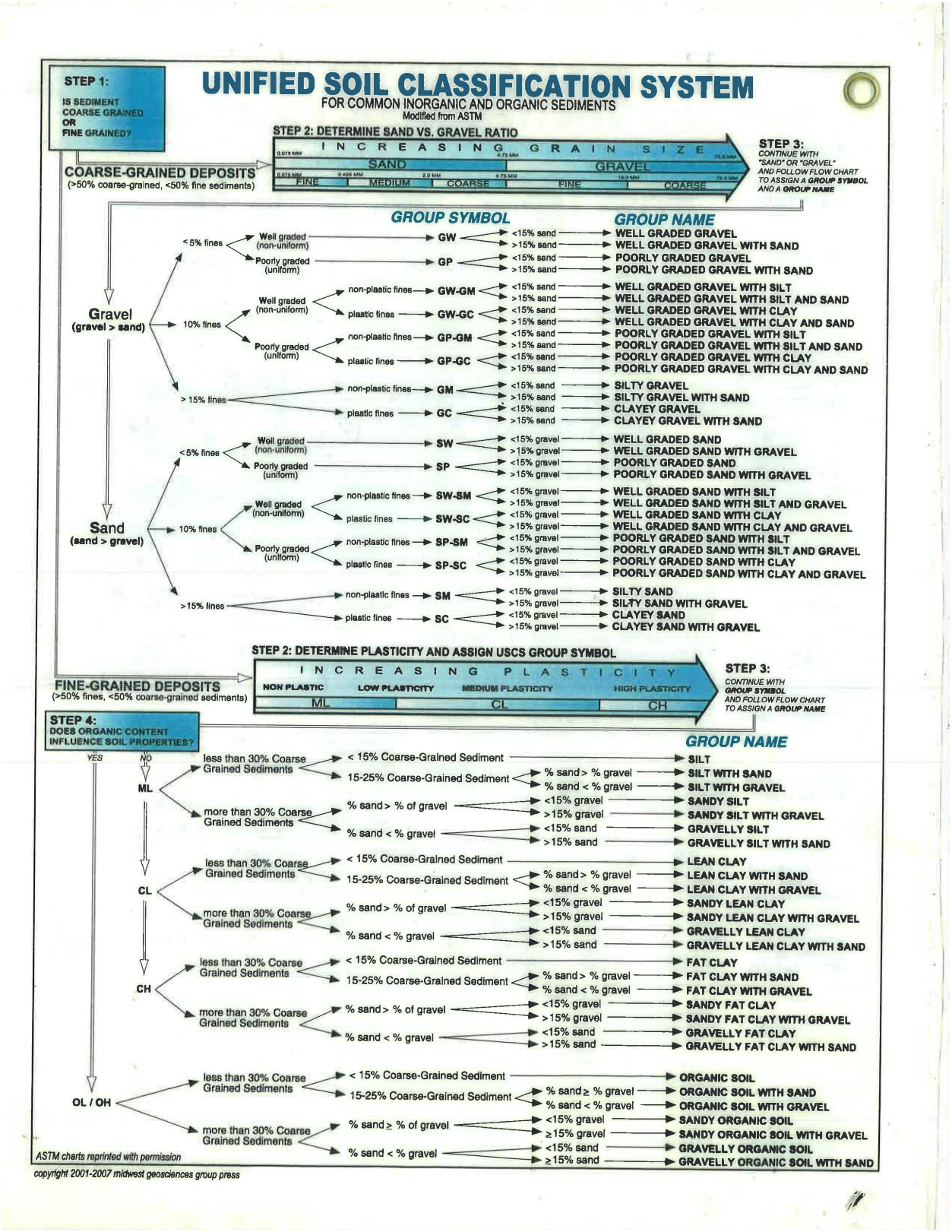
6.0 Field Documentation

All observations should be recorded on a soil boring form appropriate for the drilling method or in a bound field notebook. Field staff should make an effort to record as much detail as possible in the field log. After the field work is complete, a set of final logs (usually electronic) that serve as the record for the project will be completed in consultation with the project manager or field manager.

Enclosure: USCS Soil Classification Field Guide
Boring Log

USCS SOIL CLASSIFICATION FIELD GUIDE




UNIFIED SOIL CLASSIFICATION SYSTEM
FOR COMMON INORGANIC AND ORGANIC SEDIMENTS
Modified from ASTM
STEP 1:
IS SEDIMENT COARSE GRAINED OR FINE GRAINED?
COARSE-GRAINED DEPOSITS
(>50% coarse-grained, <50% fine sediments)
STEP 2: DETERMINE SAND VS. GRAVEL RATIO
INCREASING GRAIN SIZE
SAND
GRAVEL
FINE
MEDIUM
COARSE
FINE
COARSE
STEP 3:
CONTINUE WITH "SAND" OR "GRAVEL" AND FOLLOW FLOW CHART TO ASSIGN A GROUP SYMBOL AND A GROUP NAME
GROUP SYMBOL
GROUP NAME
Gravel (gravel > sand)
< 5% fines
Well graded (non-uniform)
GW
<15% sand
WELL GRADED GRAVEL
>15% sand
WELL GRADED GRAVEL WITH SAND
Poorly graded (uniform)
GP
<15% sand
POORLY GRADED GRAVEL
>15% sand
POORLY GRADED GRAVEL WITH SAND
10% fines
Well graded (non-uniform)
non-plastic fines
GW-GM
<15% sand
WELL GRADED GRAVEL WITH SILT
>15% sand
WELL GRADED GRAVEL WITH SILT AND SAND
plastic fines
GW-GC
<15% sand
WELL GRADED GRAVEL WITH CLAY
>15% sand
WELL GRADED GRAVEL WITH CLAY AND SAND
Poorly graded (uniform)
non-plastic fines
GP-GM
<15% sand
POORLY GRADED GRAVEL WITH SILT
>15% sand
POORLY GRADED GRAVEL WITH SILT AND SAND
plastic fines
GP-GC
<15% sand
POORLY GRADED GRAVEL WITH CLAY
>15% sand
POORLY GRADED GRAVEL WITH CLAY AND SAND
> 15% fines
non-plastic fines
GM
<15% sand
SILTY GRAVEL
>15% sand
SILTY GRAVEL WITH SAND
plastic fines
GC
<15% sand
CLAYEY GRAVEL
>15% sand
CLAYEY GRAVEL WITH SAND
Sand (sand > gravel)
< 5% fines
Well graded (non-uniform)
SW
<15% gravel
WELL GRADED SAND
>15% gravel
WELL GRADED SAND WITH GRAVEL
Poorly graded (uniform)
SP
<15% gravel
POORLY GRADED SAND
>15% gravel
POORLY GRADED SAND WITH GRAVEL
10% fines
Well graded (non-uniform)
non-plastic fines
SW-SM
<15% gravel
WELL GRADED SAND WITH SILT
>15% gravel
WELL GRADED SAND WITH SILT AND GRAVEL
plastic fines
SW-SC
<15% gravel
WELL GRADED SAND WITH CLAY
>15% gravel
WELL GRADED SAND WITH CLAY AND GRAVEL
Poorly graded (uniform)
non-plastic fines
SP-SM
<15% gravel
POORLY GRADED SAND WITH SILT
>15% gravel
POORLY GRADED SAND WITH SILT AND GRAVEL
plastic fines
SP-SC
<15% gravel
POORLY GRADED SAND WITH CLAY
>15% gravel
POORLY GRADED SAND WITH CLAY AND GRAVEL
>15% fines
non-plastic fines
SM
<15% gravel
SILTY SAND
>15% gravel
SILTY SAND WITH GRAVEL
plastic fines
SC
<15% gravel
CLAYEY SAND
>15% gravel
CLAYEY SAND WITH GRAVEL
STEP 2: DETERMINE PLASTICITY AND ASSIGN USCS GROUP SYMBOL
INCREASING PLASTICITY
NON PLASTIC
LOW PLASTICITY
MEDIUM PLASTICITY
HIGH PLASTICITY
ML
CL
CH
STEP 3:
CONTINUE WITH GROUP SYMBOL AND FOLLOW FLOW CHART TO ASSIGN A GROUP NAME
FINE-GRAINED DEPOSITS
(>50% fines, <50% coarse-grained sediments)
STEP 4:
DOES ORGANIC CONTENT INFLUENCE SOIL PROPERTIES?
YES
NO
GROUP NAME
ML
less than 30% Coarse Grained Sediments
< 15% Coarse-Grained Sediment
SILT
15-25% Coarse-Grained Sediment
% sand > % gravel
SILT WITH SAND
% sand < % gravel
SILT WITH GRAVEL
more than 30% Coarse Grained Sediments
% sand > % of gravel
<15% gravel
SANDY SILT
>15% gravel
SANDY SILT WITH GRAVEL
% sand < % gravel
<15% sand
GRAVELLY SILT
>15% sand
GRAVELLY SILT WITH SAND
CL
less than 30% Coarse Grained Sediments
< 15% Coarse-Grained Sediment
LEAN CLAY
15-25% Coarse-Grained Sediment
% sand > % gravel
LEAN CLAY WITH SAND
% sand < % gravel
LEAN CLAY WITH GRAVEL
more than 30% Coarse Grained Sediments
% sand > % of gravel
<15% gravel
SANDY LEAN CLAY
>15% gravel
SANDY LEAN CLAY WITH GRAVEL
% sand < % gravel
<15% sand
GRAVELLY LEAN CLAY
>15% sand
GRAVELLY LEAN CLAY WITH SAND
CH
less than 30% Coarse Grained Sediments
< 15% Coarse-Grained Sediment
FAT CLAY
15-25% Coarse-Grained Sediment
% sand > % gravel
FAT CLAY WITH SAND
% sand < % gravel
FAT CLAY WITH GRAVEL
more than 30% Coarse Grained Sediments
% sand > % of gravel
<15% gravel
SANDY FAT CLAY
>15% gravel
SANDY FAT CLAY WITH GRAVEL
% sand < % gravel
<15% sand
GRAVELLY FAT CLAY
>15% sand
GRAVELLY FAT CLAY WITH SAND
OL / OH
less than 30% Coarse Grained Sediments
< 15% Coarse-Grained Sediment
ORGANIC SOIL
15-25% Coarse-Grained Sediment
% sand ≥ % gravel
ORGANIC SOIL WITH SAND
% sand < % gravel
ORGANIC SOIL WITH GRAVEL
more than 30% Coarse Grained Sediments
% sand ≥ % of gravel
<15% gravel
SANDY ORGANIC SOIL
≥15% gravel
SANDY ORGANIC SOIL WITH GRAVEL
% sand < % gravel
<15% sand
GRAVELLY ORGANIC SOIL
≥15% sand
GRAVELLY ORGANIC SOIL WITH SAND
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	PROJECT:	LOCATION:	BORING ID:
	LOGGED BY:	COORDINATE SYSTEM:	
DRILLED BY:		NORTHING:	EASTING:
DRILLING EQUIPMENT:		GROUND SURFACE ELEVATION:	
DRILLING METHOD:		TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
SAMPLING METHOD:		BORING DIAMETER:	DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0							

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT:		LOCATION:	BORING ID:
LOGGED BY:		COORDINATE SYSTEM:	
DRILLED BY:		NORTHING:	EASTING:
DRILLING EQUIPMENT:		GROUND SURFACE ELEVATION:	
DRILLING METHOD:		TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
SAMPLING METHOD:		BORING DIAMETER:	DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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F|S STANDARD GUIDELINE

Soil Sample Collection

DATE/LAST UPDATE: December 2022

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field but are not intended to be step by step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline presents commonly used procedures for collection of soil samples for characterization and laboratory analysis. The methods presented in this guideline apply to the collection of soil samples during the following characterization activities: soil borings via drilling, manual collection of shallow soil samples, test pit excavation, excavation confirmation, and stockpile characterization. Specific details regarding the collection of discrete and composite samples, and special sampling techniques for volatile organic compounds (VOCs) are also included. The guideline is intended to be used by staff who collect soil samples in the field.

It is important that the field staff completing the soil sample collection discusses the specific needs for a particular investigation with the project geologist, the project manager, or whoever will ultimately be responsible for interpreting the findings of the field investigation. This discussion is in addition to field training and general knowledge about soil sampling, and should happen prior to entering the field, with additional follow-up before finalizing the field forms, after the investigation is complete.

2.0 Equipment and Supplies

Soil Sampling Equipment and Tools:

- Tape measure or measuring wheel
- Stainless steel bowls and spoons
- Trowel, hand auger, or shovel (if needed)
- Table and disposable sheeting, tape or clamps to hold down sheeting (if needed).
- White board and dry erase pen
- Graduated plunger and collection tubes for VOC samples (if needed)
- Photoionization detector (PID) (if needed)
- Ziploc bags (sandwich and gallon sizes)
- Trash bags
- Decontamination tools including:
  - Paper towels or shop towels
  - Spray bottles of Alconox (or similar) solution
  - Deionized or distilled water
  - Scrubbing brush and bucket
- Adhesive drum labels, and paint or grease pen
- Washington State Department of Transportation- (WSDOT) approved drums for investigation-derived waste (IDW) disposal, if needed (if drilling, to be provided by driller)
- Camera
- Hand-held global position system (GPS; if needed)
- Coolers, sample jars, labels, ice

Paperwork:

- Work Plan and/or Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP)
- Field map printed on Rite in the Rain paper
- Site-specific Health and Safety Plan (HASP)
  - Tailgate meeting form (for each day you expect to be on Site)
  - Safety Data Sheets
- Floyd|Snider's Accident Prevention Plan (APP)

- Sample collection forms printed in Rite in the Rain paper
- Boring Logs
- Rite in the Rain field notebook
- Chain of custody forms
- Emergency contact numbers for utilities, property owner/manager, etc. (as needed)

Safety Equipment:

- Steel-toed boots
- Safety vest
- Safety glasses
- Nitrile gloves
- Rain gear
- Work gloves
- Hard hat
- Ear protection
- Traffic barricades or cones
- Vehicle emergency kit (road flares, fire extinguisher, first aid kit, etc.)
- Sunscreen if needed
- Hand and foot warmers, if needed
- Mosquito repellent, Hornet Spray, if needed
- Drinking water
- Rain or sun shelter, if needed
- Cell phone and charger cables

3.0 Standard Procedures

3.1 OFFICE PREPARATION

Prior to going into the field, review the SAP and QAPP to become familiar with the sampling goals, data quality objectives, desired sample intervals and nomenclature, field Quality Assurance (QA) samples (i.e., frequency of field duplicates, MS/MSDs) to be collected, analytes, sample containers, and holding times for each analytical method.

At least one week prior to sampling, coordinate with the laboratory specified in the SAP/QAPP to receive coolers and appropriate sample containers (including additional containers for

QA samples). Familiarize yourself with the volume requirements and container types, preservation methods, and holding times for each class of analytes.

If drilling or digging test pits, mark the sample area and sample locations with white spray paint prior to sampling, then submit an 811 public utility locate request at least 3 business days prior to work. Hire a private utility locator and schedule to locate utilities on private property and ensure proposed boring and/or excavation locations are free of utilities (Note: not all locators are equipped to mark non-conductible utilities).

3.2 TAILGATE SAFETY MEETING

Conduct a tailgate safety meeting prior to beginning work at the Site. Include any subcontractors working with you at the Site in this meeting. The safety meeting should cover the hazards specific to soil sampling. Typical hazards include:

- Heavy machinery/drill rig awareness (overhead hazards, pinch points, noise, uncontrolled release of energy). Always make eye contact before approaching an operator.
- Physical hazards (heavy lifting, uneven ground/trip hazards)
- Chemical hazards (dust, site-specific contaminants of concern, lab preservatives)
    - Refer to HASP for specific air monitoring requirements, permissible exposure limits (PELs), and actions if PELs are exceeded.

Additional hazards that may be present at any job site include traffic, adverse weather, slips, trips, falls, biological hazards (such as insects, plants, animals), and worksite distractions (such as pedestrians or other onsite activities).

Record the meeting attendees and topics discussed on the front page of the tailgate safety meeting form. All attendees should sign the form.

3.3 OTHER HEALTH AND SAFETY GUIDELINES

The following are additional health and safety guidelines that should be followed in the field. These guidelines are intended to supplement the guidelines and requirements identified in the HASP and are not intended to replace the HASP.

- Review and sign the HASP prior to going out into the field.
- Conduct a tailgate safety meeting prior to beginning work at the site as discussed in Section 3.2.
- If conditions change (e.g., weather or personnel) or when moving between sampling locations/switching to different sampling tasks, assess any additional hazards that may be associated with the new condition or location/task. Record additional hazards noted and corrective actions to address those hazards on the second page of tailgate safety meeting form.

Record near misses and incidents on the Near Miss and Incident Reporting Form (included as an attachment to the HASP) and conduct management/client notifications according to the protocols detailed in the HASP.

3.4 GENERAL SOIL SAMPLE COLLECTION PROCEDURES

1. Locate the desired sample location and depth interval using a handheld GPS or by taking field measurements from known site features. Record the soil type and any other observations or indications of contamination on a soil boring log (enclosed), soil sample collection form, or field notebook, as described in the Soil Logging Standard Guideline. Note the location and depth of the sample on the whiteboard or notecard and take a photograph with a scale (e.g., tape measure), if possible.
2. Refer to Sections 3.4.1 through 3.4.4 for the appropriate soil collection procedures for drilling, shallow soil, test pit excavation, excavation confirmation, and stockpiles. If collecting samples for VOC analysis by the U.S. Environmental Protection Agency (USEPA) Method 5035, refer to Section 3.5 for specific sample collection procedures for this method. If composite soil sampling is recommended, refer to Section 3.6 for details.
3. Once soil has been collected from the desired depth or interval, mix thoroughly in a disposable or decontaminated stainless-steel bowl until the sample is homogenous in color, texture, and moisture.
4. Fill the required laboratory-provided jars, taking care not to overfill. If large gravels (diameter greater than ~ 1 inch) are encountered, these should be discarded to ensure that an adequate soil volume is collected for analysis. If necessary, use a clean paper towel to remove soil particles from the threaded mouth of the jar before securing lids to ensure a good seal. Remove any soil or dirt from the outside of the jar with a clean paper or shop towel.
5. Label each jar with the sample name, date, time, field staff initials and required analyses. If collecting a field duplicate, use the sample nomenclature specified in the SAP\QAPP and note the field duplicate name and sample time in the sample log and/or field notebook. If extra volume for matrix spike/matrix spike duplicate (MS/MSD) analysis is required, use the same name on all jars. Soil samples should be protected from moisture by placing the filled sample jars into separate sealed Ziploc bags before placing them into a cooler.
6. Upon completion of each day of sampling, complete a chain-of-custody form for all samples, including sample names, date and time of collection, number of containers, and required analyses and methods. Write neatly and make sure information on the chain is legible. If you need to correct an entry, strike the incorrect entry out once, and add your initials next to the strike out. Samples collected for waste characterization purposes should be recorded on a separate chain-of-custody. Keep samples on ice (unless otherwise specified in the SAP/QAPP) to maintain

temperatures of 4-6 degrees Celsius (°C) and transport to the laboratory under chain-of-custody procedures.

3.4.1 Soil Sample Collection via Drilling

These procedures should be used for drilling via direct-push, hollow stem auger, or roto-sonic methods where a pre-designated sample interval (i.e., 0 to 5 feet below ground surface [bgs]) is retrieved from the subsurface using a split spoon sampling device, lined core, or bag sampler.

1. Ensure that reusable sampling equipment has been thoroughly decontaminated prior to sampling.
2. Collect PID measurements and other field tests, if necessary. PID measurements should be collected using the head-space method: put a small amount of soil from the selected interval into a sandwich bag and seal the bag. Label the bag with the soil interval. After at least 10 seconds, insert the tip of the PID into the bag and record the PID reading on the boring log or field collection form. If a sheen test is necessary, place a small amount of soil into a disposable or decontaminated stainless steel bowl, spray it with tap water or deionized water and observe whether a sheen appears on the water. Record results on the boring log or sample collection form.
3. Prior to sample collection, log soil on the boring log or sample collection form following the Soil Logging Standard Guideline.
4. Use a stainless-steel spoon or trowel, or disposable scoop to remove an equal volume of soil across the targeted depth interval from the sampler.
    a. If using a split spoon sampler or other reusable sampler, avoid collecting the soil that is touching the sides of the sampler to the extent practical.
    b. If the soil touching a reusable sampler must be collected to obtain adequate volume for analysis, notify the PM and record in the field logbook.

3.4.2 Manual Collection of Shallow Soil Samples

These procedures should be used for shallow soil sampling via scoop, trowel, shovel, or hand auger.

1. Dig or auger to the bottom depth of the shallowest sample to be collected, using a tool that has been thoroughly decontaminated. Verify that the target depth has been reached using a measuring tape.
2. If using a scoop or trowel, collect the soil directly into a decontaminated stainless-steel bowl.
3. If using a shovel, the soil may either be collected in bowls or set as aside on plastic sheeting in favor of collecting the sample from the sidewall of the hole. If sampling the sidewall, use a decontaminated or disposable scoop or trowel to collect soil from the target depth, or scrape along the sidewall to collect soil across a target depth

interval. Transfer soil to a disposable or decontaminated stainless-steel bowl, repeating until a sufficient volume has been collected.

4. If using a hand auger, empty the cylinder of the auger directly into a disposable or decontaminated stainless-steel bowl. It may be necessary to empty the hand auger onto plastic sheeting or into a bowl to reach the target depth without overflowing the sampler.
5. Any soil from depth intervals that are not targeted for sampling should be set aside on plastic sheeting and returned to the hole after sampling.
6. Collect PID measurements and other field tests as described in Section 3.4.1.

3.4.3 Sample Collection from Test Pits or Limited Soil Excavations

These procedures should be used for collecting samples from test pit explorations excavated using a backhoe or excavator. These same general procedures should also be followed for post-excavation soil samples used to confirm that an excavation has removed contaminated material or to document post-excavation conditions after target excavation limits have been reached.

1. Measure the length, width, and depth of the test pit or excavation area to verify that the target extents have been reached. The lateral spacing of the test pit or excavation confirmation samples, or exact location of samples should be specified in the work plan and typically depend on the size of the excavation area but can vary significantly by project.
2. If not specified in the work plan, sidewall samples may be collected either midway between the ground surface and base of the excavation, or incrementally along the entire height of the sidewall. Both sidewall and base (bottom) samples should penetrate a minimum of 6 inches into the excavated surface.
3. If the test pit or excavation is less than 4 feet deep, or has been benched to accommodate safe entry, a sample may be collected directly from the sidewall(s). Do not enter an excavation before reviewing and verifying the necessary safety requirements. Most excavations can be sampled without entering, which is preferred. If entering is safe, based on the depth or accommodations to support entry, to collect soil from a sidewall, use a decontaminated or disposable scoop, trowel, or shovel to obtain soil from the desired depth or depth interval directly into a decontaminated stainless-steel bowl.
4. If a test pit or excavation cannot be safely entered, instruct the excavator operator to scoop sidewall material from the target depth or depth interval. Collect the soil sample from the excavator bucket using a decontaminated stainless-steel spoon, trowel, or disposal scoop, avoiding material that has come into contact with the teeth or sides of the bucket. Place an adequate volume of soil into a decontaminated stainless-steel bowl. If necessary, follow the compositing procedures in Section 3.6.

3.4.4 Stockpile Sampling

These procedures should be used for classifying stockpiled soil, including excavated soil and imported backfill material.

1. Where potentially contaminated soils have been previously excavated and stockpiled on site, Washington State Department of Ecology (Ecology) guidance recommends using a decontaminated or disposable scoop or trowel, penetrating 6 to 12 inches beneath the surface of the pile at several locations until sufficient volume for analysis is achieved. A decontaminated shovel may also be used to facilitate collection of soil from large piles. The locations for soil collection should be where contamination is most likely to be present based on field screening (i.e., staining, odor, sheen, or elevated photoionization detector [PID] readings). If there are not field indications of contamination, the locations should be distributed evenly around the stockpile.
2. The stockpile may need to be broken up into sections for sample collection depending on the size of the pile (i.e., segregate the pile in half or quarters). If this is necessary, it is important to document where each set of samples were collected from (i.e., north quadrant) and create a field sketch in the project notebook of the pile for reference and mark sample locations with flags.
3. If a sampling frequency is not specified in the work plan, the general rule of thumb for contaminated soil stockpile profiling is to collect and submit 3 analytical samples (these samples can be multi-point composites or grabs) for stockpiles less than 100 cubic yards (CY), 5 samples for stockpiles between 100 and 500 CY, 7 samples for stockpiles 500 to 1,000 CY, 10 samples for stockpiles 1,000 to 2,000 CY, and 10 samples for stockpiles larger than 2,000 CY with an additional sample collected for every 500 CY of material. This rule of thumb is consistent with the Washington State Guidance for Remediation of Petroleum Contaminated Site (Ecology 2016).
4. Samples for characterization of stockpiles of imported backfill or other presumed clean material should also be collected as described under 3. If not described in the work plan, the typical sample frequency for imported or clean material characterization is one sample per 500 CY.

3.5 SOIL SAMPLE COLLECTION FOR VOC ANALYSIS

If collecting soil samples for VOC analysis by USEPA Method 5035, collect these samples first before disturbing the soil. This method uses a soil volume gauge fitted with a disposable soil sampling plunger tube to collect a soil plug that can be discharged directly to a VOA vial, limiting the loss of volatiles during sampling. The collection of VOC samples using the 5035 method specifies use of an airtight VOA vial with a septum lid. Ecology's interpretation of the USEPA 5035 method allows for field preservation of the sample with methanol or sodium bisulfate, or laboratory preservation (i.e., field collection into an un-preserved vial). It is important to note that if laboratory preservation is the selected method, samples must be received at the laboratory within 48-hours of sample collection. The method of sample preservation for the 5035 method will vary for each site and is dependent on site-specific conditions. Preservation

method selection should be coordinated with the laboratory and specified in the sampling plan. Note that not all labs use the soil volume gauge as described below (some use syringes or Terra Core samplers) and that it is important to verify the sampling process with the lab.

1. Note the volume of soil needed for analysis as specified by the laboratory (commonly 5 or 10 grams). Raise the handle of the soil volume gauge to the slot in the gauge body corresponding to the desired volume and turn clockwise until the tabs in the handle lock into the slot.
2. Insert a sample tube at the open end of the gauge body and turn clockwise until the tabs on the tube lock into the "0 gram" slot. Remove the cap from the sample tube and press directly (where possible) into the shallow soil, soil core/sampler, excavation base or sidewall, or stockpile.
3. Continue pressing the sample tube until the plunger is stopped by the sample volume gauge. If a depth interval (for example 9 to10 feet) is targeted for VOC sampling, collect small volumes of soil across this interval until the sample tube is filled
4. Twist counterclockwise to disengage the sample tube, then depress the plunger to eject the soil plug directly into a laboratory-provided VOA vial. Wipe off any soil particles on the VOA vial threads before tightening the lid. Grit on the VOA vial threads can cause a poor seal and interfere with the laboratory analyses. If multiple vials per sample are required, the same plunger may be re-used to fill the remaining vials.

3.6 COMPOSITE SAMPLE COLLECTION

For this guideline, composites are considered samples that are collected across more than one location, or multiple depth intervals at a single location. Samples collected over continuous depth intervals within a sampling device (i.e., split spoon) are addressed for each sampling method in Section 3.4 above.

Compositing of sample material may be performed in the field or by the analytical laboratory. To collect a field composite sample, identify the locations and depth(s) that will comprise the composite. Collect soil from the first target sub-sample depth or depth interval and hold in a decontaminated stainless-steel bowl, covered with aluminum foil to prevent cross contamination and label with the location and depth. Continue to collect and hold individual sub-samples until all components of the composite have been collected, then transfer an equal amount of each sub-sample to a clean bowl and homogenize. Fill necessary sample jars from homogenized composite. In some cases, project plans may require that each individual sample that comprised the composite be collected in jars and submitted to the laboratory if individual sample analysis is desired, or if laboratory compositing is requested in addition to field compositing as a field quality control measure. In this case, label each individual jar, but indicate HOLD on the chain-of-custody, and note that the sample is part of composite XYZ.

To collect a laboratory composite sample, collect, and label each sub-sample using the procedures described above in Section 3.4. Record each sub-sample on the chain-of-custody form, and indicate on this form which samples should be composited by the laboratory and the

desired name of the composite sample. It is important to communicate to the laboratory if discrete samples will also require analysis (in some cases) or only the composite sample. It is helpful to send a follow up email to the laboratory PM with laboratory compositing details.

4.0 Decontamination

All reusable equipment that contacts soil or dust should be decontaminated prior to moving to the next sampling location.

Stainless-steel bowls and spoons, and any tools used for sample processing will be decontaminated between each sample; alternatively, disposable bowls and spoons may be used. Equipment decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an Alconox (or other soap)/tap water solution, and a final rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, waste soils accumulated as investigation derived waste (IDW) will be contained, transported, disposed of in accordance with applicable laws, and stored in designated drums in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials is as follows. For IDW that is containerized, such as waste soils, 55-gallon drums approved by WSDOT (or the applicable stage agency) will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “soil”), the dates on which the soil was accumulated, the site owner’s name (i.e., the generator), Floyd|Snider name, and the Floyd|Snider field person contact information or front desk telephone number.

Refer to the IDW Special Conditions SOP for further information on IDW storage, sampling, profiling, and handling.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy duty garbage bags or other appropriate containers and disposed of as solid waste in the municipal collection system (i.e., site dumpster).

6.0 Field Documentation

All observations including sample collection locations, soil descriptions, sample depths, collection times, analyses, and field QC samples should be recorded on a boring log, soil sample collection form, and/or bound field notebook. Information recorded should additionally include personnel present (including subcontractors), purpose of field event, weather conditions, sample collection date and times, sample analytes, and any deviations from the SAP.

At the end of the day, complete and review the second page of the tailgate safety meeting form detailing additional hazards, corrective actions, near-misses or incidents. Any incidents that result in field staff injuries or have the potential to result in staff injuries (such as hitting buried utility lines when drilling) should be reported immediately to the PM.

7.0 Demobilization

Upon returning to the office, ensure that all equipment is property cleaned and put away in the field room. Equipment with rechargeable batteries should be plugged in as appropriate so it is ready for use by the next person. It is preferable to dispose of trash at the project site, but any trash left in the field vehicle should be brought upstairs, labeled, and placed in the front production room for building staff to dispose of.

If equipment or sample coolers will be placed at the front desk for pickup, clearly label each item with the company picking it up, anticipated pickup time frame, and your contact information so front desk staff can contact you if there are any questions. Notify front desk staff if any items require a signature at pickup.

Within one week of returning from the field, the field lead for the event should review field notes, sampling forms and tailgate safety meeting forms with the PM. Following PM review and approval, field notes will be scanned and saved to the project folder. Hard copies should be filed. The PM will provide copies of near miss and incident reports to the Health and Safety Administrator.

Enclosures: Boring Log
Test Pit Log and Sample Collection Form

Record of Revisions:

Revisions	**Date**
Added H&S information and line edits for clarity.	7/22/2022
Reviewed with minor updates	SD 12/9/2022

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	PROJECT:	LOCATION:	BORING ID:
	LOGGED BY:	COORDINATE SYSTEM:	
DRILLED BY:		NORTHING:	EASTING:
DRILLING EQUIPMENT:		GROUND SURFACE ELEVATION:	
DRILLING METHOD:		TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
SAMPLING METHOD:		BORING DIAMETER:	DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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	PROJECT:	LOCATION:	BORING ID:
	LOGGED BY:	COORDINATE SYSTEM:	
DRILLED BY:		NORTHING:	EASTING:
DRILLING EQUIPMENT:		GROUND SURFACE ELEVATION:	
DRILLING METHOD:		TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
SAMPLING METHOD:		BORING DIAMETER:	DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

Test Pit Log and Sample Collection Form

Project:	Date:
Field Personnel:	
Test Pit #	
Pit Dimensions	Depth:_____ Length:_____ Width:_____ Units:_____
Soil Description: (note depth to native, presence of debris, odor, sheen)	
Sketch	
GPS coordinates	
Other Notes or Observations:	

Samples Details	Sample ID	Depth	Time	Analysis

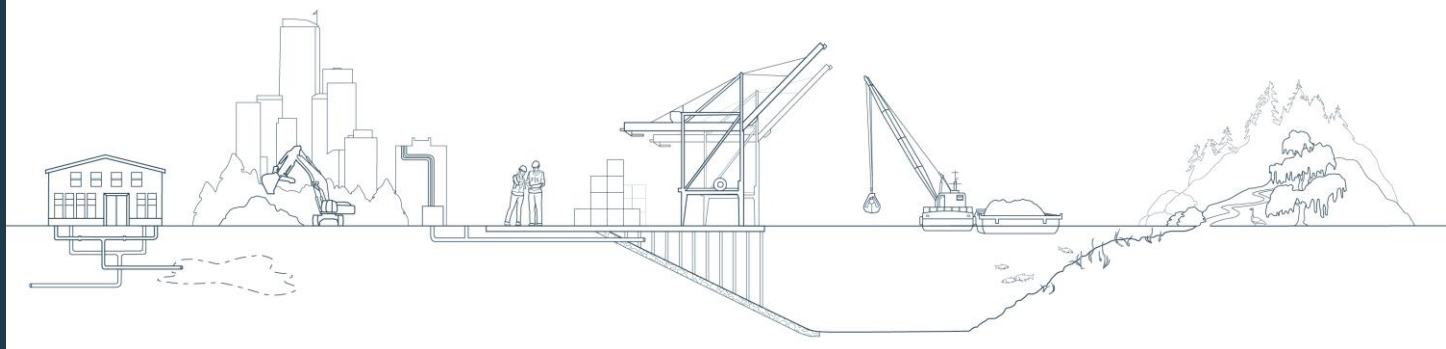
Attachment 2
Quality Assurance Project Plan

Quality Assurance Project Plan

Riverside HVOC Site

Prepared for
City of Bothell

June 2024



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LIMITATIONS

This report has been prepared for the exclusive use of the City of Bothell, their authorized agents, and regulatory agencies. It has been prepared following the described methods and information available at the time of the work. No other party should use this report for any purpose other than that originally intended, unless Floyd|Snider agrees in advance to such reliance in writing. The information contained herein should not be utilized for any purpose or project except the one originally intended. Under no circumstances shall this document be altered, updated, or revised without written authorization of Floyd|Snider.

Table of Contents

List of Tables

List of Abbreviations

Abbreviation	Definition
CAP	Cleanup Action Plan
City	City of Bothell
CUL	Cleanup level
DQI	Data quality indicator
Ecology	Washington State Department of Ecology

Abbreviation	Definition
EDD	Electronic data deliverable
HAZWOPER	Hazardous Waste Operations and Emergency Response
HVOC	Halogenated volatile organic compound
IDW	Investigation-derived waste
LCS	Laboratory control sample
MDL	Method detection limit
MNA	Monitored natural attenuation
MS	Matrix spike
MSD	Matrix spike duplicate
PDI	Pre-Remedial Design Investigation
PDI Work Plan	Pre-Remedial Design Investigation Work Plan
PM	Project manager
PQL	Practical quantitation limit
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RL	Reporting limit
RPD	Relative percent difference
SDG	Sample delivery group
Site	Riverside Halogenated Volatile Organic Compound Site
SOP	Standard Operating Procedure
TM	Task manager
USEPA	U.S. Environmental Protection Agency

1.0 Introduction

This Quality Assurance Project Plan (QAPP) is presented as an appendix to the Pre-Remedial Design Investigation (PDI) Work Plan (PDI Work Plan) for the City of Bothell (City) Riverside Halogenated Volatile Organic Compound (HVOC) Site (Site). It describes the quality assurance (QA) objectives, methods, and procedures for sample analysis to support design and implementation of a cleanup action at the Site. Sampling will include the collection and chemical analysis of environmental media to characterize HVOCs and gain additional physical information about Site media to inform aspects of cleanup action construction and performance.

The PDI Work Plan presents the objectives, background, details regarding sampling locations and field sampling methods, data quality objectives for sampling. This QAPP presents more detailed information regarding data management responsibilities, laboratory analysis methods and procedures, and reporting requirements. This document was prepared in accordance with the U.S. Environmental Protection Agency's (USEPA's) guidance on preparing QAPPs (USEPA 2002a, 2006).

1.1 DOCUMENT ORGANIZATION

This QAPP provides detailed laboratory methods and protocols for all anticipated types of data collection. QAPP addenda may be prepared if additional data types not detailed in this plan are determined to be needed after completion of part or all of the groundwater and sampling described in the PDI Work Plan.

This QAPP is organized into the following sections:

- Section 2.0—Project Organization and Responsibilities
- Section 3.0—Data Generation and Acquisition
- Section 4.0—Assessment and Oversight
- Section 5.0—Data Validation and Usability
- Section 6.0—References
- Section 7.0—Approvals

2.0 Project Organization and Responsibilities

2.1 PROJECT MANAGEMENT

The following sections describe the responsibilities of project team members for fulfillment of the QAPP. Contact information for the key QA project team members is provided in Table 1.1. The contact information for key project team members will be provided to the City and the Washington State Department of Ecology (Ecology) prior to implementation of the PDI Work Plan.

2.1.1 Project Manager

The Floyd|Snider project manager (PM) will be involved in all aspects of this project, including discussion, review, and interpretation of this QAPP, and the results of the investigation. The Floyd|Snider PM will also be responsible for the overall implementation of this QAPP.

2.1.2 Task Manager

The Floyd|Snider task manager (TM) will be responsible for providing oversight of planning and coordination, work plans, all project deliverables, and performance of the administrative tasks needed for timely and successful completion of the project. The TM will also be responsible for communicating with the PM on the progress of project tasks, conducting detailed planning and coordination, and monitoring and communicating to the PM any deviations from the QAPP. Significant deviations from the QAPP will be further reported to the City and Ecology. The TM will facilitate the transfer of analytical data to the principal data users.

2.1.3 Field Coordinator

The Floyd|Snider field coordinator will be responsible for implementation of the field data collection program, including sample handling and custody documentation. The field coordinator will work closely with the TM and PM to ensure that the required sample collection and laboratory analyses are completed. The field coordinator, or their trained and qualified designee, is also responsible for oversight of daily calibration of field equipment in accordance with the PDI Work Plan and inspection of sample containers as specified in Section 3.7.

2.1.4 Quality Assurance/Quality Control

The QA and quality control (QC) coordinator or their designee will serve as the laboratory QA/QC coordinator. The QA/QC coordinator will oversee coordination of the field sampling and laboratory program and supervise data validation and project QA coordination, including coordination with the analytical laboratories and Ecology. The laboratory QA/QC coordinator will be a Floyd|Snider staff member specializing in QA/QC who is independent from the analytical laboratories and field staff responsible for generating the data.

Analytical laboratories will be responsible for chemical analyses and will ensure that submitted samples are handled and analyzed in accordance with the analytical testing procedures and QA/QC requirements, as well as the any other requirements specified in this QAPP. The laboratories will provide certified pre-cleaned sample containers and preservatives, as appropriate, and prepare a data report containing analytical and QA/QC results. The laboratory PM will oversee laboratory operations, including receipt of samples, chemical analyses, and laboratory report preparation. They will prepare and review laboratory reports and case narratives describing any discrepancies that occurred during chemical analyses. They will also notify the laboratory QA/QC coordinator of any problems as soon as they are identified.

2.2 PROBLEM DEFINITION/BACKGROUND

The PDI Work Plan sampling design is intended to provide sufficient characterization for the engineering design and to inform any necessary adjustments to the conceptual design presented in the Cleanup Action Plan (CAP; Ecology 2023) to ensure the remedial action objectives are achieved. The conceptual site model for the Site, as well as the existing available sampling data, inform the PDI sampling design and focus it on areas and media needing more data.

2.3 PROJECT TASK DESCRIPTION

Sampling activities described in the PDI Work Plan will be initiated after Ecology approval.

2.4 SPECIAL TRAINING/CERTIFICATIONS

The Floyd|Snider field coordinator and all field personnel will be 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) certified, consistent with the Occupational Safety and Health Administration 29 Code of Federal Regulations 1910.120, and be trained in the groundwater and soil sample collection methods described in the PDI Work Plan. The field coordinator will be responsible for ensuring that field staff and contractors have the necessary training and that field staff are up to date on the annual 8-hour HAZWOPER refresher course.

All analytical laboratories will have current environmental laboratory accreditation from Ecology for the analytical methods to be used.

2.5 DOCUMENTATION AND RECORDS

This QAPP will be approved by the Floyd|Snider PM, the Ecology Site Manager and all laboratory and data validation contractor PMs (refer to Section 7.0 for approvals). The document will be maintained and updated by the Floyd|Snider PM, who will be responsible for distribution of the approved document and any updated versions to key project contacts and team members (key project contacts are provided in Table 1.1). The Ecology Site Manager or the City may distribute this QAPP to project stakeholders at their discretion.

Floyd|Snider will store all project records in a secure manner. Each project team member is responsible for filing all project information and records according to internal Floyd|Snider

requirements. All electronic data will be maintained in a database in a designated directory at Floyd|Snider.

2.5.1 Field Records

Documents and records generated in the field should be considered controlled documents that become part of the project file. Floyd|Snider field staff will keep a daily record of significant events, observations, and measurements on forms specific to the field activity. All field documents will be maintained by the field coordinator. All sampling forms will contain information on the sample collected and will include at a minimum the following information:

- Project name
- Field staff on site
- Field observations
- Sample collection date and time
- Sampling method and/or description of field activities
- Instruments or equipment used
- Location ID and sample ID
- Sample analysis
- Deviations from the PDI Work Plan

2.5.2 Laboratory Records

The analytical laboratories will retain all analytical records. Additionally, Floyd|Snider will retain a copy of analytical data in the internal project files. Laboratory data packages will include those items necessary to complete data validation. Elements to be reported in the laboratory data packages are listed in Section 5.1.

All instrument data will be fully restorable at the laboratory from electronic backup. The laboratory will be required to maintain records relevant to project sample analyses for a minimum of 7 years. The PM is responsible for determining and communicating specific requirements for record maintenance if they are different than the default. Data validation reports will be maintained within the Floyd|Snider internal project files with the laboratory data packages.

Each laboratory employs an internal QA manager who is responsible for ensuring that laboratory Standard Operating Procedures (SOPs) are followed, and laboratory staff perform routine audits for SOP compliance; routine audits are required for state accreditation. The Floyd|Snider PM, City, or Ecology Site Manager may request to review records of SOP compliance.

The analytical laboratories will submit data electronically, in the Floyd|Snider standard electronic data deliverable (EDD) format. Guidelines for EDDs will be communicated to the analytical laboratories by the QA/QC coordinator or database manager.

All electronic data submittals must be tab-delimited text files that include all results, method detection limits (MDLs; as applicable), and reporting limits (RLs) consistent with those provided in the laboratory report. If laboratory replicate analyses are conducted on a single submitted field sample, the laboratory sample identifier must distinguish each replicate analysis.

2.5.3 Data Management and Reduction

The Floyd|Snider database manager will oversee data management and reduction in coordination with the PM and TM or field coordinator. Once all required data are confirmed to be received and validated, the database manager will load all records to Floyd|Snider's electronic database accessed using Microsoft Access software. The database is maintained on the Floyd|Snider server and is backed up with a hard disk. The database manager will manage data exports and will confirm that data are assembled in the required deliverable format with appropriate qualifiers.

3.0 Data Generation and Acquisition

3.1 SAMPLING DESIGN

Analytical data will be collected for the following purposes to support the cleanup action:

- Delineate the current magnitude, horizontal extent, and vertical distribution of HVOCs exceeding cleanup levels (CULs) in Site groundwater to refine areas for groundwater treatment.
- Measure conventional geochemical parameters (referred to as monitored natural attenuation [MNA] parameters) that may promote or inhibit anaerobic degradation of HVOCs to inform the design of groundwater treatment materials.
- Determine the grain size distribution in Site soil to inform the physical parameters for delivery of in situ treatment materials.
- Delineate the horizontal and vertical extent of HVOCs exceeding CULs in Site soil to refine areas for soil treatment.

Field measurements to further inform the understanding of Site hydrogeology for groundwater treatment design will also be collected as described in the PDI Work Plan.

3.2 SAMPLING METHODS

This section summarizes the collection and analysis of groundwater samples presented in detail in the PDI Work Plan. Additional sampling design, if determined to be necessary after completion of the PDI Work Plan scope, would be addressed in a supplement to the PDI Work Plan.

3.2.1 Sample Collection

Groundwater samples will be collected from the screened intervals of existing monitoring wells and from temporary or retractable screens placed in direct-push boreholes. At a subset of the direct-push groundwater sample locations, which are classified as reconnaissance sample locations, water samples will be collected from multiple depth intervals as described in the PDI Work Plan. The final number and locations of reconnaissance samples will be determined based on the estimated current plume extents determined by PDI sampling at the existing monitoring wells.

Soil samples will be collected from direct-push borings surrounding the locations where previous samples indicate soil HVOC concentrations exceed CULs. Multiple sample intervals will be collected at each soil boring location as described in the PDI Work Plan. Except for one soil boring location within the presumed soil source area where a full vertical profile of HVOC concentrations will be collected, soil analysis will be tiered. The first tier of samples, selected based on field indications of contamination as described in the PDI Work Plan, will be analyzed immediately. The over- and underlying samples will be archived initially at the laboratory and analyzed as needed to vertically delineate HVOC concentrations exceeding CULs at each boring location.

3.2.2 Sample Analysis

All groundwater and soil samples will be analyzed for the list of HVOCs including: tetrachloroethene, trichloroethene, *cis*- and *trans*-1,2-dichloroethene, and vinyl chloride. A subset of groundwater samples collected from monitoring wells will additionally be analyzed for MNA parameters including total and dissolved calcium, iron, and manganese; total organic carbon; nitrate and nitrite; sulfate; sulfide; chloride; dissolved ethene, ethane and methane; alkalinity; and ferrous iron. A subset of soil samples will be analyzed for grain size using visual and sieve methodology.

All groundwater samples will be analyzed immediately. For groundwater samples collected from monitoring wells, the measured HVOC concentrations will be compared to Site CULs to determine the current extents of the plume exceeding CULs. Reconnaissance groundwater samples are expected to be biased high due to the inherent turbidity of samples collected from temporary well screens. These samples will be used to gather information about the distribution of HVOCs in groundwater rather than to determine compliance with CULs; however, a result less than the CUL in an inherently high-biased sample can also serve to delineate the plume extent at that location.

Soil sample results for HVOCs will be compared to Site CULs. For locations where tiered soil analysis will be performed, step-up or step-down samples will be analyzed from each boring location as needed if HVOCs exceeding CULs are detected during initial analysis, until HVOCs are vertically delineated at each location. Soil samples from the presumed HVOC source will additionally be collected for visual and laboratory sieve grain size analysis. All grain size samples will be analyzed immediately.

Field duplicate samples will be analyzed concurrently for all constituents analyzed in their respective parent samples. Trip blank samples will be analyzed for HVOCs.

Samples for characterization of investigation-derived waste (IDW) for disposal purposes will be analyzed in accordance with the Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act. IDW samples will be analyzed for compounds regulated under RCRA, including metals, volatile organic compounds, and semivolatile organic compounds.

3.3 ANALYTICAL METHODS

Laboratory analytical methods were selected to ensure that the samples can be compared to the CULs presented in the CAP and/or provide meaningful data for design of treatment components. The laboratory quantitation limits including practical quantitation limits (PQLs) or RLs and MDLs for the selected analytical methods are presented in Table 3.1.

3.4 DATA QUALITY OBJECTIVES AND CRITERA

Field and laboratory data quality objectives include obtaining data that are technically sound and properly documented, having been evaluated against established criteria for the principal data quality indicators (DQIs; i.e., precision, bias, accuracy, representativeness, completeness, comparability, and sensitivity). Evaluation of the principal DQIs is summarized in the following sections. Data QA/QC criteria (also known as measurement quality objectives) and frequencies are presented in Tables 3.2 and 3.3, respectively.

3.4.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, precision is a quantitative measure of the variability of a group of measurements compared to their average values. Precision is assessed by performing multiple analyses, such as laboratory duplicate or field duplicate samples, and is defined as the relative percent difference (RPD) between results. Precision will be evaluated for both laboratory and field duplicate samples and calculated as follows.

$$RPD = \frac{(C_1 - C_2) \times 100\%}{\frac{(C_1 + C_2)}{2}}$$

Where:

RPD = relative percent difference
C_1 = larger of the two observed values
C_2 = smaller of the two observed values

Laboratory duplicate sample precision criteria and frequency requirements are presented in Tables 3.2 and 3.3, respectively. Field duplicate precision will be screened against an RPD of 50% for all samples. Data will not be qualified based solely on field duplicate precision.

For precision calculations (i.e., for calculating RPD), the RL will be used when a non-detect result is included in the evaluation. Additionally, the result/s based on the final dilution will be used in the calculation (i.e., values flagged as estimated greater than a given concentration, which are superseded with subsequent sample dilutions, will not be used).

3.4.2 Accuracy and Bias

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Bias is “the systematic or persistent distortion of a measurement process that causes error in one direction” (USEPA 2002a). Analytical bias and accuracy may be assessed by analyzing “spiked” samples with known concentrations, such as laboratory control samples (LCSs), blank spikes, and standard reference materials. Additionally, matrix spike (MS) samples can be analyzed to provide accuracy or bias information in the actual sample matrix. Precision criteria and

frequency requirements are presented in Tables 3.2 and 3.3, respectively. Accuracy will be evaluated as percent recovery (%R) and will be calculated as follows.

$$\%R = 100\% \times \frac{(S-U)}{C_{sa}}$$

Where:

%R = percent recovery
S = measured concentration in the spiked aliquot
U = measured concentration in the unspiked aliquot
C_{sa} = actual concentration of spike added

For accuracy calculations (i.e., for calculating %R), non-detect results will be assigned a value of zero. Additionally, the results based on the final dilution will be used in the calculation (i.e., values flagged as estimated greater than a given concentration, which are superseded with subsequent sample dilutions, will not be used).

3.4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent an environmental condition. This DQO is addressed by the design of the sampling plan. A list of analytes has been identified to provide a comprehensive assessment of known or potential contaminants. Care has been taken in the design of the sampling program to ensure that sample locations are properly selected, sufficient numbers of samples are collected to accurately reflect conditions at the locations, and samples are representative of the sampling locations as described in the PDI Work Plan. Sufficient volume of samples will be collected at each sampling location to minimize bias or errors associated with sample particle size and heterogeneity.

Representativeness in laboratory data will be assessed by evaluating holding time compliance and the results of the method blanks and instrument blanks.

3.4.4 Completeness

Completeness is defined as the number of acceptable data points relative to the total number of data points and is also a measure of the amount of validated data reported versus the expected amount of data (the amount of data collected). Completeness will be assessed for each sample medium. The QA/QC objective for completeness for all components of this project is 90% (Table 3.2). Data that were qualified as estimated because the QA/QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as estimated will be further reviewed for usability. Data that were qualified as rejected will not be considered valid for their intended use or for the purpose of assessing completeness. If a sample medium has an unacceptable completeness percentage (less than 90%), original samples will be re-analyzed if sufficient sample volume is available, archived samples will be analyzed if

appropriate, or additional samples will be obtained (if feasible). The equation used to calculate completeness is as follows:

$$\text{Completeness} = \frac{\text{number of valid measurements}}{\text{total number of data points planned}} \times \mathbf{100}$$

3.4.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another. To ensure that results are comparable, samples will be analyzed using USEPA methods, Standard Methods, ASTM methods, and/or other acceptable method protocols. Calibration and reference standards will be traceable to certified standards, and standard data reporting formats will be employed.

3.4.6 Sensitivity

Analytical sensitivity is the minimum concentration of an analyte above which a data user can be reasonably confident that the analyte was reliably detected and quantified. For this investigation, the PQL will be used as the measure of sensitivity for each analyte.

3.5 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Guidance for QA/QC is derived from the protocols developed for USEPA's Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods (USEPA 1986), the USEPA National Functional Guidelines (USEPA 2020a, 2020b, 2020c), and cited methods.

The field coordinator or field personnel will assess and implement field QC procedures as required in this QAPP.

3.5.1 Field Quality Assurance/Quality Control Procedures

3.5.1.1 Sample Identification

Each sample will have a label affixed to the container, and the container will be labeled at the time of collection. The minimum information will be recorded on the label:

- Sample identifier
- Date and time of collection
- Preservative type (if applicable)
- Project name
- Sampler's name or initials

Groundwater samples collected from monitoring wells will be identified using the following format: "Sample Location"-"Date." For example, a sample collected from monitoring well RMW-6

on March 4, 2024, would be labeled "RMW-06-20240304." Groundwater and soil samples collected from boring locations will be identified using the following format: Sample Location"-"top depth in feet"-"bottom depth in feet." For example, a sample collected from 13 to 16 feet at SB-01 would be labeled SB-01-13-16. Sample depths will be rounded to the nearest 0.1 foot.

At each laboratory, a unique sample identifier will be assigned to each sample. The laboratory will ensure that a sample tracking record follows each sample through all stages of laboratory processing. The sample tracking record must contain, at a minimum, the name/initials of individuals responsible for performing the analyses, dates of sample extraction/preparation and analysis, and types of analyses being performed. The analytical laboratories will meet the sample handling requirements and follow the procedures described in the sections below.

3.5.1.2 Field Quality Control Sampling and Identification

Field QC is evaluated through the analysis of field duplicates and trip blanks. Field duplicates are used to assess proper homogenization in the field, reproducibility of the sample preparation and analysis, and heterogeneity of the matrix. Trip blank samples are used to evaluate potential cross contamination from volatile compounds from ambient conditions or from other samples during sample handling and transport. Field duplicate QC samples will be collected at a rate of 1 per 20 investigation samples. Trip blank QC samples will be collected for each cooler containing field samples for HVOC analysis. Field QA/QC criteria and frequency are presented in Tables 3.2 and 3.3.

The labeling of field QC samples is described as follows:

- Field duplicates will be labeled with a fictitious sample location by adding 100 to the sample location. For example, a field duplicate collected from monitoring well RMW-6 on March 4, 2024, would be named "RMW-106-20240304."
- Trip blanks will be collected by pouring laboratory-provided distilled water into sample containers during the sampling event near a sample collection location. Trip blanks will be labeled using the following format: "TB"-"Number"-"Date." For example, a trip blank collected on March 4, 2024, would be named "TB-1-20240304."

3.5.1.3 Sample Custody Procedures and Requirements

Sample custody is a critical aspect of environmental investigations. Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analyses, to delivery of the sample results to the recipient. Procedures to be followed for sample custody related to shipping are detailed in Section 3.5.1.4.

Samples are considered to be in custody if they are (1) in the custodian's possession or view; (2) in a secured place (under lock) with restricted access; or (3) in a container and secured with a custody seal such that the sample cannot be reached without breaking the seal. Chain-of-custody forms will accompany all samples, and each person who has custody of the samples will sign the

chain-of-custody form and ensure that the samples are not left unattended unless properly secured. Information on chain-of-custody forms will include at a minimum the following:

- Sampling location, project name, and unique sample ID
- Sample collection date and time
- Any special notations on sample characteristics or problems
- Name of the person who initially collected the sample
- Date sample was sent to the laboratory
- Shipping company name and waybill number (if applicable)

The field coordinator or qualified designee will be responsible for all sample tracking and custody procedures. They will also be responsible for final sample inventory and will maintain sample custody documentation. The field coordinator or designee will complete chain-of-custody forms prior to transporting samples. Information on the sample labels will be checked against sample collection forms and chain-of-custody forms, and sample containers will be recounted prior to transporting samples. Copies of all chain-of-custody forms will be retained and included as appendices to the data reports.

The analytical laboratories will ensure that chain-of-custody forms are properly signed upon receipt of the samples and will note any questions or observations concerning sample integrity on the chain-of-custody forms. The analytical laboratories will contact the field coordinator and project QA/QC coordinator immediately if discrepancies are discovered between the chain-of-custody forms and the sample shipment upon receipt.

3.5.1.4 Sample Preservation and Shipping Requirements

Sample volumes will be placed in laboratory-provided certified pre-cleaned sample containers and preserved in accordance with the requirements presented in Table 3.4. The laboratory will maintain manufacturer documents certifying the cleanliness of containers and/or purity of preservatives provide. The field coordinator or a designee will also inspect containers for cleanliness, for signs of damage or tampering, and for presence of preservative if pre-preserved containers will be used. Individual containers with evidence of damage or tampering will be discarded.

Prior to shipping or transporting samples, containers will be securely packed inside a cooler with ice packs or wet ice and bubble wrap. The original signed chain-of-custody forms will be placed in a sealed plastic bag and taped to the inside lid of the cooler. If third-party shipping (e.g., shipping with FedEx rather than a laboratory courier), each cooler will be sealed with a custody seal.

3.5.2 Laboratory Sample Handling and Holding Times

Samples will be stored in accordance with the conditions specified in the methods or laboratory SOPs. Samples transferred to other laboratories will be packed in coolers on ice and delivered via courier service or shipped on ice in coolers at temperatures less than 6 degrees Celsius, not frozen. The temperature inside each cooler will be checked by the laboratory upon receipt of the samples. The laboratory will specifically note any coolers that are not sufficiently cold upon receipt.

All samples will be handled to prevent contamination or sample loss. Any remaining sample material will be disposed of upon receipt of written notification by the Floyd|Snider PM. Holding times will vary by analysis and are summarized in Table 3.4.

Archive samples will be stored frozen as allowed by the analytical method (refer to Table 3.4). Samples will be disposed of after hold times expire, following written authorization from the Floyd|Snider PM. The Floyd|Snider PM may elect to hold archived samples past the specified hold time as needed to gather the additional project data.

3.5.3 Laboratory Quality Assurance/Quality Control

Laboratory results will be evaluated by reviewing analytical results of method blanks, LCSs, certified reference materials, MS/matrix spike duplicate (MSD) samples, duplicate samples, internal standards, calibrations, and performance evaluation samples, as specified by the analytical methods.

All samples will be diluted and re-analyzed if target compounds are detected at levels that exceed their respective established calibration ranges. Any required cleanups will be conducted prior to the dilutions. Re-analyses will be performed if surrogate, internal standard, or spike recoveries are outside of the QA parameters. QC samples may be re-analyzed if results are not within control limits and it cannot be determined that the sample matrix is the cause.

3.5.3.1 Sample Delivery Groups

A sample delivery group (SDG) is defined by the laboratory and is generally considered 20 samples, or a group of samples from the same sampling period received at the laboratory on the same day. Although an SDG may span 2 weeks, all holding times specific to each analytical method will be met for each sample in the SDG.

3.5.3.2 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of one method blank will be analyzed for every 20 samples.

3.5.3.3 Laboratory Control Samples

LCSs are prepared from a clean matrix source using the same process as project samples and are spiked with known amounts of the target compounds. The recoveries of the compounds are used as a measure of the accuracy of the test methods.

3.5.3.4 Matrix Spikes and Matrix Spike Duplicates

The analysis of MS and MSD samples provides information on the extraction efficiency of the method for the sample matrix and is used to evaluate the precision of the method. A minimum of one MS/MSD pair will be analyzed for every 20 samples, when sufficient sample volume is available. A laboratory duplicate sample may be analyzed in place of MSD samples, as allowed by the analytical method.

3.5.3.5 Laboratory Duplicates

Laboratory duplicate samples provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Laboratory duplicates are subsamples of the original sample that are prepared and analyzed as separate samples. A minimum of one laboratory duplicate sample will be analyzed for every 20 samples, when sufficient sample volume is available.

3.5.3.6 Surrogates

All samples, including laboratory QC samples (blanks, LCSs, MS/MSDs, and duplicate samples), analyzed for organic analytes will be spiked with appropriate surrogate compounds. Surrogate recoveries will be reported by the analytical laboratories; however, no sample results will be corrected for recovery using these values.

3.5.3.7 Internal Standards

Internal standards may be used for calibrating and quantifying organic compounds and metals. If internal standards are required by the method, all calibration, QC, and project samples will be spiked with the same concentration of the selected internal standards. Internal standard recoveries and retention times must be within method criteria, laboratory criteria, or both.

3.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Inspection and maintenance of field and laboratory equipment are important to determine the quality of sampling and analysis results.

3.6.1 Field Equipment Maintenance and Calibration and Frequency

Field equipment for groundwater sampling that requires maintenance or calibration includes the following: pH probes, specific conductivity probes, turbidity meters, reduction–oxidation

potential probes, and dissolved oxygen probes. Field equipment for soil sampling that requires maintenance or calibration includes a photoionization detector.

Field equipment will be maintained and calibrated in accordance with the procedures described in the operations manuals supplied by the manufacturer at the intervals recommended in the manual. The manufacturers' manuals will accompany each instrument for use during equipment calibration and to support troubleshooting. Equipment maintenance information will be documented in the instrument's maintenance log. Equipment calibration performed by field staff will be documented in a calibration log. The calibration log will include at minimum, the equipment type and model number, date and time, project name, the calibration results, and the initials of the calibrator. Any discrepancies or calibration failures will be noted in the calibration log and corrected prior to sampling. During the sampling event, any discrepancies or calibration failures will be noted in the field notes and corrected prior to continuing sampling. Maintenance and calibration records will be verified prior to each sampling event by the field coordinator.

The subcontractor responsible for navigation will confirm proper operation of the navigation equipment daily, and all equipment will be operated and maintained according to manufacturer specifications.

3.6.2 Laboratory Instruments Calibration and Frequency

Laboratory equipment will be maintained and calibrated according to the manufacturers' recommendations, the laboratory QA plan, SOPs, and standard methodologies. Calibrations will be performed on each analytical instrument prior to analysis. Calibrations are performed at a frequency determined by the analytical method and/or the laboratory SOP. The analysis must stop if the calibration does not meet the specified criteria. The analysis may resume after corrective actions have been taken to meet the method specifications. All project samples analyzed by an instrument found to be out of compliance must be reanalyzed. Laboratories will be responsible for their own preventative maintenance and calibration of laboratory equipment.

3.7 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Inspection and acceptance of field supplies, including laboratory sampling containers, will be the responsibility of the field coordinator. Any chemical standards and solutions (such as hydrochloric acid for sample preservation) used in this project will be provided by a reliable, commercial source and will be traceable. Any discrepancies will be documented by the field coordinator.

3.8 DATA MANAGEMENT AND REPORTING

Analytical chemistry results will be provided by the laboratory in PDF and EDD formats. Data packages will be returned within the time frame specified in the service agreement contract or work order between Floyd|Snider and each laboratory, with a duration not to exceed 10 or 15 business days, unless delays are otherwise communicated to and approved by the Floyd|Snider PM. The data packages will be reviewed to ensure that the correct analyses were performed for each sample submitted and that all analyses requested on the chain-of-custody

forms were performed. If discrepancies are noted, the QA/QC coordinator will be notified and will promptly follow up with the laboratory to resolve any issues. After completion of data validation, the digital files will be used to generate the appropriate report tables.

Laboratory data, which are electronically provided and loaded into Floyd|Snider's electronic database, will undergo a check against the laboratory data deliverable. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. All manually entered data will be verified by a secondary review performed by Floyd|Snider staff. As a final review, after entry into the database, the EDD data will be compared to the field information (e.g., station/location identifiers, sample identifiers, requested analyses) previously entered into the database to confirm that all requested analytical data have been received.

4.0 Assessment and Oversight

The project field activities will be overseen by the Floyd|Snider PM and laboratory activities will be overseen by the laboratory PM. Once data are received from the laboratory, a number of QC procedures will be followed to evaluate data quality and attainment of the data QA/QC objectives and criteria. Specific procedures will be followed to assess the principal DQIs (precision, bias, accuracy, representativeness, completeness, comparability, and sensitivity).

4.1 FIELD OVERSIGHT AND CORRECTIVE ACTIONS

The field coordinator or designated field lead will be responsible for field oversight and identifying issues that may result in noncompliance with this QAPP that could adversely affect data quality. The FC is responsible for performing corrective actions. The field coordinator and the QA/QC coordinator will be responsible for completing and for verifying and documenting completion of any corrective actions.

Field performance inspections may be conducted at the discretion of the Floyd|Snider PM to determine the effectiveness of QA/QC procedures and compliance with the QAPP. Field performance inspections should be conducted by the field coordinator, health and safety officer, or the Floyd|Snider PM. During a field performance inspection, the inspector will observe and review field procedures and health and safety procedures, including but not limited to documentation of sample collection, packaging procedures, sample shipment to the laboratories, and proper use of personal protection equipment per the Health and Safety Plan (refer to Attachment 3 of the PDI Work Plan).

If issues are identified that may adversely affect data quality, corrective actions will be identified and implemented as soon as possible, and potential impacts to data quality will be evaluated. The inspector or a key member of the project team may temporarily stop work until deficiencies adversely affecting data quality are corrected. The field coordinator and the QA/QC coordinator will be responsible for verifying and documenting completion of any corrective actions.

4.2 LABORATORY OVERSIGHT AND CORRECTIVE ACTIONS

Laboratory audits and performance inspections consist of on-site reviews of QA systems and equipment. Laboratory audits will not be conducted as part of this study; however, the laboratory will provide reports from laboratory audits performed as part of general operations to the QA/QC coordinator upon request. The laboratory will provide written details of all method modifications planned prior to project commencement.

The laboratory is required to comply with its SOPs. The laboratory PM will be responsible for ensuring that appropriate corrective actions are initiated as required for compliance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data. If QC results exceed the laboratory control limits, the analyst will identify and correct the anomaly before continuing with the sample analyses, if possible. If the issue

cannot be overcome with standard corrective action (e.g., repreparation and reanalysis), the causes of the exceedance and corrective actions will be described in the data package narrative. If the exceedance is gross or widespread, the Floyd|Snider PM and project QA/QC coordinator will be notified immediately, and the appropriate action will be decided.

5.0 Data Validation and Usability

5.1 DATA REVIEW

Floyd|Snider will review the laboratory reports for internal consistency, transmittal errors, laboratory protocols, and adherence to the objectives specified in this QAPP. A Stage 2A Data Quality Review will be performed as described in this section for all data. The results of the Data Quality Review will be summarized in the PDI Data Report.

A Stage 2A Data Quality Review (Summary Validation) includes the following:

- Evaluation of package completeness
- Verification that sample numbers and analyses match those requested on the chain-of-custody form
- Review of method-specified preservation and sample holding times
- Verification that the required detection limits and RLs have been achieved
- Verification that the field and laboratory duplicates, MS/MSDs, and LCSs were analyzed at the proper frequency
- Verification of analytical precision and accuracy via replicate analysis and analyte recoveries
- Verification that the surrogate compound analyses have been performed and meet QC criteria
- Verification that the laboratory method blanks are free of contaminants

5.2 VALIDATION METHODS AND RECONCILIATION WITH USER REQUIREMENTS

Data validation programs have been established in accordance with USEPA guidance (USEPA 2002a). Data validation will be based on the QA/QC criteria as recommended in the methods identified in this QAPP and in the USEPA's National Functional Guidelines (USEPA 2020a, 2020b, 2020c) and environmental data verification and validation guidance (USEPA 2002b).

Data usability and any deviations that may have affected the quality of the data, as well as the basis of application of qualifiers, will be included in the final reporting of the data. Any required corrective actions based on the evaluation of the analytical data will be determined by the laboratory PMs, Floyd Snider PM, and data validators in consultation.

6.0 References

U.S. Environmental Protection Agency (USEPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.* Publication No. EPA-530/SW-846. Office of Solid Waste and Emergency Response.

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_____. 2006. *EPA Requirements for Quality Assurance Project Plans*. EPA QA/R-5. Office of Environmental Information. Washington, DC. March 2001, reissued May 2006.

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_____. 2020b. *National Functional Guidelines for Inorganic Superfund Methods Data Review.* Prepared by the Office of Superfund Remediation and Technology Innovation. EPA-542-R-20-006/OLEM 9240.1-66. November.

_____. 2020c. *National Functional Guidelines for Organic Superfund Methods Data Review.* Prepared by the Office of Superfund Remediation and Technology Innovation. EPA-540-R-20-005/OLEM 9240.0-51. November.

Washington State Department of Ecology (Ecology). 2023. *Agreed Order No. DE 21531*. March

7.0 Approvals

By signing below, I acknowledge that I have reviewed the Quality Assurance Project Plan and agree to follow the methods and quality assurance procedures contained therein.

_____ **Date_____**
Lynn Grochala, Principal, Floyd|Snider

_____ **Date_____**
Chell Black, QA Manager, Floyd|Snider

_____ **Date_____**
Sunny Becker, Site Manager, Ecology

_____ **Date_____**
David Baumeister, Project Manager, OnSite Environmental

_____ **Date_____**
Aaron Young, Project Manager, AmTest

_____ **Date_____**
Mike Ridgeway, Project Manager, Fremont Analytical

Quality Assurance Project Plan

Riverside HVOC Site

Tables

Table 1.1
Key Project Quality Assurance Contacts

Title	Name	Phone	Email	Address
Floyd|Snider PM/Principal	Lynn Grochala	206-292-2078	lynn.grochala@floydsnider.com	601 Union Street Suite 600 Seattle, WA 98101
Floyd|Snider Task Manager	Kristin Anderson		kristin.anderson@floydsnider.com	
Floyd|Snider QA/QC Coordinator	Chell Black		chell.black@floydsnider.com	
Floyd|Snider Field Coordinator	Danielle Gallaher		danielle.gallaher@floydsnider.com	
Ecology Site Manager	Sunny Becker	425-457-3842	HLIN461@ecy.wa.gov	P.O. Box 330316 Shoreline WA 98133
OnSite Environmental PM	David Baumeister	425-883-3881	dbaumeister@onsite-env.com	14648 NE 95th Street Redmond, WA 98052
AmTest PM	Aaron Young	425-885-1664	aarony@amtestlab.com	13600 NE 126th Place, Suite C Kirkland, WA 98034
Fremont Analytical PM	Mike Ridgeway	206-352-3790	mridgeway@fremontanalytical.com	3600 Fremont Ave N Seattle, WA 98103

Abbreviations:

Ecology	Washington State Department of Ecology
PM	Project Manager
QA/QC	Quality assurance/quality control

Table 3.1
Quality Assurance Project Plan Analyte List for Water and Soil

Analyte	Method	Units	Cleanup Level	Laboratory Detection Limits	
				MDL	RL
Soil [(1)]					
Volatile Organic Compounds					
Grain Size	ASTM D422	%	--	--	0.10
Tetrachloroethene	USEPA 8260D	mg/kg	0.050	0.00036	0.0010
Trichloroethene			0.030	0.00038	0.0010
cis-1,2-Dichloroethene			160	0.00031	0.0010
trans-1,2-Dichloroethene			--	0.00042	0.0010
Vinyl Chloride			0.67	0.00045	0.0010
Groundwater					
Volatile Organic Compounds					
Tetrachloroethene	USEPA 8260D	µg/L	4.9	0.045	0.20
Trichloroethene			0.38	0.040	0.20
cis-1,2-Dichloroethene			16	0.037	0.20
trans-1,2-Dichloroethene			--	0.046	0.20
Vinyl Chloride	USEPA 8260D/SIM		0.020	0.0076	0.020
Metals					
Total calcium	USEPA Method 200.7/200.8	µg/L	--	45	100
Dissolved Calcium			--	90	110
Total Iron			--	43	50
Dissolved Iron			--	31	56
Total Magnesium			--	39	100
Dissolved Magnesium			--	44	110
Conventionals					
Total Organic Carbon	SM 5310B	mg/L	--	--	1.0
Nitrate	USEPA Method 353.2	mg/L	--	--	0.050
Nitrite			--	--	0.020
Sulfate	ASTM D516-11	mg/L	--	--	5.0
Sulfide	SM 4500-S2	mg/L	--	--	0.050
Chloride	SM 4500-Cl	mg/L	--	--	2.00
Ethene	RSK-175	µg/L	--	--	0.50
Ethane			--	--	0.50
Methane			--	--	1.0
Alkalinity	SM 2320B	mg/L	--	--	15
Ferrous iron [(1)]	SM3500-FeB	mg/L	--	0.0060	0.15
	Color disc/ 1,10 Phenanthroline	mg/L	--	--	0.5 (maximum detect 7.0)

Notes:

-- Not applicable or not established.

1 Soil RLs are on a wet-weight basis.

2 Ferrous iron may be analyzed by either the listed laboratory or field method.

Abbreviations:

MDL Method detection limit

µg/L Micrograms per liter

mg/kg Milligrams per kilogram

mg/L Milligrams per liter

RL Reporting limit

Table 3.2
Quality Assurance/Quality Control Criteria

Parameter	Precision	Accuracy	Completeness
Soil			
Grain Size	--	--	90%
VOCs	±25% RPD	60–140%	90%
Groundwater			
VOCs	±20%	66–133%	90%
Metals	±20%	75–125%	90%
TOC	±20%	75–125%	90%
Nitrate/Nitrite	≤19% RPD / 11% RPD	85–121% / 85–119%	90%
Sulfate	≤10% RPD	73–127%	90%
Sulfide	≤15% RPD	75–124%	90%
Chloride	≤12% RPD	83-120%	90%
Ethene/ethane/methane	≤25% RPD	75-125%	90%
Alkalinity	≤10% RPD	82-112%	90%
Ferrous Iron (1)	≤20% RPD	85–115%	90%

Notes:

-- Not applicable.

1 Criteria apply only to laboratory analysis for ferrous iron.

Abbreviations:

QA/QC Quality Assurance/Quality Control

RPD Relative percent difference

TOC Total organic carbon

VOC Volatile organic compound

Table 3.3
Quality Assurance/Quality Control Frequency

Parameter	Method Blank [1]	Laboratory Control Samples [1]	Matrix Spike	Matrix Spike Duplicate [2]	Laboratory Duplicate	Surrogate Spike	Field Duplicate	Trip Blank
Grain size	--	--	--	--	--	--	1 per 20 samples	--
VOCs	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	--	Every sample		1 per cooler
Metals			--	--	1 per 20 samples			--
TOC								
Nitrate/Nitrite								
Sulfate								
Sulfide								
Chloride								
Ethene/ethane/methane								
Alakalinity								
Ferrous Iron [3]								

Notes:

-- Not applicable.

1 If less than 20 samples, analyze 1 per analytical batch.

2 Duplicates may be analyzed in place of matrix spike duplicates.

3 Criteria apply only to laboratory analysis for ferrous iron.

Abbreviations:

TOC Total organic carbon

VOC Volatile organic compound

Table 3.4
Container and Preservation Criteria for Water and Soil

Analyte	Method	Sample Handling		
		Container	Holding Time	Sample Preservation Technique
Soil				
Grain size	ASTM D422	16 oz WMG	180 days	Cool <6 °C
VOCs	USEPA 8260D	4-oz WMG, three 40-mL pre-weighted VOA vials: 2 with stir bar, 1 without	48 hours to freeze or preserve VOA vials, 14 days to analyze	Cool <6 °C
Groundwater				
VOCs	USEPA 8260D	Three 40-mL pre-weighted VOA vials	14 days	HCl pH<2, Cool <6 °C
Metals: total	USEPA 200.7/200.8	One 500-mL HDPE	6 months	HNO_3 pH<2, Cool <6 °C
Metals: dissolved		One 500-mL HDPE, field filter		HNO_3 pH<2, Cool <6 °C
Total organic carbon	SM 5310B	One 250-mL HDPE	28 days	HCl pH<2, Cool <6 °C
Nitrate/Nitrite	USEPA 353.2	One 250-mL HDPE	48 hours	Cool <6 °C
Sulfate	ASTM D516-11	One 250-mL HDPE	28 days	Cool <6 °C
Sulfide	SM 4500-S2	One 100-mL HDPE, add zinc acetate	7 days	NaOH pH>9, Cool <6 °C
Chloride	SM 4500-Cl	One 250-mL HDPE	28 days	Cool <6 °C
Ethene/Ethane/Methane	RSK-175	Two 40-mL pre-weighted VOA vials	14 days	HCl pH<2, Cool <6 °C
Alkalinity	SM 2320B	One 250-mL HDPE	14 days	Cool <6 °C
Ferrous Iron	SM3500-FeB	500 mL amber glass, no headspace	24 hours	HCl pH<2, Cool to <4 °C
	Color disc/ 1,10 Phenanthroline	Two 18-mm plastic viewing tubes with color comparator box	Analyze immediately—field method	Ferrous iron reagent power (added to one 25-mL sample aliquot)

Abbreviations:

°C	Degrees Celsius
HCl	Hydrochloric acid
HDPE	High-density polyethylene
HNO_3	Nitric acid
mL	Milliliters
mm	Millimeters
NaOH	Sodium hydroxide
oz	Ounces
VOA	Volatile organic analysis
VOC	Volatile organic compound
WMG	Wide-mouth glass

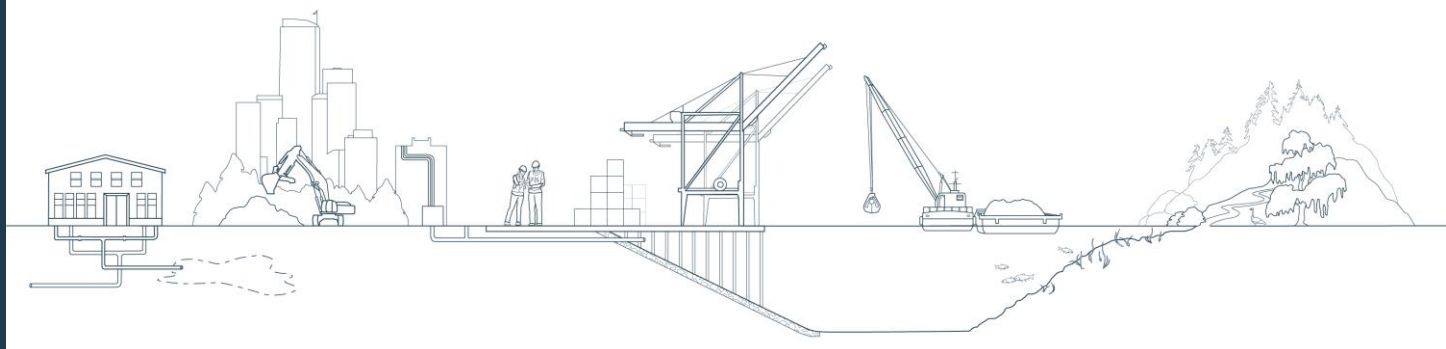
Attachment 3
Health and Safety Plan

Health and Safety Plan

Riverside HVOC Site

Prepared for
City of Bothell

June 2024



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LIMITATIONS

This report has been prepared for the exclusive use of the City of Bothell, their authorized agents, and regulatory agencies. It has been prepared following the described methods and information available at the time of the work. No other party should use this report for any purpose other than that originally intended, unless Floyd|Snider agrees in advance to such reliance in writing. The information contained herein should not be utilized for any purpose or project except the one originally intended. Under no circumstances shall this document be altered, updated, or revised without written authorization of Floyd|Snider.

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List of Abbreviations

Abbreviation	Definition
ANSI	American National Standards Institute
APP	Accident Prevention Plan
cis-1,2-DCE	*cis*-1,2-Dichloroethene
City	City of Bothell
COC	Contaminant of concern
HASP	Health and Safety Plan
HSO/SS	Health and Safety Officer/Site Supervisor
HVOC	Halogenated volatile organic compound
O&M	Operations and maintenance
OSHA	Occupational Safety and Health Act
PID	Photoionization detector
PCE	Tetrachloroethene
PM	Project Manager
PPE	Personal protective equipment
ppm	Parts per million
ROW	Right of way
Site	Riverside Halogenated Volatile Organic Compound Site
SSO	Site Safety Officer
TCE	Trichloroethylene

1.0 Plan Objectives and Applicability

This Health and Safety Plan (HASP) has been written to comply with the standards prescribed by the Occupational Safety and Health Act (OSHA) and the Washington Industrial Safety and Health Act.

The purpose of this HASP is to establish site-specific protection standards and mandatory safe practices and procedures for all personnel involved with operations and maintenance (O&M), investigation and remediation under the Agreed Order and Cleanup Action Plan with the Washington State Department of Ecology at the City of Bothell (City) Riverside Halogenated Volatile Organic Compound (HVOC) Site (Site), in Bothell, Washington. It has been prepared as a supplement to Floyd|Snider's Accident Prevention Plan (APP; Appendix A).

This HASP establishes standard operating procedures and provides for contingencies that may be implemented during field work activities. This HASP consists of Site and facility descriptions, a summary of work activities, the identification and evaluation of chemical and physical hazards, monitoring procedures, a description of Site zones, decontamination and disposal practices, and emergency procedures.

The provisions and procedures outlined in this HASP apply to all Floyd|Snider personnel on-site. Contractors, subcontractors, other oversight personnel, and all other persons involved in the field work activities described herein are required to develop and comply with their own HASP or Job Safety Analysis but must also comply with the requirements of this HASP on job sites managed by Floyd|Snider. All Floyd|Snider staff conducting field activities are required to read this HASP and indicate that they understand its contents by signing the Health and Safety Officer/Site Supervisor's (HSO/SS's) copy of this plan prior to conducting field work activities. A copy of this plan must be maintained on site at all times by the HSO/SS.

This HASP is based on information that was available as of the date indicated on the title page. Additional hazards not specifically addressed by this HASP may exist at the work site or may be created as a result of site activities. Should project personnel identify a site condition that is not addressed by this HASP and have any questions or concerns about site conditions, they should immediately notify the HSO/SS, and work shall be paused to assess any new hazards. If any new hazards identified can be mitigated or controlled, work can proceed and the HASP will be revised, if appropriate.

The HSO/SS has field responsibility for ensuring that the HASP adequately protects worker health and safety and is properly implemented. In this capacity, the HSO/SS will conduct regular site inspections and has the authority to make health and safety decisions that may not be specifically outlined in this HASP based on site conditions. If the HSO/SS leaves the Site while work is in progress, an alternate Site Safety Officer (SSO) will be designated. Personnel responsibilities are further described in the APP.

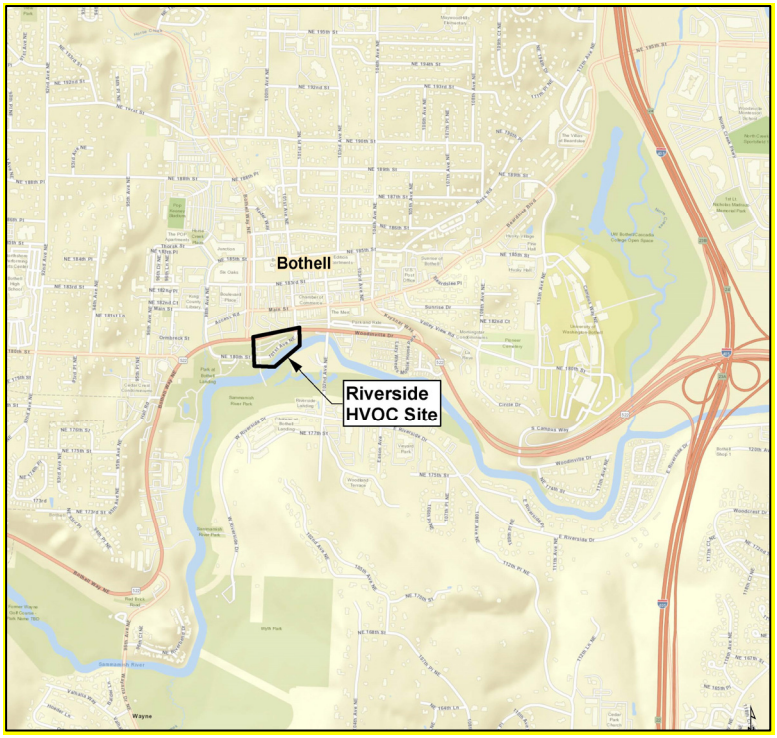
This HASP was reviewed by the Project Manager (PM) and the HSO/SS prior to commencement of work activities.

2.0 Background Information

2.1 SITE BACKGROUND

The Site is located on the eastern end of the King County Assessor's parcel 082605-9120 in downtown Bothell as shown on Figure 2.1 The parcel containing the Site is currently vacant and is utilized as a City park and a public gravel parking lot, accessed by public roadways.

Figure 2.1
Riverside HVOC Site Vicinity Map



The Site is the location of a former small machine shop where tetrachloroethene (PCE) was believed to be used for degreasing.

To the west of the Site are City-owned properties associated with The Park at Bothell Landing; south of the Site is the Sammamish River; east of the Site is a dental office; and north of the Site is State Highway 522 (Woodinville Drive) with retail parking on the opposite side of the street. Roadways in the vicinity of the Site are the state highway with high traffic frequency and side streets that have a low traffic frequency.

The contaminants of concern (COCs) at the Site include HVOC associated with dry cleaning activities, including PCE and its breakdown products trichloroethylene (TCE), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), and vinyl chloride.

Floyd|Snider will be conducting investigation activities in the north-east portion of the property.

2.2 SCOPE OF WORK

The purpose of the investigation is to refine the extent of HVOC contamination and gather hydrogeologic data to support cleanup action design. The investigation will consist of the following:

- O&M of existing groundwater extraction system
- Water level monitoring and flow testing of existing well performance
- Site wide groundwater sampling
- Soil sampling via direct push drilling

3.0 Emergency Contacts and Information

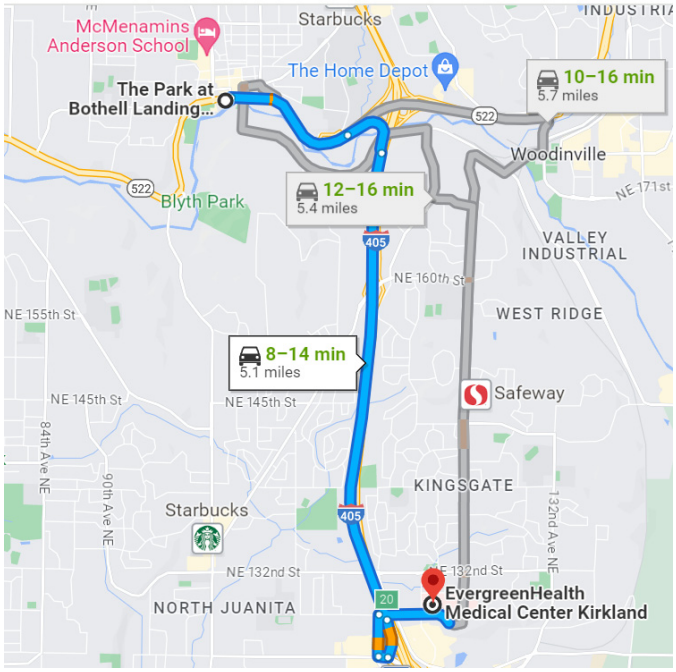
3.1 DIAL 911

In the event of an emergency, dial 911 to reach fire, police, and first aid.

3.2 HOSPITAL AND POISON CONTROL

Nearest Hospital Location and Telephone: (Refer to Figure 3.1 for directions and map to the hospital.)	Evergreen Health Medical Center 12040 NE 128th St Kirkland, Washington (425) 899-1700
Washington Poison Control Center:	(800) 222-1222

Figure 3.1
Hospital Directions



1. Head southeast toward NE 180th St
2. Turn left onto NE 180th St
3. Turn right at the 1st cross street onto WA-522 E/Woodinville Dr
4. Use the right two lanes to merge onto I-405 S via the ramp to Bellevue
5. Merge onto I-405 S
6. Take exit 20 for NE 124th St
7. Use the right lane to turn right onto NE 124th St
8. Turn right at the 1st cross street onto 116th Ave NE
9. Turn right onto NE 128th St to arrive at Evergreen Health Medical Center

3.3 PROVIDE INFORMATION TO EMERGENCY PERSONNEL

All Floyd|Snider project personnel should be prepared to give the following information:

Information to give to Emergency Personnel	
Site Location: (Refer to Figure 2.1)	The Park at Bothell Landing Additional Parking Area NE 180th Street and Woodinville Dr Bothell, Washington
Number You Are Calling From:	This information can be found on the phone you are calling from.
Type of Accident or Type(s) of Injuries:	Describe accident and/or incident and number of individuals needing assistance.

3.4 UTILITY EMERGENCY CONTACTS

Additional entities that may need to be contacted in the event of an emergency involving damage to a utility include the following:

PSE Electric or Gas Emergency Line:	(888) 225-5773
City of Bothell Sewer & Water Utility Contact	(425) 488-0118

3.5 PROJECT CONTACTS

After contacting emergency response crews as necessary, contact the Floyd|Snider PM, or a Principal, to report the emergency. The Floyd|Snider PM may then contact the City or direct the field staff to do so.

Floyd|Snider Emergency Contacts:

Contact	Office Phone Number	Cell Phone Number
Kristin Anderson, PM	(206) 292-2078	(206) 552-4241
Lynn Grochala, Associate Principal		(603) 491-3952
Danielle Gallaher, HSO/SS		(619) 302-6688

City of Bothell Emergency Contacts:

Contact	Office Phone Number	Cell Phone Number
Scott Adamek	(425) 806-6824	(425) 409-4278
Ryan Roberts	(425) 806-6823	(425) 471-1837

4.0 Hazard Evaluation and Risk Analysis

The typical fire, explosion, and physical hazards likely to be present on the job site, and procedures to control the mitigation of these hazards, are presented in the APP. This HASP presents additional information regarding site-specific hazards, including chemical exposure hazards associated with site COCs or the scope of field activities and analysis of the hazards associated with each site investigation task.

4.1 CHEMICAL EXPOSURE HAZARDS

This section describes potential chemical hazards associated with the field activities being conducted. Based on previous site data, elevated concentrations of the following chemicals may be encountered at the Site:

- HVOCs including PCE and its breakdown products TCE, *cis*-1,2-DCE, and vinyl chloride in soil and/or groundwater
- Laboratory preservatives encountered during sampling
- Petroleum products used for equipment

Human health hazards associated with these chemicals are presented in the following table. This information covers potential toxic effects that might occur in the event of relatively significant acute and/or chronic exposure. Potential routes of exposure include inhalation, dermal contact, ingestion, and eye contact. The primary exposure route of concern during site work is ingestion of contaminated water, soil, or sediment, though such exposure is considered unlikely and highly preventable.

The types of planned work activities and use of monitoring procedures and protective measures will limit potential exposures at this Site. The use of appropriate personal protective equipment (PPE) and decontamination practices will assist in controlling exposure by means of all pathways to the COCs listed in the following table.

Chemical Hazard	OSHA-Permissible Exposure Limits (8-hour TWA/STEL)	Highest Historical Concentration	Routes of Exposure	Potential Toxic Effects
Groundwater/Sediment Operations				
PCE	25 ppm / 38 ppm	1.5 mg/kg in soil, 6,270 µg/L in groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Eye irritation; allergic dermatitis; chloracne; GI distress; liver, kidney damage; breast and other cancers.
TCE	50 ppm / 200 ppm	0.30 mg/kg in soil, 130 µg/L in groundwater	Inhalation	Dermatitis; bronchitis; lung, skin, and stomach cancer.
cis-1,2-DCE	200 ppm / 250 ppm	0.50 mg/kg in soil; 190 µg/L in groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Ulceration of nasal septum; dermatitis; GI disturbance; respiratory irritation; hyperpigmentation of skin; skin and lung cancer.
Vinyl Chloride	1 ppm / 5 ppm	0.0048 mg/kg in soil; 47 µg/L in groundwater	Inhalation, skin/eye contact	Lassitude; abdominal pain, GI bleeding; enlarged liver; pallor or cyanosis of extremities; cancer

Chemical Hazard	OSHA-Permissible Exposure Limits (8-hour TWA/STEL)	Highest Historical Concentration	Routes of Exposure	Potential Toxic Effects
Groundwater/Sediment Operations (cont.)				
Laboratory Preservatives (hydrochloric acid, methanol, sodium bisulfate, nitric acid)	Not applicable	Not applicable	Dermal contact, eye contact	Irritation to skin or eyes. Avoid contact by proper use of PPE during sample handling and collection.
Fueling Operations				
Diesel-Range and Heavy Oil-Range Organics	None established	Not applicable	Inhalation, skin/eye contact	Irritation of eyes, reduction in pulmonary function, and effects to central nervous system.
Gasoline-Range Hydrocarbons	300 ppm / 500 ppm	Not applicable	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation of eyes, skin, mucus membranes; headache; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; liver, kidney damage.

Abbreviations:

GI	Gastrointestinal
µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
ppm	Parts per million
STEL	Short-term exposure limit
TWA	Time-weighted average

4.2 JOB HAZARD ANALYSIS

This section identifies potential hazards associated with each task listed in Section 2.2 of this HASP. Tasks have been grouped according to the types of potential hazards associated with them.

Work Task	Potential Hazards	Actions to Control Hazards
Load and Transport Equipment on Vehicles	Damage or injury from unsecured cargo	Ensure that all cargo is secured when packing equipment in or out. Prevent movement of equipment while vehicle is in operation.
	Injuries during the removal of work zone delineators	Verify that traffic is clear before removing work zone delineators and/or traffic control devices.
Lifting and manual transport of equipment	Improper lifting techniques, overreaching/ overextending, lifting overly heavy objects	Use proper lifting techniques and mechanical devices where appropriate. Test the weight of the load prior to lifting. Do not attempt to lift a heavy load alone. Never try to lift more than you are accustomed to lifting. Avoid quick, jerky movements and twisting motions.
Working in populated/urban area	Third party impacts from noise, COCs	Perimeter controls of cones and barricades with controlled entry around the work area.
Traffic hazards	Vehicle traffic and hazards when working near active operations	Personnel working are required to wear American National Standards Institute (ANSI) class 2 vests or garments within any right of way (ROW). Traffic control plans and permits from the City will be required for any lane closures, work in sidewalks and equipment or truck movement that is against established traffic signals. Washington State Department of Transportation required signage, protection devices, and flagging will be used by the Contractor if required during lane closures. Avoid working with your back to traffic whenever possible.
Ground impacting tasks	Underground Utility damage	Utilities are to be surveyed with a public and private utility locate and marked prior to work
Accidents due to inadequate lighting	Improper illumination	Work will only proceed during daylight hours or under sufficient artificial light.

Work Task	Potential Hazards	Actions to Control Hazards
Soil Sampling characterization, direct push drilling, geo-probe sampling and well removal activities	Heavy equipment usage (drill rigs)	Ensure the use of competent operators, backup alarms, regular maintenance, daily mechanical checks, and proper guards. All project personnel will make eye contact with the operator and obtain a clear "OK" before approaching or working within the swing radius of heavy equipment, staying clear of the swing radius.
	Exposure to loud noise	Wear earplugs or protective ear covers when heavy equipment is operating and when a conversational level of speech is difficult to hear at a distance of 3 feet; when in doubt, a sound level meter may be used on-site to document noise exposure.
	Overhead hazards, falling and/or sharp objects, bumping hazards, construction equipment	All personnel will wear hard hats at all times when overhead hazards exist, such as during drilling activities and around heavy or large equipment. Workers will never work under overhead loads
Water level measurements, well surveying activities, well development and groundwater sampling from monitoring wells	Slip, trip, or fall hazards	Steel-toed boots must be worn on-site at all times while heavy equipment is present. Pay attention to footing on uneven or wet terrain and do not run. Keep work areas organized and free from unmarked trip hazards.
	Biological hazards, dermal or eye exposure to site contaminants in groundwater	Wear proper PPE including safety glasses at all times while on-site. If a pressure washer is used to decontaminate heavy equipment, a face shield will be worn over safety glasses or goggles. Care will be taken during decontamination procedures and groundwater sampling to avoid splashing or dropping equipment into decontamination water.
	Heat and cold exposure hazards	Refer to Section 5.3 in the APP.

5.0 Site Controls and Monitoring

The following sections describe site controls and monitoring that will be implemented during site field activities. The HSO/SS, or a designated alternate (SSO), is responsible for inspecting the work area daily and identifying additional hazards. Personnel responsibilities are further described in the APP.

5.1 DAILY SAFETY MEETINGS

A safety meeting will be conducted by the HSO/SS or designated SSO daily prior to the start of work. Additional safety briefings or safety checks should also be performed when switching tasks or whenever new hazards are identified. Safety meetings topics and attendance will be recorded on the Daily Tailgate Safety Meeting and Debrief Form provided in Appendix B.

Any near-misses or incidents that occur on the job site will be recorded on the Near Miss and Incident Reporting Form provided in Appendix C.

5.2 EMERGENCY MUSTER POINT

The emergency muster point is the east parking lot of the dental building to the east of the Site.

The APP describes required emergency equipment and procedures to be followed in the case of medical emergency; release of a hazardous substance; or other emergencies such as a thunderstorm, vehicle collision, fire, or earthquake.

5.3 PERSONAL PROTECTIVE EQUIPMENT

Work will proceed in standard Level D as described in the APP. PPE should be inspected for defects before each use. Field staff will use clean, disposable nitrile gloves when handling sample material. ANSI class 2 high-visibility vests or garments are required for work within ROWs, working around heavy equipment and on road shoulders. During drilling work, staff will additionally wear hard hats and hearing protection.

5.4 WORK AREAS

An exclusion zone will be established when working with contaminated materials. The exclusion zone will be delineated with cones and barricades.

A contaminant reduction zone will be set up at the entry/exit point of the exclusion zone. The contaminant reduction zone will contain the necessary elements to perform personnel and equipment decontamination as described in Section 5.5. The contaminant reduction zone will be established approximately 5 feet from the exclusion zone in the downwind direction.

The support zone will consist of vehicles and public restroom facilities located near the side.

5.5 DECONTAMINATION AND WASTE DISPOSAL

Field staff should always follow the best practices for prevention of contamination detailed in the APP.

Large equipment and vehicle decontamination generally consists of scrubbing to remove visible debris followed by washing with a soap and water solution and rinsing with clean water. For drilling equipment, decontamination wash water will be captured in a watertight trailer and drummed at the end of the work day. Sampling equipment will be decontaminated by scrubbing to remove visible debris, washing with soap and water, and rinsing with distilled water. Personnel decontamination will include removal of disposal gloves/other disposable PPE followed by washing of hands.

Floyd|Snider and its subcontractors will use safe and prudent waste collection and housekeeping practices to minimize the spread of contamination beyond the work zone and the amount of investigation-derived waste. The Floyd|Snider HSO/SS will work with site personnel to ensure the proper collection, packaging, and identification of waste materials so that waste materials will be properly disposed of.

Disposable PPE and sampling equipment will be placed into trash bags and disposed as municipal solid waste. Excess sample material will be containerized in drums approved by U.S. Department of Transportation. Equipment wash water will also be containerized in drums on-site.

5.6 AIR MONITORING

Air monitoring using a photoionization detector (PID) will be performed if personnel are likely to be exposed to volatile contaminants. Contaminant concentrations in soil and groundwater at the Site are present at concentrations that are not expected to result in vapor concentrations that exceed allowable OSHA levels. Potential volatile COCs include chlorinated solvents such as PCE, TCE, *cis*-1,2-DCE, and vinyl chloride in soil or groundwater.

Action levels for air monitoring are presented in the following table with PID calibrated to isobutylene with the correction factor for vinyl chloride for a 10.6 electron volt (eV) lamp.

Monitoring Equipment	VOC Concentration	Action
PID	Less than 2 ppm less than 10 ppm for no longer than 15 minutes	Continue operations in Level D PPE. Work upwind of excavation area when possible.
	Greater than 2 ppm and less than 10 ppm; intermittent	Leave work area and allow vapor to dissipate; use engineering controls if necessary. Monitor VOC concentration every 5 minutes; resume work once concentrations are less than 2 ppm for 15 minutes.
	Greater than 10 ppm	Stop operations and evacuate area. Do not resume work until engineering controls are able to maintain VOC concentrations less than 2 ppm in breathing space are in place.

6.0 Approvals

Project Manager	Date
Project Health & Safety Officer	Date

7.0 Signature Page

I have read this Health and Safety Plan and understand its contents. I agree to abide by its provisions and will immediately notify the HSO/SS if site conditions or hazards not specifically designated herein are encountered.

Name (Print)	Signature	Date	Company/Affiliation

Health and Safety Plan

Riverside HVOC Site

Appendix A
Accident Prevention Plan

Accident Prevention Plan

June 2022

FLOYD | SNIDER

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List of Abbreviations

Acronym/ Abbreviation	Definition
AED	Automated external defibrillator
APP	Accident Prevention Plan
AQI	Air quality index
COPD	Chronic obstructive pulmonary disease
CPR	Cardiopulmonary resuscitation
°F	Degrees Fahrenheit
FFR	Filtering facepiece respirator
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSO/SS	Health and Safety Officer/Site Supervisor
JHA	Job Hazard Analysis
JSA	Job Safety Analysis
L&I	Washington State Department of Labor & Industries
MTCA	Model Toxics Control Act
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Act
PEL	Permissible exposure limit
PM	Project Manager

Acronym/ Abbreviation	Definition
PPE	Personal protective equipment
RPP	Respiratory Protection Program
SDS	Safety Data Sheet
SSO	Site Safety Officer
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act

1.0 Plan Objectives and Applicability

This Accident Prevention Plan (APP) describes the policies and best practices established by Floyd|Snider to ensure the safety of employees to the maximum extent possible when performing their work duties. Employee safety is Floyd|Snider's highest priority. Employees are encouraged to use the Health and Safety Department as a resource in identifying potential hazards and the appropriate precautions to address them. While additional safety precautions may impact project schedules and costs, Floyd|Snider will ultimately benefit as accidents are avoided.

This APP has been written to comply with the standards of the Occupational Safety and Health Act (OSHA) and Washington Industrial Safety and Health Act (WISHA) as they pertain to work activities performed by Floyd|Snider.

This APP applies to all employees of Floyd|Snider. It consists of the following components:

- A description of the roles and responsibilities of all Floyd|Snider personnel in ensuring worker safety,
- General safety policies for the office and the field job site,
- Procedures to follow in an emergency,
- Information on common hazards and steps that should be taken to mitigate these hazards,
- A description of the basic safety controls that should be implemented on all field job sites,
- Training requirements for field staff, and
- Safety record keeping and reporting requirements and procedures.

2.0 Roles and Responsibilities

All staff members share responsibility for safety. The roles and responsibilities for Floyd|Snider staff in ensuring company safety are described in the following sections.

2.1 BOARD OF DIRECTORS

The Floyd|Snider board of directors consists of the elected senior officers of Floyd|Snider who establish the company's culture of safety. These individuals set policy for the company, including safety policy. The Management Committee, which consists of the Board of Directors and additional shareholder representatives, is also responsible for enforcement of this APP.

2.2 HEALTH AND SAFETY COMMITTEE

The Health and Safety Committee is composed of field and management staff, who meet on a quarterly basis or more frequently if needed to review and update the Floyd|Snider Health and Safety Program. The Health and Safety Committee is responsible for making updates to this APP as approved by the Management Committee. Health and Safety Committee meeting minutes are recorded and made accessible on Floyd|Snider's Health and Safety department page on SharePoint.

2.3 HEALTH AND SAFETY ADMINISTRATOR

The Health and Safety Administrator receives, organizes, and reviews reports of near misses and incidents in the workplace. The Health and Safety Administrator is responsible for the administration of benefits, working with managers to identify OSHA-reportable incidents, and managing the OSHA reporting process. The Health and Safety Administrator is also responsible for documentation of Health and Safety Committee meeting minutes and employee training record keeping. The Health and Safety Administrator is supported by the Board of Directors and the Health and Safety Committee, who are responsible for taking corrective actions when near misses, incidents, and other safety issues identified in this plan occur.

2.4 PROJECT MANAGERS

Project Managers (PMs) reinforce the Floyd|Snider safety culture. During all phases of projects, PMs review health and safety issues and will have authority to allocate resources and personnel to safely accomplish project work.

PMs direct the field personnel at a job site. PMs coordinate with the project Health and Safety Officer/Site Supervisor (HSO/SS) to ensure that the scope of the project and site conditions are accurately documented in all project safety materials and that all Floyd|Snider personnel on site have received the required safety training and understand the procedures to follow should an incident occur on site. PMs review safety documentation materials with the HSO/SS at intervals

determined prior to the start of field events and report near misses and incidents to the Health and Safety Administrator.

2.5 FIELD HEALTH AND SAFETY OFFICER AND SITE SUPERVISOR

The HSO/SS prepares and/or approves the site Health and Safety Plan (HASP) and any amendments thereof and is responsible for full implementation of all elements of the HASP.

The HSO/SS will advise the PM and project personnel on all potential health and safety issues of the field investigation activities to be conducted at a site. The HSO/SS will specify required exposure monitoring to assess site health and safety conditions, modify the site HASP based on field assessment of health and safety accidents and/or incidents, and recommend corrective action if needed. The HSO/SS will report all accidents and/or incidents to the PM. If the HSO/SS observes unsafe working conditions by Floyd|Snider personnel or any contractor personnel, the HSO/SS will suspend all work until the hazard has been addressed.

The HSO/SS is responsible for conducting tailgate safety meetings daily before the start of field work. Tailgate safety meetings should identify the work to be completed, safety hazards likely to be encountered, and the appropriate work practices needed to minimize exposure to these hazards. Tailgate safety meeting forms are included in the HASP documents.

2.6 FIELD SITE SAFETY OFFICER

The field Site Safety Officer (SSO) may be a person dedicated to this task, to assist the HSO/SS during field work activities. The SSO will ensure that all personnel have appropriate personal protective equipment (PPE) on site and that PPE is properly used. The SSO will assist the HSO/SS in field observation of Floyd|Snider personnel safety. If a health or safety hazard is observed, the SSO shall suspend all work activity. The SSO will conduct onsite safety meetings daily before work commences. All health and safety equipment will be calibrated daily and records kept in the daily field logbook. The SSO may perform exposure monitoring if needed and will ensure that equipment is properly maintained.

2.7 FLOOR WARDENS

Floor Wardens are Floyd|Snider staff members who have volunteered to coordinate Floyd|Snider's response in case of an emergency at Union Square. Floor Wardens are responsible for ensuring that all staff have evacuated the building if an evacuation order is issued by building management and accounting for staff at the emergency muster point. Floor Wardens also post and update emergency evacuation routes and maintain maintenance records for fire extinguishers located at the office. The names of current Floor Wardens are posted in the office above fire extinguishers and on the Floyd|Snider SharePoint home page.

2.8 EQUIPMENT MANAGER

The Equipment Manager is responsible for ensuring that all field equipment, including the company vehicle, is in safe working order and for keeping records of equipment maintenance. Employees must report any issues with the company vehicle or field equipment to the Equipment Manager. The Equipment Manager will designate an alternate for days when the manager will not be available to assist field staff with urgent equipment or vehicle issues.

2.9 FLOYD|SNIDER PERSONNEL

All Floyd|Snider project personnel will take precautions to prevent accidents and/or incidents from occurring to themselves and others. Employees must read, understand, and sign this APP. Employees will report all incidents and near misses to their PM, HSO/SS, or SSO and inform of any physical conditions that could impact their ability to perform their work.

2.10 EMERGENCY CONTACTS

All Floyd|Snider staff must designate a person outside of the company who may be contacted in case of an emergency in which a staff member requires medical care. Emergency contacts are responsible for making decisions regarding medical treatment in the event that the staff member is incapacitated, or for contacting the individual who has been designated authority by the staff person to make such decisions if they do not have that authority.

Emergency contact information will be provided to the Health and Safety Administrator and updated as needed, at a minimum frequency of once per year. The Health and Safety Administrator is responsible for maintaining emergency contact information in the Floyd|Snider firm contact database and making this information available on the Floyd|Snider SharePoint home page.

3.0 Safety Policies

The safety policies presented in this section have been developed to ensure the safety of all staff. They should be considered the minimum requirements to maintain a safe workplace; staff should be vigilant at all times and take the needed actions to identify and correct unsafe situations.

3.1 GENERAL OFFICE SAFETY

This section describes the policies that have been developed to keep staff safe in all work scenarios, including at the office and on the job site.

3.1.1 Injury Prevention

In office areas, trips and falls are the primary cause of acute injury, and they can be easily prevented. There are many different ways to prevent injury, including, but not limited to:

- Keep all work areas, aisles, and hallways clear at all times.
- Make sure all exits are accessible, clearly marked, and properly illuminated.
- Keep all work and storage areas in a sanitary condition; floors shall be clean and, as much as possible, kept in a dry condition. If floors are wet, they should be marked with signage to notify others.
- Pile or store materials in a stable manner, so that they will not be subject to falling.
- Keep walkways and work areas free of electrical cords.
- Never make repairs to light fixtures unless authorized to do so by a supervisor.
- Use a stepstool when reaching overhead objects.
- Do not lift equipment and materials weighing more than 20 pounds by yourself; ask for help and/or use a handtruck.
- When carrying loads, exercise care to avoid overexertion and strain. Use proper lifting and reaching techniques.
- Use adjustable desk chairs to reduce musculoskeletal injuries; ask for assistance if you are unfamiliar with proper ergonomic adjusts for your desk, computer, and chair.
- Report all unsafe conditions and symptoms of injury to the Health and Safety Administrator.
- Exercise caution in moving about the office.

3.1.2 Administration of First Aid and Cardiopulmonary Resuscitation

First aid and cardiopulmonary resuscitation (CPR) should only be administered by individuals with the appropriate training. Floyd|Snider makes First Aid and CPR/automated external defibrillator (AED) training to available to all staff members and requires this training for all field staff members. At least one person on a field site must be trained and have current certification in

First Aid and CPR. First aid kits compliant with the ANSI Z308.1-2015 Class B standard will be available at the Floyd|Snider office and at all field sites. First aid kits for field sites additionally include basic medications (aspirin and diphenhydramine), tweezers, a clotting sponge, potable water, outdoor skin cleanser, super glue, adhesive moleskin pads, safety pins, sunblock, insect repellant, medical masks and a printed field staff emergency contact list.

3.1.3 New Employee Orientation

All new employees receive an orientation to the Floyd|Snider Health and Safety Program from a member of the Health and Safety Committee. This orientation is arranged by the assigned mentor for the new employee and includes a review of the materials available on the Health and Safety department home page (APP, HASP templates, near miss and incident forms, training resources, etc.) as appropriate to the employee's role at Floyd|Snider, office and field safety policies, and training and documentation requirements for field and office safety.

3.1.4 Workplace Hostility

Floyd|Snider intends to provide a work environment that is free from intimidation, hostility, or other offenses that are inappropriate. Harassment of any sort—verbal, physical, or visual—will not be tolerated.

Harassment can take many forms. It may be, but is not limited to, words, signs, jokes, pranks, physical or verbal intimidation, physical contact, or violence. Harassment is not necessarily sexual in nature, although these prohibitions against harassment specifically include all forms of sexual harassment.

It is the company's policy to regard sexual harassment and other forms of harassment, as well as the threat of such harassment, as very serious matters and to prohibit them in the workplace by any person and in any form. All staff are required to complete harassment training. Floyd|Snider also makes bystander intervention training available to all staff.

3.2 FIELD SAFETY

This section describes the additional policies developed to keep field staff safe on the job site.

3.2.1 Stop Work Authority

All staff members have Stop Work Authority. Stop Work could be a temporary pause in work for a few minutes or a full shutdown of work until unsafe work conditions can be addressed. If unsafe work conditions are encountered and cannot be immediately addressed by the staff on-site, the HSO/SS should report immediately to the PM. Safety hazards may include physical site conditions or dangerous work practices by subcontractors or other workers. The PM will help the field staff to make modifications to the work practices to mitigate the hazard if possible. If the unsafe conditions cannot be mitigated, field staff have the authority to stop all work until the conditions can be properly addressed.

3.2.2 Health and Safety Plan

A site-specific HASP must be prepared and made available to field staff at job sites. A site-specific HASP is required for any activities where field staff may contact contaminated material; activities such as a site visit or oversight where no contact with contaminated material or physical hazards may occur can be completed without a HASP, if approved by the PM. The HASP should address both potential physical and chemical hazards on-site and steps taken to mitigate those hazards.

3.2.3 Tailgate Safety Meetings

The HSO/SS is responsible for conducting tailgate safety meetings daily before the start of field work. Tailgate safety meetings should identify the work to be completed, safety hazards likely to be encountered, and the appropriate work practices needed to minimize exposure to these hazards. Tailgate safety meetings must always cover the site-specific procedures to follow in case of an emergency.

When performing field work, staff should maintain awareness of new or changing hazards at the job site. Staff should always assess then reassess the hazards when changing between tasks or changing the manner in which a task is performed and document meetings and assessments on the tailgate safety meeting form.

3.2.4 Buddy System

Floyd|Snider employs the buddy system for work at job sites meaning employees are never alone in the field. The buddy system ensures that employees can get help in case of an emergency. Working in the field without another Floyd|Snider employee present may be permissible in the following scenarios:

- When the site is occupied, you are not performing an activity with high risk of injury (e.g., not working in traffic, not entering small spaces or lifting heavy objects), and you are in close proximity of other people capable of responding if you call for help.
- If you are accompanied by a teaming partner or subconsultant who may act as your buddy.
- IF FOR ANY REASON YOU ARE NOT COMFORTABLE WITH THE ASSIGNMENT OR THE CONDITIONS, DISCUSS IT WITH YOUR PM AND ASK FOR A BUDDY.

3.2.5 Check-in Procedure

All employees in the field, whether in groups or alone, will follow the check-in procedure detailed below:

- Notify front desk or your PM when you are leaving for field work. Notification can be by email, phone, or in person.
- Provide an estimated completion time of when you think you will return to the office or head home.

- At the end of the field day, before leaving the site, call the office and let the front desk or your PM (the same person you notified at the beginning of the day) know you are returning to the office or heading home. Ask to be transferred to the PM to discuss how things went.
- If you will not be finished with field work by 5:00 p.m., call the office and let the front desk know you are still in the field and that you will check in with the PM when fieldwork is finished.
- Communicate with the PM when you are finished with work and leaving the site (after 5:00 p.m.).
- If you are in a group of Floyd|Snider employees doing this field work, one person can do this check-in process on behalf of the group.
- If you fail to check in and cannot be reached by cell phone, someone from the office may be sent to locate you, or local authorities may be notified.

3.2.6 Personal Protective Equipment

Field staff must wear the appropriate PPE required in the site-specific HASP. Floyd|Snider provides employees with all required PPE such as steel-toed boots, reflective vest/jacket, hardhat, safety glasses, gloves, ear protection, and first aid kits. Field staff are responsible for wearing the appropriate PPE in accordance with the HASP, keeping their PPE in good condition, and replacing it as needed.

All work will proceed in Level D PPE, which shall include hard hat, protective footwear, hearing protection, eye protection, gloves, and sturdy outer work clothing. Protective footwear must be compliant with ASTM F2413 or the former ANSI Z41 (repealed) standard, with oil- and chemical-resistant soles, and must be securely laced without signs of excessive tread wear. For all work involving potential exposure to soil and groundwater, workers will wear nitrile gloves and Level D PPE. Personal floatation devices will be worn at all times during work in the vicinity of surface water. When working in a remote location, all teams must carry a field first aid kit. The contents of a field first aid kit include basic medications (aspirin and diphenhydramine), sterile dressings, adhesive bandages and tape, wound-cleansing towelettes, sting-relief wipes, antibiotic ointment, butterfly bandages, tweezers, safety pins, and a printed field staff emergency contact list.

All field personnel will be properly fitted for PPE and trained in the use of PPE during initial 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training (refer to Section 7.0 for additional training information). The level of protection will be upgraded by the HSO/SS whenever warranted by conditions present in the work area. The HSO/SS will ensure that field staff know how to properly use PPE and periodically inspect equipment such as gloves and hard hats for defects.

3.2.7 Confined Spaces

Floyd|Snider field staff are not trained in confined space entry and may not enter permit-required confined spaces. It is considered entry if your head/face breaks the plane of the confined space opening.

Confined spaces are defined as a spaces that have limited or restricted means for entry or exit and are not designed for continuous occupancy. Confined spaces commonly encountered at field sites may include vaults, manholes, pits, and tanks. OSHA designates confined spaces as "permit-required confined spaces" if they exhibit one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere
- Contains material that has the potential to engulf an entrant
- Has walls that converge inward or floors that slope downward and taper into a smaller area that could trap or asphyxiate an entrant
- Contains any other recognized safety or health hazard (e.g., unguarded machinery, exposed wires, extreme heat)

In accordance with OSHA regulations, only personnel with specialized confined space training may enter a permit-required confined space under a confined space entry plan.

3.3 RESPIRATORY PROTECTION PROGRAM

The goals of the Respiratory Protection Program (RPP) are to protect employees from potential exposure to respiratory hazards and to ensure compliance with applicable occupational safety and health standards regarding respiratory hazards. Additionally, the RPP provides requirements for the proper selection and use of respiratory protection equipment.

On July 16, 2021, the Washington State Department of Labor & Industries (L&I) adopted an emergency rule to protect workers who are exposed to harmful levels of wildfire smoke (WAC 296-62-085). This RPP conforms to the Washington Administrative Code (WAC) standards for WAC 296-841 Airborne Contaminants and WAC 296-842 Respirators, as well as draft rule WAC 296-65-085 Wildfire Smoke.

3.3.1 Applicability

This RPP applies to respiratory protection used in the field due to impaired ambient air quality when respirator use is not required but may be preferred for comfort. This applies to impaired ambient air quality due to chemical hazards or wildfire smoke. Employees will not be required to perform site work when airborne substances (i.e., site contaminants) are present at concentrations exceeding their OSHA permissible exposure limits (PELs) or if air quality due to wildfire smoke exceeds the Stop Work action threshold and respiratory protection would be

required to safely complete the work. Employees may additionally elect to use respirators for comfort purposes to control non-hazardous substances such as nuisance odors.

If there is the potential to exceed a PEL or wildfire smoke action threshold at a site, engineering and administrative controls will be implemented to mitigate the hazard. Project work that cannot be altered by using engineering or administrative controls must be approved by the Management Committee in advance of the scheduled fieldwork.

The RPP is intended to help employees identify conditions that may warrant the voluntary use of a respirator and to support the selection and maintenance (if applicable) of an appropriate respirator. The RPP should be implemented when employees are working in conditions where respiratory hazards may be encountered, such as when working in conditions with wildfire smoke.

3.3.2 Administrator and Employee Responsibility

The RPP administrator is the Health and Safety Committee chair. The RPP administrator oversees the development, execution, and evaluation of the RPP and will ensure procedures are followed, respirator use is monitored, and respirators provide adequate protection when job conditions change. The RPP administrator will ensure appropriate respirators and the associated supplies are provided to employees for voluntary use at no cost to the employee.

Employees voluntarily using respirators have the following responsibilities:

1. Participate in the Floyd|Snider medical monitoring program in accordance with Section 7.1.
2. Use the respirator only for the specific tasks that it was issued for.
3. Seek medical help if wearing a respirator creates negative health effects such as difficulty breathing, dizziness, or anxiety.
4. Care for and maintain respirators as instructed, including following the manufacturer's specific cartridge change-out or respirator replacement schedule.
5. Notify the supervisor of any problems associated with using a respirator. This includes a respiratory hazard that needs further evaluation, if the respirator is not providing adequate protection, and any concerns with the RPP.
6. Monitor air quality while wearing a respirator and calling Stop Work if PELs are exceeded or if the Stop Work action level for wildfire smoke is exceeded.

3.3.3 Use of Respirators

Respirator use by Floyd|Snider employees is done on a voluntary basis and may be done at any time when the use of an approved respirator may increase comfort or provide additional

protection when air quality conditions are still within a level considered to be safe for work. Voluntary use of respirators applies only when it has been determined that:

- Such respirator use will not in itself create a hazard.
- Airborne occupational exposures to hazardous chemicals will not exceed applicable PELs.
- Exposure to fine particles called PM2.5 in wildfire smoke does not exceed the Stop Work action level (refer to Table 3.1).
- No airborne biological hazard is present.
- No specification standards require the mandatory use of respirators.

3.3.4 Wildfire Smoke Exposure Control Plan

The Wildfire Smoke Exposure Control Plan is intended to address risks to employees working outside from potential exposure to wildfire smoke. This plan will be in effect whenever wildfires are present in the region (in Washington State, surrounding states, or British Columbia, Canada) and will continue to be implemented until such a time that wildfire smoke is no longer a health risk as determined by the air quality index (AQI). The greatest risk of wildfire coincides with the dry season from approximately mid-May through mid-October; however, fires can also occur outside of the typical dry season.

Smoke from wildfires contains chemicals, gases, and fine particles that can be harmful to human health. Breathing in smoke can cause immediate health effects such as coughing, trouble breathing, stinging eyes, a scratchy throat, runny nose, irritated sinuses, wheezing and shortness of breath, chest pain, headaches, an asthma attack, tiredness, and fast heartbeat (CDC 2013). The smallest and most harmful particulate matter in wildfire smoke and other air pollutants are PM2.5. PM2.5 are particles that are 2.5 micrometers or less in width. Increases in daily PM2.5 exposure has been linked to premature death in people with heart or lung disease and nonfatal heart attacks (USEPA 2020). Long-term exposure to PM2.5 is associated with increased rates of lung cancer and heart disease.

Those at increased risk for adverse health effects from wildfire smoke include the following:

- People with lung diseases such as asthma or chronic obstructive pulmonary disease (COPD), including bronchitis and emphysema, and those who smoke
- People with respiratory infections, such as pneumonia, acute bronchitis, bronchiolitis, colds, or flu, or those with or recovering from COVID-19
- People with existing heart or circulatory problems, such as irregular heartbeat, congestive heart failure, coronary artery disease, or angina, and those who have had a heart attack or stroke
- Adults over age 65 and pregnant women

- People with diabetes
- People with other medical or health conditions that can be exacerbated by exposure to wildfire smoke as determined by a physician

Program elements and protocols for wildfire smoke have been developed in accordance with emergency rule WAC 196-62-085 and additionally consider Cal/OSHA Title 8 California Code of Regulations Section 5141.1 regarding Wildfire Smoke.

The Wildfire Smoke Program includes the following elements:

1. Identification of Harmful Exposures (WAC 296-62-08530):

   When wildfire smoke is present, the site-specific HSO will monitor the AQI before each shift and periodically thereafter using U.S. Environmental Protection Agency's (USEPA's) AirNow,[1] available at www.airnow.gov, or a similar state or federal AQI modeling service. The HSO can also monitor real-time air quality using an air quality detector capable of measuring $PM_{2.5}$. The HSO will take actions consistent with the action levels presented in Table 3.1.

2. Hazard Communication (WAC 296-62-08540):

   The HSO will communicate wildfire smoke hazards to employees during the tailgate safety meeting and will record the AQI or $PM_{2.5}$ concentration on the tailgate meeting form when wildfire smoke is present in the air. The HSO will communicate available measures for employees to mitigate wildfire smoke exposure and the symptoms of smoke exposure.

3. Information and Training (WAC 296-62-08550):

   Employees will be trained in the information presented in this RPP (refer to Section 3.3.9), consistent with mandatory information presented in WAC 296-62-08590, prior to conducting work in the presence of wildfire smoke.

4. Exposure Symptom Response (WAC 296-62-08560):

   Employees displaying adverse symptoms of wildfire smoke exposure must be monitored to determine whether medical attention is necessary and may not be penalized for seeking medical treatment. Symptoms of wildfire smoke exposure most often include persistent coughing, difficulty breathing, and aggravation of existing respiratory conditions such as asthma. Provisions for prompt medical treatment will be established for each job site and reviewed during the tailgate safety meetings.

[1] AirNow reports air quality using the official U.S. AQI, a color-coded index designed to communicate whether air quality is healthy or unhealthy. AirNow is a partnership of the USEPA; National Oceanic and Atmospheric Administration; National Park Service; National Aeronautics and Space Administration; Centers for Disease Control and Prevention; and tribal, state, and local air quality agencies.

5. Exposure Controls (WAC 296-62-08560):

   Floyd|Snider will reduce workers' exposure to wildfire smoke by using the hierarchy of controls. Controls are encouraged whenever the ambient air concentration of PM2.5 is greater than 20.5 micrograms per cubic meter (µg/m^3; AQI 69) and required when the concentration of PM2.5 is greater than 55.5 µg/m^3 (AQI 151).

   A. Engineering controls will be implemented where feasible. Such controls include providing enclosed buildings, structures, or vehicles where the air is adequately filtered.

   B. If engineering controls are not sufficient to reduce exposure, Floyd|Snider will implement administrative controls. Such controls include relocating work to a location with a lower ambient air concentration of PM 2.5, changing work schedules to a time where the ambient air concentration of PM 2.5 is less, reducing work intensity, and providing additional rest periods.

   C. In addition to the standards provided in the emergency regulation (WAC 296-62-085), Floyd|Snider has developed action levels for wildfire smoke exposure to be followed at job sites. Table 3.1 shows the AQI categories, equivalent $PM_{2.5}$ measurement in micrograms per cubic meter, the level of health concern, and the action required. The HSO will stop work if the AQI for $PM_{2.5}$ is greater than 301 or if it is not possible to conduct field activities safely due to discomfort or decreased visibility.

   D. Where overnight stays are required in areas that do not have filtered indoor air, additional Floyd|Snider policies apply. If the AQI is forecasted to be greater than 301 overnight, or if the AQI exceeds 500 for several hours, the HSO, Floyd|Snider PM, and client PM will coordinate and decide whether demobilization to an off-site location is necessary.

6. Respiratory Protection (WAC 296-62-08570):

   Floyd|Snider will provide respirators at no cost to all employees for voluntary use in accordance with WAC 296-842 Safety Standards for Respirators. Employees are encouraged to use respirators any time the PM2.5 concentration is greater than 20.2 µg/m^3 (AQI 69), and especially when the PM2.5 concentration is 55.5 µg/m^3 (AQI 151) or greater.

Table 3.1
Action Levels for Wildfire Smoke

AQI Categories for PM2.5	PM2.5 (µg/m³)	Levels of Health Concern	Action [1]
0 to 50	0 to 12.0	Good	• Monitor air quality if wildfire smoke is present. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority.
51 to 68	12.1 to 20.1	Moderate	• Monitor air quality. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority. • Implement administrative and engineering controls.
69 to 150	20.2 to 55.4	Unhealthy for Sensitive Groups	• Monitor air quality. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority. • Implement administrative and engineering controls. • Respirator provided for voluntary use; respirator use is strongly encouraged. • Take frequent breaks in an indoor space with filtered air.
151 to 200	55.5 to 150.4	Unhealthy	• Monitor air quality. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority. • Implement administrative and engineering controls. • Respirator provided for voluntary use; respirator use is strongly encouraged. • Provide for frequent breaks—at least once per hour—in an indoor space with filtered air; stop work if an indoor space with filtered air is not available. • Accommodations must have filtered air for multi-day and overnight field events.
201 to 300	150.5 to 250.4	Very Unhealthy	• Monitor air quality. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority. • Implement administrative and engineering controls. • Respirator provided for voluntary use; respirator use is strongly encouraged. • Take breaks at least once per hour in an indoor space with filtered air; stop work if an indoor space with filtered air is not available. • Accommodations must have filtered air for multi-day and overnight field events. • Reduce work hours; limit workday to no more than 8 hours on-site.
301 to 500	250.5 to 500.4	Hazardous	• **Stop work.** • Demobilize to an off-site work location if necessary.

Notes:
(1) Respirators can be worn at lower AQI levels based on personal preference. Respirators are provided at no cost to employees for use during any air quality conditions.
(2) Symptoms of wildfire smoke exposure most often include persistent coughing, difficulty breathing, and aggravation of existing respiratory conditions such as asthma.

3.3.5 Selection of Respirators

Employees can voluntarily use a respirator based on personal preference. Floyd|Snider will provide respirators at no cost to all employees for voluntary use in accordance with WAC 296-842 Safety Standards for Respirators. PPE is the last line of defense and should be considered after engineering and administrative controls are implemented.

The only approved respirator types to be used without fit testing are filtering facepiece respirators (FFRs), also known as N95 dust masks. Per WAC 296-842-10200, FFRs are any tight-fitting, half-facepiece, negative-pressure, particulate air purifying respirator with the facepiece composed mainly of filter material. These respirators do not use cartridges or canisters and may have sealing surfaces composed of rubber, silicone, or other plastic-like materials. Employees may elect to use respirators for other voluntary uses such as to control nuisance odors and may additionally elect to use respirators other than FFRs for protection from wildfire smoke if the respirator provides protection from PM2.5 equivalent to or greater than an FFR. Use of respirators other than FFRs is subject to fit testing requirements in accordance with the manufacturer specifications. Fit testing, if required for the selected respirator, is provided by Floyd|Snider at no cost to employees.

The National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control and Prevention certifies N95 respirators including FFRs. A label or statement of certification by NIOSH should appear on the respirator or respirator packaging. KN95 respirators, which are filtering facepiece respirators manufactured to the Chinese particulate filtration standard equivalent to N95, are approved for respiratory protection by the U.S. Food and Drug Administration and may also be used if an adequate supply of NIOSH-approved respirators is not available.

Any employee who experiences any difficulties while wearing a respirator must immediately inform their supervisor. If an employee requests to wear a respirator other than an FFR, they must contact their supervisor to ensure the respirator is appropriate and properly fitted for the user.

3.3.6 Medical Evaluations

All Floyd|Snider field staff participate in a medical monitoring program and are evaluated biennially. This evaluation includes respiratory clearance and accomplishes the goal of medical clearance for this program on a voluntary use basis per WAC 296-842-11005. Workers with breathing problems such as asthma, COPD, or chronic heart and lung disease should communicate these conditions to their doctor to determine whether it is safe for them to voluntarily wear an FFR or other type of protection at work. Respirators restrict breathing and can put stress on the heart and lungs, which may worsen health symptoms.

3.3.7 Respirator Fit and Seal Check

Proper fit is necessary to get the most protection from a respirator. Fit testing is not required for FFRs, so employees are not required to participate in fit testing; however, fit testing can be provided at employee request. Note that facial hair, piercings, or facial abnormalities may disqualify an employee from using certain types of tight-fitting respirators. Shaving facial hair is recommended, but not required, for voluntary FFR or use. Employees who choose to use a tight-fitting elastomeric respirator (half- or full-face respirators) will require fit testing and additional training, which Floyd|Snider will provide at no cost to employees.

FFRs should fit according to the manufacturer's instructions. Elastic straps, a moldable nosepiece, or adhesive may be used to aid in sealing. A seal check should be performed after fitting the respirator to the face, using the following procedure:

1. Cover the respirator with both hands and exhale. If air leaks where the respirator seals against the face, readjust the respirator and nosepiece and try again. When a proper fit is achieved, the respirator should bulge from the face and not leak around the seal.
2. Cover the respirator with both hands and inhale. If air leaks where the respirator seals against the face, readjust the respirator and nosepiece and try again. When a proper fit is achieved, the respirator should collapse slightly and not leak around the seal.

The following video provides additional demonstration of fitting the respirator to the face and performing a seal check: https://www.youtube.com/watch?v=GmJxzGXeIvo

3.3.8 Respirator Replacement, Maintenance, and Storage

FFRs are disposable and generally designed for single use (i.e., one 8-hour day); however, the total hours of use may vary by manufacturer. Employees will replace respirators according to the manufacturer-recommended schedule, or a minimum of once per work day if not specified. Disposable respirators should also be immediately discarded if, at any time during use, they become damaged, deformed, dirty, or difficult to breathe through. The number of times an FFR is doffed and donned should be limited whenever possible. Respirators other than FFRs will be maintained or replaced (in full or in part, such as in the case of respirators with detachable cartridges) according to the manufacturer specification. Respirators will be given to a specific employee and may not be shared among employees.

Before donning, respirators will be inspected by the user for damage, deterioration, or improper functioning before use. FFRs will also be checked for proper sealing using the seal check procedures described in Section 3.3.7.

Respirators will be stored in a clean, dry, and sealed area in the field room, field vehicle, or a designated clean area on the job site.

3.3.9 Training

Training will be provided to all employees who voluntarily wear respirators. At a minimum, the training will cover the following information:

- Identification of the hazard (i.e., wildfire smoke)
- Floyd|Snider's policy on hazard communication and how to obtain current information regarding the AQI
- Potential health affects as a result of exposure to the hazard
- Employee rights regarding medical treatment for exposures
- Mitigation measures for smoke exposure
- Employer requirements to provide respirators under the L&I emergency rule
- The respirator's capabilities and limitations
- Proper fit, use, and maintenance of respirators

3.3.10 Record Keeping

As per WAC 296-842-11010, voluntary use of respirators does not require record keeping; however, all employees are required to read and sign this APP, and Floyd|Snider will retain a copy of the signature page and any additional relevant training materials.

3.4 BUILDING SECURITY

For security purposes, Union Square is equipped with an access card system. Computerized proximity cards let you enter the building on your own, any time, but prevent unauthorized access to the building.

To help maintain the integrity of this system:

- Do not let others follow you into the building when exiting and entering when entrances to the building are locked.
- Notify Tenant Services of lost access cards.
- Notify the company when transferring ownership of access cards.

General regular building hours are defined as the time between 6:00 a.m. and 6:30 p.m. After-hours are defined as the time between 6:30 p.m. and 6:00 a.m. During this time period, One and Two Union Square are in after-hours mode and will require an after-hours access card for entry into the buildings.

There is a security guard desk in the main lobby where any security-related incidents should be reported. The security guards are also available to escort employees to their vehicles if they are

feeling unsafe for any reason or can provide access to the office (after verifying your employment status by calling a Principal) if you do not have your access card or keys with you.

3.5 VEHICLE SAFETY

Floyd|Snider maintains a company vehicle for use during field work and to attend meetings. Personal vehicles and/or rental vehicles may be used if additional transportation is needed for a specific task. General vehicle safety and Floyd|Snider vehicle-specific procedures when driving for business purposes are described in the following sections.

3.5.1 General Vehicle Safety

Before driving a vehicle, always perform a safety check:

- Walk around and look for damage such as broken reflectors, damaged mirrors, windshield cracks, missing wiper blades, obviously low tire pressure or damage to tires, new dents, or scratches. Report new damage to the Equipment Manager. Do not drive a vehicle with obvious tire damage or an unrepaired windshield crack. Also note collision hazards in the immediate area.
- Check the vehicle emergency kit for the following items: first aid kit, potable water, eye wash, fire extinguisher, Mylar blanket, road flares, and collapsible traffic cones.
- Ensure that all items stored inside the vehicle are secure and will not slide or tumble during transport. Do not drive with unsecured loads.
- Start the vehicle and check that safety systems are working: headlights, turn signals, emergency flashers, headlights, brake lights, and windshield wipers. Check for dashboard warning lights and address any critical safety warnings (low tire pressure, low oil pressure, high engine temperature, antilock brake system, battery) immediately.

When driving a vehicle for business purposes, all traffic laws must be obeyed. Obey speed limits and all posted signs. Minimize distractions and stay aware of your surroundings. In addition to your safety, you are also a representative of the company behind the wheel and should not conduct any behaviors that would put you or Floyd|Snider in a negative light.

The following safety violations will not be tolerated by Floyd|Snider and will cause revocation of your driving privileges for company business purposes (even if they occur after business hours):

- Texting/cell phone use while driving (hands-free device permitted)
- Citations for reckless driving
- Use of alcohol or drugs before or while driving
- Carrying more passengers than available seatbelts

In the event of an accident, call 911 and follow the procedures in Section 4.3. In the event of a breakdown, call roadside assistance if possible in the area where you are located. If roadside assistance is not available, staff may perform basic tasks (such as addressing a flat tire) in order to be able to return to the office safely only if they are trained and feel comfortable to do so. If you are stuck, call your PM to arrange for emergency assistance.

In the event of a multi-day field effort or a late-night finish, all field equipment (high-dollar-value items) must be stored in a locked garage or other locked storage area for the night and should not be left in the vehicle.

3.5.2 Floyd|Snider Vehicle Safety

The Floyd|Snider vehicle is not equipped with 4-wheel drive, so no off-road driving should be attempted. If the project site is especially muddy or has limited access, an appropriate vehicle should be rented. No one other than Floyd|Snider employees (except for emergency personnel in case of emergency or qualified repair personnel) should be allowed to drive the company vehicle. Do not smoke in the company vehicle.

A first aid kit and fire extinguisher will be kept in the vehicle at all times. A checklist of supplies is kept in the vehicle bulkhead vertical file area and inside the door to the field room for reference. Additional safety supplies that are stocked in the vehicle include nitrile and work gloves, hearing protection, safety glasses, and basic decontamination equipment including Alconox solution, distilled water, disinfectant spray/wipes, and paper towels. If you have used these items, please notify the Health and Safety Committee so they can be replenished. The vehicle is also equipped with basic maintenance supplies including a jack, air pump, and spare tire. The gas tank should always be left at least half full before returning the company vehicle to the garage. The vehicle engine has a minimum octane rating and should be filled with premium gasoline.

Report vehicle warning lights immediately to the Equipment Manager or a designated alternate in the event that the Equipment Manager is not available. The Equipment Manager will work with you to determine a plan to safely address the warning light. If you cannot use the field vehicle safely, notify your PM to assist you with arranging an alternate vehicle. Tire pressure warning lights should be addressed immediately using the pump stored in the van or at a service station if a station is readily available—never drive a vehicle with insufficient tire pressure.

The Equipment Manager will be responsible for making sure the following routine maintenance is performed (but please notify them immediately if you notice any other problems):

- Oil changes and periodic routine maintenance per dealer schedule
- Monthly walk-around check (tires, lights, damage, etc.)
- Detailing when needed

3.6 CONTROLLED SUBSTANCE ABUSE

Floyd|Snider has a strong commitment to provide a safe and drug-free workplace for its employees.

Drug or alcohol testing of current employees may be performed where (a) there are reasonable grounds to believe an employee is under the influence of or suspected of consuming alcohol or using marijuana during work hours or using illegal drugs at any time; (b) as a follow-up to a rehabilitative program; or (c) on a random basis when health and safety requirements for clients or projects necessitate testing.

If the alcohol or drug test reveals positive results, the employee may be suspended pending evaluation of the situation by management.

An employee who voluntarily seeks assistance on a timely basis for an alcohol- or drug-related problem, prior to the company identifying the problem, may do so without jeopardizing their employment status, provided the prescribed treatment is followed and work performance is acceptable. In some cases, temporary reassignment may be necessary.

If an employee is undergoing a prescribed medical treatment with a substance that may alter physical or mental capacity, the employee must report this to the Health and Safety Administrator, particularly if they will be conducting field work. The Health and Safety Administrator will coordinate with the Board of Directors, who will determine how to manage the affected employee's work load.

Any manager who observes or receives a report of alcohol or drug use must promptly investigate the allegations in a confidential manner. The Board of Directors should also be notified immediately. Any other employee who observes or has knowledge of a violation, whether by an employee or others, has an obligation to promptly report this to their immediate supervisor. If an employee's immediate supervisor is suspected of violating the company's drug and alcohol policy, the report should be made directly to the Board of Directors.

In any instance where there exists an imminent threat to the safety of persons or property, an employee shall immediately contact a Principal.

4.0 Emergency Procedures

This section defines the emergency procedures for Floyd|Snider. Reasonably foreseeable emergency situations include medical emergencies; accidental release of hazardous materials or hazardous waste; and general emergencies such as vehicle accident, fire, thunderstorm, and earthquake.

A muster point should be designated for all personnel. The Floyd|Snider office emergency muster point is at the Paramount Theatre, on the corner of Pine Street and 9th Avenue. A map of the office evacuation route and a map of the locations of first aid kits, fire extinguishers, and AEDs is posted in all communal office spaces including kitchens and conference rooms, is available on the Floyd|Snider SharePoint home page. On a job site, the SSO should designate a muster point that is clear of adjacent hazards and not located downwind of site activities and communicate this location to the field team each day. In an emergency, all personnel and visitors will evacuate to the muster point for roll call.

It is important that each person understand their role in an emergency and that they remain calm and act efficiently to ensure everyone's safety. Expected actions for potential emergency situations are outlined in the following sections.

4.1 MEDICAL EMERGENCIES

In the event of a medical emergency, the following procedures should be used:

- Stop any imminent hazard if you can safely do so.
- Remove ill, injured, or exposed persons from immediate danger if moving them will clearly not cause them harm and no hazards exist to the rescuers.
- Evacuate other personnel from the immediate vicinity until the ill, injured, or exposed persons have been evacuated and it is safe for work to resume.
- If serious injury or a life-threatening condition exists, call 911 for paramedics, fire department, and police. When in doubt, contact emergency services; do not drive a seriously ill or injured person to the hospital unless emergency services cannot be summoned (for example, if phone service is out or there is not an ambulance that can reach the location).
- Clearly describe the location, injury, and conditions to the dispatcher. Designate a person to go to the site entrance and direct emergency equipment to the injured persons. Provide the responders with information about any chemical hazards that might be present on a job site.
- Trained personnel may provide first aid/CPR if it is necessary and safe to do so. Remove contaminated clothing and PPE only if this can be done without endangering the injured person.

- Once more highly trained personnel (i.e., emergency services) have taken over care of the person experiencing the medical emergency, immediately contact the staff member's designated emergency contact person.
- If you are in the field, notify your PM and HSO/SS.
- If a person experiencing a medical emergency is taken to the hospital, another staff member should accompany whenever possible and remain at the hospital until a designated emergency contact person arrives.
- Immediately implement steps to prevent recurrence of the accident.

4.2 ACCIDENTAL RELEASE OF HAZARDOUS MATERIALS OR WASTES

In the event of a release of a hazardous material or waste:

1. Evacuate all personnel to the designated emergency muster point until it is safe for work to resume.
2. If you are in the field, instruct a designated person to contact the PM or HSO/SS and confirm a response. If a release occurs in the office, the Floor Wardens will contact building security.
3. Contain the spill, if it is a known material, is possible, and can be done safely.
4. If the release is not stopped, contact 911 to alert the fire department.
5. Contact the Washington State Emergency Response Commission at 1 (800) 258-5990 to report the release.
6. Initiate the cleanup process. Cleanup must be performed by professionals trained in cleanup response for the type of material released.
7. Submit a written report to the Washington State Department of Ecology in the event of a reportable release of hazardous materials or wastes.

4.3 OTHER EMERGENCIES AND NATURAL DISASTERS

Vehicle Accident

In the event of an accident:

- Check yourself and your passengers and, if safe to do so, any other persons involved in the accident for serious injuries. If anyone is seriously injured, call 911 and wait for emergency personnel.
- If the vehicle can be moved, move to the shoulder or side of the road out of the way of traffic before calling 911. Do not leave the scene of the accident, and avoid engaging in conversation with other persons involved, aside from confirming injury status.
- If the vehicle cannot be moved, get yourself and your passengers to safety if possible. If the vehicle is disabled in a place with fast moving traffic (such as a multi-lane freeway), it may be safest to wait in the vehicle. Use your best judgment.

- If you are able to move the vehicle to the shoulder, use road flares (located in the vehicle emergency kit) to warn oncoming drivers.
- Wait for police to arrive and fill out an accident report.
- Call your PM or HSO/SS to report the accident. In the case of a minor accident, the PM or HSO/SS will consult with the Equipment Manager to determine whether the vehicle should be driven back to the office or towed to a repair facility. Contact roadside assistance if towing is needed.

Fire

During the incipient phase of a fire, the available fire extinguisher may be used by persons trained in putting out fires, if it is safe for them to do so.

If a fire is identified in the office building (either by smell or by the fire alarm), walk to the nearest emergency exit and walk down the stairs (do not use the elevator). Walk to the emergency muster point. Use common sense during a fire to avoid injury if areas are inaccessible.

In the case of a fire in a job site, work shall be halted and all onsite personnel will be immediately evacuated to the emergency muster point, if the fire cannot be extinguished. The local police/fire department shall be notified if the emergency poses a continuing hazard by calling 911.

Thunderstorm

A thunderstorm may present danger of lightning strike any time that visible lightning or audible thunder are present.

In the event of a thunderstorm, seek shelter inside a building if possible. Avoid concrete walls and floors, corded phones, and puddles. When a thunderstorm is accompanied by high winds, also avoid windows. If sheltering in a building is not possible, shelter inside your vehicle, and avoid direct contact with any metal objects in contact with the frame of the vehicle.

Do not resume work activities outdoors until at least 30 minutes have elapsed since the last thunder or lightning was observed.

Earthquake

If you are inside a building during an earthquake, the area near the exterior wall of a building is the most dangerous place to be. Windows, facades, and architectural details are often the first parts of the building to collapse. To stay away from this danger zone, stay inside if you are inside and outside if you are outside. In a high-rise: drop, cover, and hold on. Face away from windows and other hazards. Do not use elevators. Do not be surprised if sprinkler systems or fire alarms activate. Once the earthquake is over, be alert for aftershocks that might occur, follow instructions of your Floor Warden or building security, take your emergency kit or emergency supplies, proceed to the emergency exit, and walk down the stairs. Walk to the emergency

muster point. The above are general guidelines and are not meant to apply to every situation, so please use common sense during an earthquake to avoid injury. Additional office safety precautions for earthquakes are posted in the Production Room of the Floyd|Snider office and posted to the Health and Safety department page on SharePoint.

If you are on a jobsite when an earthquake occurs, move away from buildings, overhead power lines, and any other structures that may collapse. Get down low and stay down until the shaking stops to avoid injury. If you are in a moving vehicle, stop as quickly and safely as possible. Move to the shoulder or curb, away from utility poles, overhead wires, and under- or overpasses. Stay in the car and set the parking brake. Turn on the radio for emergency broadcast information. A vehicle may jiggle violently on its springs, but it is a good place to stay until the shaking stops. If a power line falls on the vehicle, stay inside until a trained person removes the wire. After the shaking stops, take your emergency supplies and proceed to the emergency muster point if it is safe to do so. Call your PM or HSO/SS when it is safe to do so.

4.4 EMERGENCY COMMUNICATIONS

Emergencies at Union Square will be communicated by building security using the public address system. If an emergency announcement is made, pause what you are doing and listen to the entire message. Emergencies involving the Floyd|Snider office only may be communicated over the office telephone system.

In the case of a job site emergency, signals may vary by site and should be discussed at daily tailgate meetings so all personnel on-site are aware of the site-specific signals and alarms. In general, horns (vehicle or airhorns) are used as needed to signal the emergency. One long (5-second) blast will be given as the emergency/stop work signal. If horns are not working, waving of arms is typically used to signal an emergency. In any emergency, all personnel will evacuate to the designated muster point and await further instruction.

After an emergency is resolved, the involved personnel or management will meet and debrief on the incident—the purpose is not to fix blame, but to improve the planning and response to future emergencies. The debriefing will review the sequence of events, what was done well, and what can be improved. The debriefing will be documented in a written format and filed by the Health and Safety Administrator.

4.5 EMERGENCY EQUIPMENT

The following minimum emergency equipment will be readily available in the office and at all job sites and functional at all times:

- First Aid Kit: Contents approved by the HSO/SS, including two blood-borne pathogen barriers. First aid kits are located in the company vehicle; a personal vehicle kit is located in the field room and should be used when field staff drive personal or rental vehicles; and in the office, first aid kits are located at each fire extinguisher location in the north hall, west hall, main kitchen, and large conference room. The location of

first aid kits and fire extinguishers will also be posted on maps kept in communal office spaces (kitchens and conference rooms).

- Portable fire extinguishers are included in the field first aid/safety kits and are also located in the office in the north hall, west hall, main kitchen south entrance, and Cedar Conference room.
- A copy of the HASP if on a job site.
- A binder of Safety Data Sheets (SDSs) for commonly encountered chemicals and all potential contaminants of concern that may be present on a job site. This binder is kept in the document organizer compartment of the company vehicle and an additional copy is kept in the field room.

4.6 INCLEMENT WEATHER

Occasionally, there are weather conditions, like snow, that make travel difficult. If the Seattle Public Schools are closed for the day due to hazardous road conditions, then the office will also be closed out of concern for your safety. Any field work scheduled during an office closure due to inclement weather should also be postponed.

4.7 CATASTROPHIC EVENTS

Floyd|Snider has formed an Emergency Planning Committee to develop preparation, communication, and safety plans to implement if a catastrophic event occurs. A catastrophic event is an event that disrupts or destroys critical infrastructure, such as a large-scale earthquake or other natural disaster.

Emergency Kits

Each staff member is provided one emergency kit backpack in case of emergencies that disrupt transportation or utilities. These backpacks include a map with critical structures, contact list and work plan, 32-ounce water bottle (to be filled and replaced every 6 months by the employee), additional 14-ounce water bottle and Platypus water container, water purification tablets, food bars, magnesium firestarter and matches, a multi-purpose tool, an LED flashlight and extra batteries, an emergency radio, an emergency (heat reflective) blanket, rags, nylon rope, a tarp and trash bags, duct tape, hand cleanser, Super Glue, and a hiker's first aid kit. Employees should provide their own raingear, extra socks, walking/hiking shoes, family plan, sunscreen, and 3-day supply of critical medicines. Not all packs are exactly the same, but all should include the items listed above. The Emergency Planning Committee will send regular reminders to check emergency kits and replace expired items.

Staff members should keep their emergency contact card up to date, listing phone numbers for whom to contact if they are unable to make calls themselves. Emergency contact cards should be kept in the front pocket of the backpack, where they can be easily located by others.

Staff should familiarize themselves with the contents of the emergency backpack to make sure all necessary items are included and that they are operational. The Emergency Planning Committee will remind staff every 6 months to check and update backpack contents (replace water in water containers, check the expiration date on the nutrient bars, update contact list if it is not current, etc.). Staff are responsible for keeping the employee contact list updated and having a sensible pair of shoes available in the office.

WhatsApp Emergency Contact Group

The purpose of our WhatsApp group is for group coordination needs during periods of emergency. It will be an easy way for management to communicate next steps back to the entire group, such as the status of the office/IT and expected timelines for returning to work. It also serves as an additional way to check in and communicate that staff and family are safe. Remember, immediately after an emergency, the initial call to check in with Jessi should still be made. Join the Floyd|Snider group on WhatsApp:

1. Download the WhatsApp app on to your phone and setup your account
2. Join the "F|S Emergency Contact" group by following the instructions on the Health & Safety Department site: https://floydsnider.sharepoint.com/Dept/Safety/SitePages/Emergencies.aspx#emergency-coordination-whatsapp

At the 6-month check-in time for backpack contents, employees should also confirm that they are still connected and included in the WhatsApp group. If an employee has been removed from the group (which can occur during software updates, etc.), the employee should notify the Emergency Planning Committee to have the group invitation resent so they can rejoin the group.

What to Do if You Are in the Office When a Disaster Occurs

If you are in the office when an emergency occurs, first and foremost is to remain safe. Wait until the building gives instructions over the PA system, then take your emergency kit and exit the building safely and quickly to meet at the Floyd|Snider muster point at the Paramount Theatre, on the corner of Pine Street and 9th Avenue. Once you have checked in with other Floyd|Snider staff there, you should find your way home safely to check on family and property. Jessi Massingale has been identified as the Disaster Contact. One person from the muster point will contact Jessi once all employees have been safely evacuated. Floyd|Snider will use the WhatsApp group to communicate next steps, as well as email (if available). WhatsApp is described in more detail above.

What to Do if You Are Not in the Office When a Disaster Occurs

If you are not in the office when an emergency occurs, the first thing to do after ensuring your safety and the safety of your family and property, is to text Jessi or Matt Massingale in Bend, Oregon. Report that you are okay and await further instructions. Other management team

members can also be contacted if needed. Floyd|Snider will use the WhatsApp group to communicate next steps, as well as email (if available).

In Emergency, Text Jessi/Matt in Bend		
Jessi	206.683.4307 (cell)	
Matt	206.255.2799 (cell)	541.241.6255 (work)
Management Team Numbers		
Allison	206.722.2460 (cell)	206.842.4484 (home)
Kate	206.375.0762 (cell)	206.781.7682 (home)
Tiffany	206.779.2806 (cell)	

Building Access

Depending on the severity of the disaster, Union Square may be closed for inspection, bus routes may be disrupted, and cell phone service may be limited. The nature and likely duration of the emergency aftermath will affect decision-making around working at the office during this time. Floyd|Snider will send out communications via WhatsApp and/or email with information on when to resume work and when it is safe to return to the office.

5.0 Hazard Awareness and Mitigation

In general, there are three broad hazard categories that may be encountered on the job: chemical exposure hazards, fire and explosion hazards, and physical hazards. Sections 5.1 through 5.3 discuss the specific hazards that fall within each of these broad categories and ways to mitigate these hazards.

Additional hazard analysis for specific chemicals present or tasks to be performed at a job site should be detailed in the HASP for the site.

5.1 CHEMICAL EXPOSURE HAZARDS

Potential toxic effects can occur from significant acute or chronic exposure to hazardous chemicals.

Hazardous products used in the office or on the job site should be sealed and stored in places where they cannot be easily spilled. Always follow manufacturer instructions for storage and use of hazardous chemicals. Discard chemicals no longer in use in accordance with manufacturer's instructions, and discard chemicals if containers are damaged, corroded, or otherwise leaking. Consider nontoxic alternatives to cleaning and other products when possible. Consider use of gloves or eye protection when handling or using chemicals with the potential to irritate eyes or skin if contacted.

On contaminated sites and on work sites where hazardous chemicals are used, chemical exposure hazards, monitoring procedures, and decontamination procedures should be detailed in the site HASP.

5.2 FIRE AND EXPLOSION HAZARDS

When storage of material posing a fire and explosion hazards is necessary, such material will be stored in containers approved by the Washington State Department of Transportation in a location not exposed to strike hazards and provided with secondary containment. A minimum 2A:20B fire extinguisher will be located within 25 feet of the storage location and where refueling occurs. Any subcontractors bringing flammable and combustible liquid hazards to a job site are responsible for providing appropriate material for containment and spill response, which should be addressed in their respective HASP, Job Hazard Analysis (JHA), or Job Safety Analysis (JSA). Transferring of flammable liquids (e.g., gasoline) will occur in areas with containment to capture any spillage, and only after making positive metal-to-metal connection between the containers, which may be achieved by using a bonding strap. Storage of ignition and combustible materials will be kept away from fueling operations.

5.3 PHYSICAL HAZARDS

When working in or around any hazardous or potentially hazardous substances or situations, all personnel should plan all activities before starting any task. Personnel shall identify health and

safety hazards involved with the work planned. If you have concerns or uncertainty about the safety of a given task, always consult with your PM or, if in the field, with your HSO/SS to determine how the task can be performed in the safest manner.

All field personnel will adhere to general safety rules including wearing appropriate PPE—hard hats, steel-toed boots, high-visibility vests, safety glasses, gloves, and hearing protection, as appropriate. Eating, drinking, and/or use of tobacco or cosmetics will be restricted in all work areas. Personnel will prevent splashing of liquids containing chemicals and minimize dust emissions.

The following table summarizes a variety of physical hazards that may be encountered during work activities. For convenience, these hazards have been categorized into several general groupings with recommended preventative measures.

Hazard	Cause	Prevention
Head strike	Falling and/or sharp objects, bumping hazards	Hard hats will be worn by all personnel at all times when overhead hazards exist.
Foot/ankle twist, crush, slip/trip/fall	Sharp objects, dropped objects, uneven and/or slippery surfaces	Steel-toed boots must be worn at all times on site while heavy equipment is present. Pay attention to footing on uneven or wet terrain and do not run. Keep work areas organized and free from unmarked trip hazards.
Hand cuts, splinters, and chemical contact	Hands or fingers pinched or crushed; chemical hazards; cut or splinters from handling sharp/rough objects and tools	Nitrile safety gloves will be worn to protect the hands from dust and chemicals. Leather or cotton outer gloves will be used when handling sharp-edged rough materials or equipment. Refer to preventive measures for mechanical hazards below.
Eye damage from flying materials, or splash hazards	Sharp objects, poor lighting, exposure due to flying debris or splashes	Safety glasses will be worn at all times on a job site. If a pressure washer is used to decontaminate heavy equipment, a face shield will be worn over safety glasses or goggles. Care will be taken during decontamination procedures to avoid splashing or dropping equipment into decontamination water.

Hazard	Cause	Prevention
Electrical hazards	Electrical cord hazards	Make sure that no damage to extension cords occurs. If an extension cord is used, make sure it is the proper size for the load that is being served and rated SJOW or STOW (an "-A" extension is acceptable for either) and inspected prior to use for defects. The plug connection on each end should be of good integrity. Insulation must be intact and extend to the plugs at either end of the cord. All portable power tools will be inspected for defects before use and must be either double-insulated or grounded with a ground-fault circuit interrupter.
Mechanical hazards	Heavy equipment such as drilling machine	Ensure the use of competent operators, backup alarms, "kill" switches, regular maintenance, daily mechanical checks on all hoses and cables, and proper guards. Verify that "whip checks" or similar securing devices are installed on "quick-connections," where the failure of high-pressure connections could lead to the whipping of hoses. Discuss the need for plastic sheeting or other methods to contain drips (hydraulic oil, motor oil, etc.) to determine if measures are needed to prevent releases to the ground. Subcontractors will supply their own JHA, HASP, or JSA. All personnel will make eye contact with operator and obtain a clear OK before approaching or working within a hazardous radius of the heavy equipment.
Noise damage to hearing	Machinery creating more than 85 decibels time-weighted average, less than 115 decibels continuous noise, or peak at less than 140 decibels	Wear earplugs or protective ear covers when a conversational level of speech is difficult to hear at a distance of 3 feet or if an employee must shout to be heard by nearby coworkers; when in doubt, a sound level meter may be used on site to document noise exposure.

Hazard	Cause	Prevention
Strains from improper lifting	Injury due to improper lifting techniques, overreaching/ overextending, lifting overly heavy objects	Use proper lifting techniques and mechanical devices where appropriate. The proper lifting procedure first involves testing the weight of the load by tipping it. If in doubt, ask for help. Do not attempt to lift a heavy load alone. Take a good stance and plant your feet firmly with legs apart, one foot farther back than the other. Make sure you stand on a level area with no slick spots or loose gravel. Use as much of your hands as possible, not just your fingers. Keep your back straight, almost vertical. Bend at the hips, holding load close to your body. Keep the weight of your body over your feet for good balance. Use large leg muscles to lift. Push up with one foot positioned in the rear as you start to lift. Avoid quick, jerky movements and twisting motions. Turn the forward foot and point it in the direction of the eventual movement. Never try to lift more than you are accustomed to lifting.
Traffic hazards	Vehicle traffic and hazards when working near active operations	When working in or near the right-of-way, orange cones and/or flagging will be placed around the work area. Safety vests will be worn at all times while conducting work in or near the right-of-way. Multiple staff will work together (buddy system) and spot traffic for each other. Avoid working with your back to traffic whenever possible.
Cold stress	Cold temperatures and related exposure	Workers will ensure appropriate clothing, stay dry, and take breaks in a heated environment when working in cold temperatures. Further detail on cold stress is provided in Section 5.3.1.
Heat exposure	High temperatures exacerbated by PPE, dehydration	Workers will ensure adequate hydration, shade, and breaks when temperatures are elevated. Further detail on heat stress is provided in Section 5.3.2.
Accidents due to inadequate lighting	Improper illumination	Work will proceed during daylight hours only or under sufficient artificial light.
Drowning hazards	Work in or near water	Wear a personal flotation device at all times when working in or near water. Be aware of surroundings including head strike and trip hazards that could cause a fall into water.

Hazard	Cause	Prevention
Slip, trip, and fall hazards	Working in vegetated areas, areas with uneven ground surface, or areas with obstructions	Watch your step when walking and minimize distractions. Establish a path free of obstructions before mobilizing equipment.

5.3.1 Cold Stress

Exposure to moderate levels of cold can cause the body's internal temperature to drop to a dangerously low level, causing hypothermia. Symptoms of hypothermia include slow, slurred speech, mental confusion, forgetfulness, memory lapses, lack of coordination, and drowsiness.

To prevent hypothermia, stay dry and avoid exposure. On a job site, personnel will have access to a warm, dry area, such as a vehicle, to take breaks from the cold weather and warm up. Site personnel will be encouraged to wear sufficient clothing in layers such that outer clothing is wind- and waterproof and inner layers retain warmth (wool or polypropylene), if applicable. Site personnel will keep hands and feet well protected at all times. The signs and symptoms and treatment for hypothermia are summarized below.

Signs and Symptoms

- Mild hypothermia (body temperature of 98–90 degrees Fahrenheit [°F])
  - Shivering
  - Lack of coordination, stumbling, fumbling hands
  - Slurred speech
  - Memory loss
  - Pale, purplish gray, or dusky and cold skin
- Moderate hypothermia (body temperature of 90–86 °F)
  - Shivering stops
  - Unable to walk or stand
  - Confused and irrational
- Severe hypothermia (body temperature of 86–78 °F)
  - Severe muscle stiffness
  - Very sleepy or unconscious
  - Ice cold skin
  - Death

Treatment of Hypothermia—Proper Treatment Depends on the Severity of the Hypothermia

- Mild hypothermia
  - Move to warm area.
  - Stay active.
  - Remove wet clothes, replace with dry clothes or blankets, and cover the head.
  - Drink warm (not hot) sugary drinks.
- Moderate hypothermia
  - All of the above, plus:
    - Call 911 for an ambulance.
    - Cover all extremities completely.
    - Place very warm objects such as hot packs or water bottles on the victim's head, neck, chest, and groin.
- Severe hypothermia
  - Call 911 for an ambulance.
  - Treat the victim very gently.
  - Do not attempt to re-warm—the victim should receive treatment in a hospital.

Frostbite

Frostbite occurs when the skin actually freezes and loses water. In severe cases, amputation of the frostbitten area may be required. Although frostbite usually occurs when the temperatures are 30 °F or lower, wind chill factors can allow frostbite to occur in above-freezing temperatures. Frostbite typically affects the extremities, particularly the feet and hands. Frostbite symptoms include cold, tingling, stinging, or aching feeling in the frostbitten area followed by numbness and skin discoloration: Paler skin may change from red to purple, then to white or very pale, and darker skin may become more pale, dusky, or purplish. Frostbitten skin will be waxy and firm while still frozen and may redden, swell, or blister when thawed. Should any of these symptoms be observed, wrap the area in soft cloth, do not rub the affected area, and seek medical assistance. Call 911 if the condition is severe.

Protective Clothing

Wearing the right clothing is the most important way to avoid cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, on the other hand, retains its insulation even when wet. The following are recommendations for working in cold environments:

- Wear at least three layers of clothing.
  - An outer layer to break the wind and allow some ventilation (like Gortex or nylon)

  - A middle layer of down or wool to absorb sweat and provide insulation even when wet
  - An inner layer of cotton or synthetic weave to allow ventilation
- Wear a hat—up to 40 percent of body heat can be lost when the head is left exposed.
- Wear insulated boots or other footwear.
- Keep a change of dry clothing available in case work clothes become wet.
- Do not wear tight clothing—loose clothing allows better ventilation.

Work Practices

- Drinking—Drink plenty of liquids, avoiding caffeine and alcohol. It is easy to become dehydrated in cold weather.
- Work Schedule—If possible, heavy work should be scheduled during the warmer parts of the day. Take breaks out of the cold in heated vehicles.
- Buddy System—Work in pairs to keep an eye on each other and watch for signs of cold stress.

5.3.2 Heat Stress

To avoid heat-related illness, current regulations in WAC 296-62-095 through 296-62-09570 will be followed during all outdoor work activities. These regulations apply to any outdoor work environment from May 1 through September 30 when workers are exposed to temperatures greater than 89 °F when wearing breathable clothing, greater than 77 °F when wearing double-layered woven clothing (such as jackets or coveralls), or greater than 52 °F when wearing non-breathing clothing such as chemical resistant suits or Tyvek. Floyd|Snider will identify and evaluate temperature, humidity, and other environmental factors associated with heat-related illness including, but not limited to, the provision of rest breaks that are adjusted for environmental factors and encourage frequent consumption of drinking water. Drinking water will be provided and made readily accessible in sufficient quantity to provide at least 1 quart per employee per hour. All Floyd|Snider personnel performing outdoor work will be informed and trained for responding to signs or symptoms of possible heat-related illness and accessing medical aid.

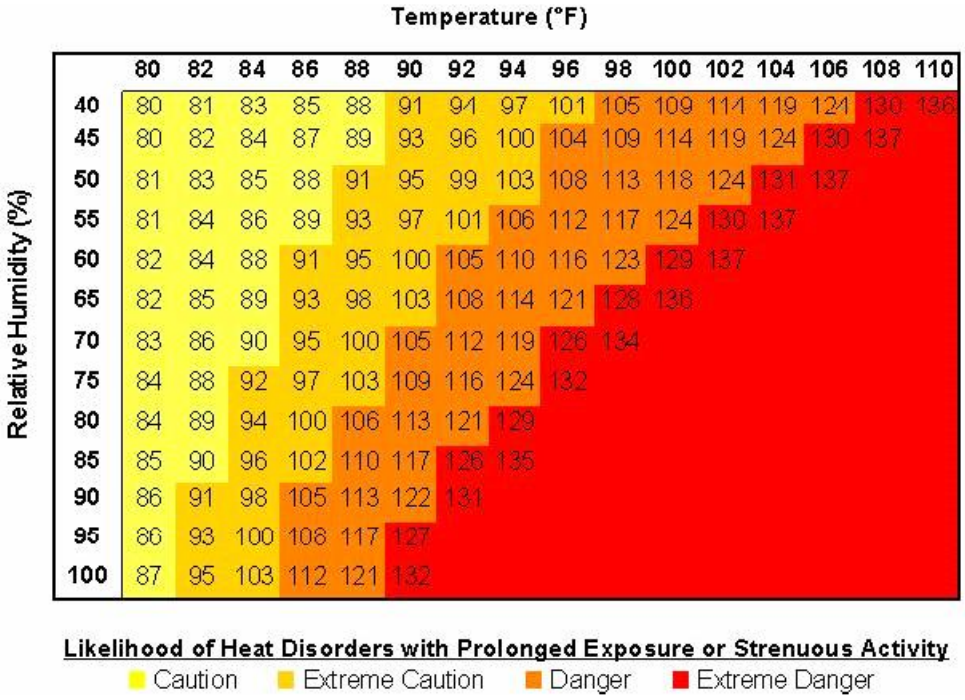
Employees showing signs or demonstrating symptoms of heat-related illness must be relieved from duty and provided with a sufficient means to reduce body temperature, including rest areas or temperature-controlled environments (i.e., air conditioned vehicle). Any employee showing signs or demonstrating symptoms of heat-related illness must be carefully evaluated to determine whether it is appropriate to return to work or whether medical attention is necessary.

Any incidence of heat-related illness must be immediately reported to the employer directly through the HSO/SS.

The signs, symptoms, and treatment of heat stress include the following:

Condition	Signs/Symptoms	Treatment
Heat cramps	Painful muscle spasms and heavy sweating	Increase water intake, rest in shade/cool environment.
Heat syncope	Brief fainting and blurred vision	Increase water intake, rest in shade/cool environment.
Dehydration	Fatigue, reduced movement, headaches	Increase water intake, rest in shade/cool environment.
Heat exhaustion	Pale and/or clammy skin, possible fainting, weakness, fatigue, nausea, dizziness, heaving sweating, blurred vision, body temperature slightly elevated	Lie down in cool environment, water intake, loosen clothing, and call 911 for ambulance transport if symptoms continue once in cool environment.
Heat stroke	Cessation of sweating, skin hot and dry, red or flushed face, high body temp, unconsciousness, collapse, convulsions, confusion or erratic behavior; life-threatening condition	**Medical Emergency!! Call 911** for ambulance transport. Move victim to shade and immerse in water.

If site temperatures are forecast to exceed 85 °F and physically demanding site work will occur in impermeable clothing, the HSO/SS will promptly consult with a certified industrial hygienist and a radial pulse monitoring method will be implemented to ensure that heat stress is properly managed among the affected workers. The following heat index chart indicates the relative risk of heat stress.



5.3.3 Allergies and Biohazards

Allergens capable of triggering a severe reaction may be present in the office environment or the job site. Outdoor work presents additional biohazards such as bees and other insects and wildlife.

Staff with severe allergies should make these allergies known to Floyd|Snider and maintain appropriate preventative medications (EpiPen, Benadryl, etc.) as directed by their physician in a location that can be easily accessed in case of emergency. The locations of these medications should be shared with the Floor Wardens, along with instructions for delivery if needed.

In the field, persons with allergies to bees or other insects will make the HSO/SS aware of their allergies and will avoid areas where bees/insects are identified. Controls such as repellents, hoods, nettings, masks, or other personal protection may be used. Report any insect bites or stings to the HSO/SS and seek first aid, if necessary. Especially when working during the summer months, staff should monitor the work area for evidence of insect nests of stinging insects. A nest may be nearby if multiple flying insects are observed in the area, or if flying insects appear to be entering and leaving the same locations. Nests may be buried underground, located in vegetated areas, or in structures such as well monuments, vaults, and buildings.

Inspect the work area for hazardous plants, medical waste (syringes and similar items), and indications of hazardous organisms, and avoid such areas if possible. On job sites, personnel will maintain a safe distance from any urban wildlife encountered, including stray dogs, raccoons, and rodents, to preclude a bite from a sick or injured animal.

A severe allergic reaction, or anaphylaxis, is a rapid immune response that may be fatal if untreated. Persons experiencing anaphylaxis require medical care beyond preventative medication or first aid. The signs of anaphylaxis may include the following:

- Extensive skin rashes, itching, or hives
- Swelling of the lips, tongue, or throat
- Shortness of breath, trouble breathing, or wheezing
- Dizziness and/or fainting
- Stomach pain, bloating, vomiting, or diarrhea
- Uterine cramps
- Feelings of panic or dread

5.3.4 Fatigue

Worker fatigue can impair judgment and increase the risk of injuries on the job site. Fatigue may be caused by physical exertion from difficult tasks, extended working hours, and environmental challenges, including exposure and extreme weather. Fatigue can be caused by working extended hours for a duration of 1 week or more (including overtime work, consecutive long shifts, and extended work weeks) or by extremely physically and mentally demanding work of any duration. Tasks should be assessed individually for risk of fatigue. Variable weather conditions (high and

low temperatures, sustained strong winds) can place additional physical and mental strain on field personnel.

5.3.4.1 Fatigue Symptoms and Self-Monitoring

Signs and symptoms of fatigue may present similarly to inebriation and can include:

- Reduced fine motor skills and coordination (e.g., tripping or dropping items)
- Impaired concentration
- Poor communication
- Poor judgment
- Mood swings or irritation

The above are typical symptoms of fatigue, but individuals can also experience or present fatigue in other ways that may be less obvious to an observer. The HSO/SS should additionally check in with staff members to ensure they are not experiencing any symptoms of fatigue that may impair their judgment or coordination in the field.

5.3.4.2 Managing Fatigue

Fatigue should be managed by limiting working hours and implementing rest days. Signs and symptoms of fatigue and fatigue management should be discussed, when applicable, at the daily tailgate and debrief meetings.

Potential actions to minimize fatigue include the following:

- Plan to get 7 to 9 hours of sleep each night
- Take a lunch break inside, or out of the weather
- Take snack and hydration breaks throughout the day
- Take a late start, half-day, or rest day during the field event

5.3.4.3 Fatigue Response Actions

In job situations where fatigue is likely, the HSO/SS should monitor employee fatigue using the following guide.

If the answer is yes to any of the following questions, the HSO/SS should consider implementing a shortened work day, light duty, or a day off for the affected employee.

- Do environmental factors pose an additional fatigue load (e.g., exposure to extreme hot/cold weather or wind)?
- Has the team member exhibited signs of fatigue?
- Has the team member worked on a physically intense task?

- Has the team member worked through the day without taking regular breaks to eat, stay hydrated, and rest?
- Has the team member had less than 6 hours of sleep in the past 24 hours?
- Did the team member work more than 12.5 hours in the past day?

If the answer is yes to either of the following questions, the HSO/SS will implement a day off for the affected employee.

- Did the team member work more than 75-80 hours in the past week?
- By the end of the shift, has the team member been awake for more than 17 hours?

Employees should also self-monitor for signs of fatigue and immediately report to the HSO/SS if fatigue becomes a concern.

If fatigue becomes a team-wide safety issue on the job site, the HSO/SS should coordinate with the PM to determine the actions that will be taken at the project level to manage fatigue. Actions may include adding team members, changing work practices, and/or adjusting the work schedule.

6.0 Job Site Controls

This section describes the best practices to be implement on a field job site to protect personnel and the environment. These best practices are considered the minimum controls for any job site, and additional site-specific protocols should be detailed in the site-specific HASP.

- All site work should be completed in teams when possible. Teams should establish a primary means of communication on-site and with offsite contacts (generally via cell phones or radios on-site). An agreed-upon system of alerting via air horns and/or vehicle horns may be used around heavy equipment to signal an emergency if shouting is ineffective.
- Work area perimeter controls should be established to ensure that members of the public do not enter the work area and limit the potential for chemical exposure associated with site activities when hazardous materials may be present. These work areas include a support zone, a contaminant reduction zone (decontamination area), and an exclusion zone.
- Staff will take precautions to prevent contamination:
    - Inspect all PPE prior to entering the exclusion zone.
    - Avoid walking through puddles or areas of known or obvious surface soil contamination.
    - Do not carry unnecessary items into the exclusion zone.
    - Take care to limit contact with heavy equipment and vehicles.
    - Protect the ground surface when processing samples and wipe down or sweep surfaces frequently to minimize the amount of potential contaminated material that may be spread during site work.
- Staff will decontaminate all equipment and gear as necessary during field events. Decontamination procedures will be strictly followed to prevent offsite spread of contaminated materials. Decontamination procedures should be detailed in the site-specific HASP but at a minimum will include cleaning equipment to a visually debris-free surface. The HSO/SS will assess the effectiveness of decontamination procedures by visual inspection.
- Hands must be thoroughly washed before leaving the Site to eat, drink, or use tobacco or cosmetics.
- Visual monitoring for fugitive dust and soil track-out by vehicles leaving the job site should be conducted by the HSO/SS or a dedicated member of the field staff. If visible dust leaving the work area or track-out are observed, immediate action should be taken to correct the issue.
- The HSO/SS will ensure the proper collection, packaging, and identification of waste materials so that waste materials will be properly disposed of.

7.0 Training Requirements

All Floyd|Snider field personnel must comply with applicable regulations specified in WAC Chapter 296-843, Hazardous Waste Operations, and WISHA (WAC Chapter 296-800). WISHA states that personnel who may come into contact with hazardous materials must have current HAZWOPER certification and participate in an employer-sponsored medical monitoring program. Therefore, these sections apply to any employee at Floyd|Snider who performs work where they have the potential to come in to contact with hazardous or dangerous substances. Additionally, when doing site work, at least one person on-site must be trained in CPR/First Aid. In order to maintain compliance with the regulation, **employees whose medical clearance or HAZWOPER certification are expired may not conduct field work unless their medical examination or refresher course is scheduled to occur within 30 days of their previous certification expiration date.**

7.1 MEDICAL MONITORING

In accordance with state medical surveillance regulations, field staff employees must participate in the medical monitoring program, which benefits both the employees and Floyd|Snider by evaluating the overall health of each individual in connection with the work to be performed, as well as monitoring workplace health and safety initiatives. Employees who will be working on-site are required to participate in a baseline examination and biennial examinations, as well as completion of an exit exam should an employee no longer conduct onsite work requiring medical monitoring.

The purpose of the Floyd|Snider examination program is to:

- Provide a baseline of health information for an employee, which can be used for comparison in related future examinations;
- Detect any adverse health effect that might be a result of workplace exposures;
- Detect any underlying medical condition that may place an employee at higher risk for medical problems related to workplace activities; and
- Ensure that an employee is able to function safely while performing their essential job functions at Floyd|Snider.

When an employee is no longer participating in fieldwork and wishes to unenroll from the Floyd|Snider medical monitoring program, the employee should contact the Health and Safety Administrator for approval and to begin the medical monitoring program exit process described in Section 7.5.

7.2 HAZWOPER TRAINING

HAZWOPER training and certification are required for all staff on-site at sites regulated by the Model Toxics Control Act (MTCA) or the USEPA more than 30 days per year. This training typically

includes an initial 40-hour HAZWOPER certification and annual 8-hour refresher courses. Field staff who have the potential to contact contaminated materials must have 40-hour HAZWOPER certification and attend annual 8-hour refresher courses. HAZWOPER certification may also be necessary on a project-specific basis for PMs who are not active in the field safety training and medical monitoring program. Field staff who do not have the potential to contact contaminated material, and are not in a supervisory field role, may require fewer hours of HAZWOPER training, to be determined on a case-by-case basis. These employees will also be required to attend annual 8-hour refresher courses.

7.3 JOB-SPECIFIC TRAINING

In addition to the 40-hour classroom training required by HAZWOPER, all field staff must complete 24 hours of job-specific training. This training is conducted on-site in the field under direct supervision of a skilled supervisor who is another Floyd|Snider employee. These training hours can occur on one or multiple field events and can cover an array of standard field activities. Once the 24-hours of training is complete, job-specific training forms (available on Floyd|Snider's Health and Safety department page on SharePoint) must be completed and signed by the trainer and submitted to the Health and Safety Administrator.

Additional site-specific training should be conducted to cover onsite hazards; PPE requirements, use, and limitations; decontamination procedures; and emergency response information as outlined in the HASP for the site.

7.4 CPR/FIRST AID

When conducting field work, at least one person on-site must be trained in CPR/First Aid, with a current certification. All employees who are on-site at MTCA- or USEPA-regulated sites more than 30 days per year are required to have current CPR/First Aid certification. This training is also provided by the company to any interested employees, including those who do not do field work.

7.5 EXITING THE FIELD STAFF SAFETY TRAINING AND MEDICAL MONITORING PROGRAM

This section presents the protocols to be followed in the event that an employee must exit the field staff safety training and medical monitoring program due to termination of their employment or transition to a different role at Floyd|Snider.

7.5.1 Termination of Employment

Washington's medical surveillance regulations require Floyd|Snider to schedule an exit exam for an employee upon termination of employment. Upon termination, employees will be notified of the appointment date and time and will be given information to reschedule the appointment if needed. The exit exam will be provided at Floyd|Snider's sole expense, and it is strongly recommended, in the best interest of your health, that you attend the appointment.

Floyd|Snider reserves the right to withhold payment of any severance package offered until confirmation of the exam is received.

7.5.2 Transition of Role

Floyd|Snider is a company of versatile employees with technical expertise who collaborate effectively to meet client and project needs; because of this collaborative approach, we do not employ full-time field technicians who exclusively fill a sampling role. Therefore, to ensure that client needs are met even during our busiest times and spread workload equitably across the firm, it is essential that all staff involved in field data collection, including in a supervisory capacity, maintain current field safety certification and medical clearance.

However, under certain limited circumstances, an employee may transition roles at the company such that field certifications are no longer needed. An employee who wishes to exit the field staff safety training and medical monitoring program must:

- Document that employee has performed fewer than 30 partial or full days of field work for each of the past 2 calendar years; and
- Obtain approval from the Management Committee, by coordinating with the Health and Safety Administrator.

If an employee's exit from the program is approved, the employee is required by WISHA to complete a medical monitoring exit exam. Failure to complete an exit exam may result in withholding any bonus pay and a delay in annual pay increases.

A letter to document the date and reason for an employee's rationale for terminating participation in the field staff safety training and medical monitoring program, signed by the employee and a Principal, must be maintained in the employee's personnel file.

8.0 Record Keeping and Reporting

Prompt and accurate recording and reporting is essential for continuing to improve the Floyd|Snider health and safety program and comply with the safety regulations.

8.1 RECORD KEEPING

Records should be kept of all employee training, safety meetings including Health and Safety Committee meetings and daily tailgate safety meetings conducted in the field, and near misses and incidents. Forms for on-the-job employee training, daily tailgate safety meetings, and near misses and incidents are available on the company's Health and Safety department page on SharePoint.

The minutes of Health and Safety Committee meetings are recorded by the Health and Safety Administrator and maintained on Floyd|Snider's Health and Safety department page on SharePoint.

The HSO/SS, or a designated alternate, will be responsible for conducting daily tailgate safety meetings and recording the meeting on a daily tailgate safety meeting form. The form, which must be appended to all HASPs, lists the hazards discussed and is signed by all personnel present at the meeting. The HSO/SS will manage the administration of job-specific training. Job-specific training forms must be completed and signed by the trainer.

Daily tailgate safety meeting and job-specific training forms must be reviewed with the PM after completion of the field event. After PM review, scans of the forms should be saved to the appropriate project folder, and the original copies of the forms will be submitted to the Health and Safety Administrator. The PM and the Health and Safety Administrator will determine whether any issues identified on tailgate safety meeting forms require further review or follow-up actions.

8.2 REPORTING

Near misses and incidents should be recorded on a Near Miss and Incident Reporting Form. The form gathers information regarding the circumstances of the near miss or incident, consequences, and corrective actions implemented. Near misses and incident report forms may be filled out by any Floyd|Snider staff. If a near miss or incident occurs in the field, the form must be reviewed and signed by the HSO/SS and the PM. This form must be appended to all site-specific HASPs.

Near Miss and Incident Reporting Forms will be maintained by the Health and Safety Administrator and made accessible to all staff for review after information that may identify specific individuals is redacted. In the event that an injury occurs in the workplace, the Health and Safety Administrator will coordinate with the PM or Management Committee to determine whether the injury is OSHA-reportable and implement follow-up reporting.

9.0 Signature Page

I have read this Accident Prevention Plan and understand its contents. I agree to abide by its provisions and will immediately notify the Health and Safety Administrator or Board of Directors if conditions or hazards not specifically designated herein are encountered.

Name (Print)	Signature	Date

Health and Safety Plan

Riverside HVOC Site

Appendix B
Daily Tailgate Safety Meeting Form

DAILY TAILGATE SAFETY MEETING FORM

Instructions: To be completed by the Field Lead or Site Safety Officer (SSO) prior to beginning of work each day, when changes in work procedures occur, or when additional hazards are present. Review with your Project Manager (PM) at the conclusion of your event and file with your field notes.

PROJECT NAME AND SCOPE OF WORK:	**SITE ADDRESS FOR EMERGENCY RESPONDERS:**

EMERGENCY RESPONSE:

Muster Point:
Emergency Contacts & Resources:
Allergies/ Medical Alerts:

GENERAL TOPICS/HAZARDS: (Discuss all)

☐ Emergency Response Information	☐ Weather/Heat or Cold Stress
☐ HASP Review and Location	☐ Required PPE: Overview and Verification
☐ Near Miss & Incident Reporting	☐ Slip, Trip, Fall Hazards
☐ Safety Equipment Location: AED, First Aid Kit & Fire Extinguisher	☐ Buddy System and Communication
☐ Chemicals of Concern & SDS locations	☐ Vehicle Safety, Road Conditions

DETAILS OF DISCUSSION

SITE SPECIFIC CONSIDERATIONS: (Discuss as applicable)

☐ Lessons Learned	☐ Construction	☐ Forested/Brush Environment
☐ Fatigue	☐ Heavy Equipment	☐ Insects/Animals
☐ Site Access & Security	☐ Overhead Hazards	☐ Water Hazards & Vessel Safety
☐ Establishing Work Zones	☐ Excavation/Trenching	☐ Decontamination
☐ Urban Environment	☐ Flammables/Sparks	☐ Mob/Demob
	☐ Tool Usage	☐ Other (Describe)

DETAILS OF DISCUSSION

ATTENDEE NAME/AFFILIATION/SIGNATURE:

SSO/Field Lead Signature & Date: _____

Health and Safety Plan

Riverside HVOC Site

Appendix C
Near Miss and Incident Reporting Form

NEAR MISS AND INCIDENT REPORTING FORM

Date & Time:	**Project:**
Incident Type: □ **Near Miss** □**Incident**	**Site/Location:**
Check all that apply: □ **Injury/illness** □ **Vehicle/Equipment** □ **Workplace Violence** □ **Evacuation/Emergency** □ **Other Stop Work Hazard (describe: _____)**	

Employee(s) Involved (include witnesses, teaming partners, and subcontractors)**:**

Description of Incident (include precise location, injuries, the task performed, equipment/materials involved, 3rd party involvement, structure, or property damage)**:**

Describe Any First Aid or Medical Treatment:

What Was the Root Cause of the Incident Based on the 5 Whys Approach?

What were the Contributing Factors or Conditions during the incident? (weather, fatigue, low visibility, lighting, etc.)**:**

What actions can be taken to prevent the incident from reoccurring? (Include any preliminary actions taken):

Preparer's Signature:_____ Date:_____

SSO or Field Lead Signature:_____ Date:_____

Instructions:

- A Near Miss is a potential hazard or incident in which no property was damaged, and no personal injury was sustained, but where, given a slight shift in time or position, damage or injury could have easily occurred. An incident is when injuries or damage do occur and can range in severity.
- If there are multiple employees involved in an incident or near miss, select one to be the primary reporter.
- Complete the form as soon as practical after the incident with any witnesses or involved employees. A witness may complete the form on behalf of an injured employee if they cannot complete the form themselves.
- Fill out the forms completely. If a section does not apply mark the section as "N/A".

Field Near Miss/Incident

1. All Near Misses/Incidents in the field shall be reported to the Site Safety Officer or Field Lead.
   A. Serious field incidents (Injury, equipment damage, stop work etc.) are to be reported to the Project Manager (PM) as soon as it is safe to do so.
2. Complete the Near Miss and Incident Reporting form with the SSO/Field lead as soon as practical after the near miss/incident.
   A. The SSO/Field Lead will ensure any required reporting is made to the Client on the site.
3. Review the completed form with the PM at the end of the field work for the day.
4. Submit the final form to the Safety Program Manager after the PM review.

For incidents that result in injury, the SSO or PM will complete the Injury Reporting Follow-up Form within 24 hours and submit it to the Safety Program Manager.

Non-Field Near Misses/Incidents

1. Report the Near Miss or Incident to the Safety Program Manager or a Safety Committee Member.
2. Complete the Near Miss and Incident Reporting form as soon as practical after the incident with any witnesses or involved employees.
3. Review the completed form with the Safety Program Manager or a Safety Committee Member
4. For incidents that result in injury, the Safety Committee Member or Safety Program Manager will complete the Injury Reporting Follow-up Form within 24 hours.
5. Final versions of all forms should be submitted to the Safety Program Manager.

Follow-Up From an Incident

- For all near misses/incidents additional information (i.e., corrective action or medical updates) should be reported to the Safety Program Manager within 1 week.
- Notification of the event to the firm will be shared in a timely manner in the format most appropriate for the severity/complexity of the incident.
- Corrective action completion will be tracked and verified by the Safety Program Manager as applicable.
- Additional notifications to third parties (agencies, teaming partners, or clients) may be required by the PM or Principal-in-charge as appropriate.
- For vehicle incidents, notify Tiffany of the accident as insurance reporting may be required.
- Notify the Field Equipment Manager of any damage to equipment or vehicles.

INJURY REPORTING FOLLOW-UP FORM

Instructions for the Site Safety Officer or Project Manager:

- Complete this form following an incident with an injury within 24 hours of the incident.
- Submit this form with a copy of the completed Near Miss and Incident Reporting Form to the Safety Program Manager with copies to the Principal-in-Charge for the project if applicable. [1]
- Any additional information (i.e., corrective action or medical updates) should be reported to the Safety Program Manager within 1 week of the incident.

Was this an OSHA- Recordable Injury/Illness? Why?

□**Yes**	□ Loss of consciousness □ Days away from work □ Restricted work/Job transfer □ Medical Treatment Beyond First Aid[1] □ Other _____
□**No**	□First Aid treatment only □ Recordkeeping exemption □ No treatment □ Other _____

Describe Any Follow-Up First Aid or Medical Treatment:

Did the Injury/Illness involve Inpatient Hospitalization, Amputation or Loss of an Eye?
□No □Yes – Contact the Principal-in-Charge

What Was the Root Cause of the Incident Based on the 5 Why's Approach?

Follow-Up Actions Taken (include owners & dates)**:**

SSO or Field Lead Signature:_____ Date:_____

Project Manager's Signature: _____ Date:_____

[1] First Aid is defined as: using non-prescription medication at non-prescription strength, cleaning wounds on the skin surface, applying wound coverings (not sutures/staples), removing foreign bodies from the eye using irrigation or a swab, removing foreign bodies from elsewhere (not the eye) using tweezers, hot/cold therapy, drinking fluids to relieve heat stress, using finger guards or eye patches, using non-rigid means of support (such as bandages), using temporary immobilizing devices while transporting an injured person, administering tetanus immunizations. Guidelines for determining what incidents are OSHA Recordable are available here: *https://www.osha.gov/recordkeeping/*. The principal in charge is to be notified of any Recordable Incidents.

Attachment 4
Inadvertent Discovery Plan

DAHP USE ONLY
Date Received:
DAHP Log #:
Reviewer(s):
☐ ARCHY ☐ BEU

dahp
protect the past, shape the future
DEPT OF ARCHAEOLOGY + HISTORIC PRESERVATION

EZ-1 FORM

Request to initiate consultation for Governor's Executive Order 21-02 (GEO 21-02) projects

GEO 21-02

New Consultation? ☑ YES ☐ NO ☐ ADDITIONAL INFORMATION PROVIDED PER REQUEST

Questions? *Contact DAHP at 2102@dahp.wa.gov or (360) 586-3065. You may also find answers to your questions online at www.dahp.wa.gov/2102.*

SECTION 1: PROJECT INFORMATION

Project Title: Riverside Soil and Groundwater Remediation

Property Name: *if applicable* Riverside HVOC Site

Project Address: Parcel No. 0826059120

Provide 1-2 sentence summary of the project.

Installation of soil vapor extraction wells to remediate chlorinated solvent contaminated soil. Installation of groundwater remediation wells connected to a closed-loop bioremediation system to treat chlorinated solvent contaminated groundwater.

City / State / Zip: Bothell WA

County: King

Township / Range / Section: *leave blank if unsure* T26R05E08

SECTION 2: PROJECT DESCRIPTION

Project includes (check all that apply): ☐ NEW CONSTRUCTION ☐ DEMOLITION ☑ GROUND DISTURBANCE ☐ REHABILITATION / RENOVATION ☐ ACQUISITION

Does the project involve any buildings, objects, sites, structures or districts that are over 45 years old? ☐ YES ☑ NO ☐ NOT SURE *Contact DAHP

☐ Check here if the project involves multiple resources. If so, attach a table including all information in Sections 1 and 2 for each resource.

Does the project involve any properties determined eligible for or listed in the National Register of Historic Places or Washington Heritage Register? ☐ YES ☑ NO ☐ NOT SURE

Is the building, structure or site already recorded in WISAARD? ☐ YES ☑ NO [!] See Note ☐ NOT SURE *Contact DAHP

If Yes, what is the Property ID # or Site #? _____

☐ **[!] If the resource is not recorded in WISAARD, please contact DAHP Staff.** ***Go to www.dahp.wa.gov/wisaard for more information. Check the box when complete.***

Are there any Federal funds, lands, permits, or licenses involved in/required by this project? ☐ YES ☑ NO ☐ NOT SURE If Yes, what Federal Agency?

What is the nature of your request? (Check all that apply) ☐ PREDESIGN ☑ DESIGN ☑ CONSTRUCTION ☑ APPLYING FOR GRANT / LOAN ☐ TRYING TO GET UNDER CONTRACT ☐ NOT SURE

SECTION 3: STATE AGENCY INFORMATION

State Agency: WA State Dept of Ecology

Grant / Loan Program Name: Toxics Cleanup Program

☐ Direct Appropriation?

Contact Person: Lydia Lindwall

Phone: 360.515.6217

e-mail: Lydia.Lindwall@ecy.wa.gov

Funding biennium? 2023/2024

Requested grant / loan amount: TBD

Total project amount: TBD

SECTION 4: CONTACT INFORMATION

If different from State Agency contact person.

Submitter Name: Ryan Roberts

Submitter Organization: City of Bothell

Submitter Address: 18415 101st Ave NE

City / State / Zip: Bothell WA

Submitter Phone: 425-806-6823

Submitter e-mail: Ryan.Roberts@bothellwa.gov

SECTION 5: ATTACHMENTS

Please email completed form and all attachments to:
2102@dahp.wa.gov

☑ MAP / APE - Be sure to show the project boundary and location of property(ies). *See Section 7 on Page 3 for optional template. May also submit online through WISAARD using eAPE.*

☑ DESCRIPTION / SCOPE OF WORK - Describe the project, including any ground disturbance. *See Section 6 on Page 2 for optional template.*

☑ SITE PLAN / DRAWINGS - Indicate location and dates of resources, proposed improvements and ground disturbance, etc.

☑ PHOTOGRAPHS - Attach digital photographs showing the project site, including images of all resources. *Photos submitted through WISAARD may suffice.*

DAHP DETERMINATION (DAHP USE ONLY)

☐ **EXEMPT** from GEO 21-02 review.

☐ There are **NO HISTORIC PROPERTIES IMPACTED** by the proposed project.

☐ The project will have **NO ADVERSE IMPACT** on historic properties.

☐ The project will have an **ADVERSE IMPACT** on historic properties.

☐ DAHP requires **ADDITIONAL INFORMATION** in order to complete review (see attached).

☐ SURVEY REQUIRED ☐ IDP REQUIRED

☐ MONITORING REQUIRED

DAHP REVIEWER _____

DATE _____

DEPT OF ARCHAEOLOGY + HISTORIC PRESERVATION

Instructions: **Please describe the type of work to be completed. Be as detailed as possible to avoid a request for additional information. Be sure to describe all ground disturbing activities in the appropriate box below, and provide photos of areas of work.**

SECTION 6: ADD'L PROJECT INFORMATION

NOTE: To save this fillable form you must fill it out in Adobe Acrobat or use the PRINT to PDF function in Acrobat Reader. In Reader choose File > Print and choose Adobe PDF as the printer. The fill will save to your computer.

Please be aware that this form may only initiate consultation. For some projects, DAHP may require additional information to complete our review such as plans, specifications, and photographs. An historic property inventory form may need to completed by a qualified cultural resource professional.

Provide a detailed description of the proposed project:

Closed-loop groundwater treatment will be accomplished through bioremediation and groundwater recirculation. This work involves the pumping of groundwater from existing and new extraction wells at the Site, treatment of this water with a bioremediation product, and reinjection of this treated groundwater into the Site subsurface via injection wells. This method will also serve as the treatment of saturated soils which extend down to a depth of approximately 30 feet bgs. Proposed well locations associated with this work are shown in the attached figure. The wells will be connected in trenches no deeper than 18 inches to a temporary portable remediation shed. Vertical soil vapor extraction (SVE) wells will be installed and connected using 1-inch diameter PVC pipe in trenches no deeper than 18 inches in the northern portion of the site along the sidewalk bordering Hwy 522. The SVE wells are connected to an air blower in a temporary shed which draws a vacuum. The SVE wells will remediate unsaturated contaminated soils on the Site.

Describe the existing project site conditions (include building age, if applicable):

The property is currently occupied by areas of an existing roadway and gravel parking area for access to Bothell Landing Park south and adjacent to former State Highway Route 522. The planned future use is to remain in parking use.

The property is located at 47.760 degrees north, -122.209 degrees west in Section 8 of Township 26 north, Range 5 east. The property is presently vacant of structures, except for a small shed containing permitted groundwater extraction pumps that discharge directly into the King County sanitary sewer.

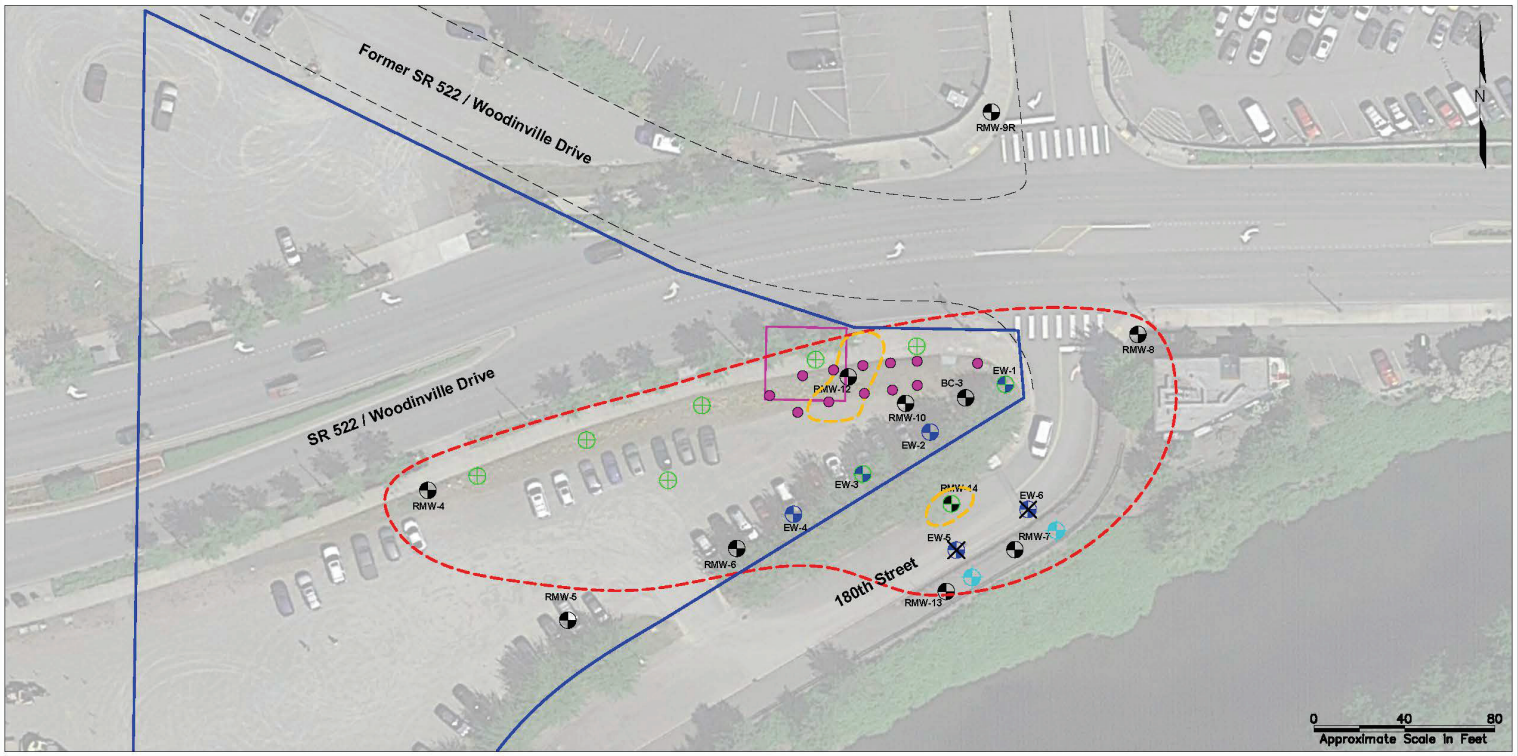
If there are ground disturbing activities proposed, describe them *including the approximate depth of ground disturbance*:

Shallow trenches no deeper than 18 inches will be excavated to connect the SVE wells and bioremediation extraction and injection wells to associated pumps located in the shed with 1-inch diameter PVC pipe.

DEPT OF ARCHAEOLOGY + HISTORIC PRESERVATION

Instructions: Please attach a MAP of the project area. (Use WISAARD with USA Topo Basemap background. Click HERE for Snipping Tool Tutorial. Draw an outline of the Area of Potential Effect (APE) that clearly delineates the project boundary.

SECTION 7: MAP / Area of Potential Effect



LEGEND

- Approximate location of monitoring well
- Approximate location of extraction well
- Approximate location of historical machine shop
- Approximate location of historical Riverside property
- Approximate location of Riverside HVOC Site Boundary and approximate extent of groundwater containing HVOCs contaminants above Site-specific cleanup levels
- Approximate extent of soil containing HVOC contaminants at concentrations exceeding MTCA Method A/B Cleanup Levels
- Approximate location of new bioremediation injection well
- Approximate location of existing monitoring/extraction well to be converted to bioremediation injection well
- Approximate location of existing extraction well to be decommissioned
- Approximate location of new extraction well
- Approximate location of soil vapor extraction well

KANE ENVIRONMENTAL INC

Supplemental Remedial Investigation / Feasibility Study
Riverside HVOC Site
Bothell, Washington 98011

Bioremediation and Groundwater Recirculation Combined with SVE


TUNDRA

INADVERTENT DISCOVERY PLAN

PLAN AND PROCEDURES FOR THE DISCOVERY OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

To request ADA accommodation, including materials in a format for the visually impaired, call Ecology at 360-407-6000 or visit https://ecology.wa.gov/accessibility. People with impaired hearing may call Washington Relay Service at 711. People with a speech disability may call TTY at 877-833-6341.

Site Name(s): Riverside HVOC Site

Location: Bothell, Washington

Project Lead/Organization:

Ryan Roberts/ City of Bothell

County: King

If this Inadvertent Discovery Plan (IDP) is for multiple (batched) projects, ensure the location information covers all project areas.

1. INTRODUCTION

The IDP outlines procedures to perform in the event of a discovery of archaeological materials or human remains, in accordance with applicable state and federal laws. An IDP is required, as part of Agency Terms and Conditions for all grants and loans, for any project that creates disturbance above or below the ground. An IDP is not a substitute for a formal cultural resource review (Executive 21-02 or Section 106).

Once completed, **the IDP shall always be kept at the project site** during all project activities. All staff, contractors, and volunteers shall be familiar with its contents and know where to find it.

2. CULTURAL RESOURCE DISCOVERIES

A cultural resource discovery could be prehistoric or historic artifacts. Examples include (see images for further examples):

- An accumulation of shell, burned rocks, or other food related materials.
- Bones, intact or in small pieces.
- An area of charcoal or very dark stained soil with artifacts.
- Stone tools or waste flakes (for example, an arrowhead or stone chips).
- Modified or stripped trees, often cedar or aspen, or other modified natural features, such as rock drawings.
- Agricultural or logging materials that appear older than 50 years. These could include equipment, fencing, canals, spillways, chutes, derelict sawmills, tools, and many other items.
- Clusters of tin cans or bottles, or other debris that appear older than 50 years.
- Old munitions casings. ***Always assume these are live and never touch or move***.
- Buried railroad tracks, decking, foundations, or other industrial materials.
- Remnants of homesteading. These could include bricks, nails, household items, toys, food containers, and other items associated with homes or farming sites.

The above list does not cover every possible cultural resource. When in doubt, assume the material is a cultural resource.

3. ON-SITE RESPONSIBILITIES

If any employee, contractor, or subcontractor believes that they have uncovered cultural resources or human remains at any point in the project, take the following steps to ***Stop-Protect-Notify***. **If you suspect that the discovery includes human remains, also follow Sections 5 and 6.**

STEP A: Stop Work.

All work must stop immediately in the vicinity of the discovery.

STEP B: Protect the Discovery.

Leave the discovery and the surrounding area untouched and create a clear, identifiable, and wide boundary (30 feet or larger) with temporary fencing, flagging, stakes, or other clear markings. Provide protection and ensure integrity of the discovery until cleared by the Department of Archaeological and Historical Preservation (DAHP) or a licensed, professional archaeologist.

Do not permit vehicles, equipment, or unauthorized personnel to traverse the discovery site. Do not allow work to resume within the boundary until the requirements of this IDP are met.

STEP C: Notify Project Archaeologist (if applicable).

If the project has an archaeologist, notify that person. If there is a monitoring plan in place, the archaeologist will follow the outlined procedure.

STEP D: Notify Project and Washington Department of Ecology (Ecology) contacts.

Project Lead Contacts

Primary Contact		Alternate Contact	
Name:	Ryan Roberts	Name:	Steven Morikawa
Organization:	City of Bothell	Organization:	City of Bothell
Phone:	425.471.1837	Phone:	425.419.3742
Email:	ryan.roberts@bothellwa.gov	Email:	steven.morikawa@bothellwa.gov

Ecology Contacts (completed by Ecology Project Manager)

Ecology Project Manager		Alternate or Cultural Resource Contact	
Name:	Sunny Becker	Name:	
Program:	Toxic Cleanup Program	Program:	
Phone:	360.515.6217	Phone:	
Email:	HLIN461@ECY.WA.GOV	Email:	

STEP E: Ecology will notify DAHP.

Once notified, the Ecology Cultural Resource Contact or the Ecology Project Manager will contact DAHP to report and confirm the discovery. To avoid delay, the Project Lead/Organization will contact DAHP if they are not able to reach Ecology.

DAHP will provide the steps to assist with identification. DAHP, Ecology, and Tribal representatives may coordinate a site visit following any necessary safety protocols. DAHP may also inform the Project Lead/Organization and Ecology of additional steps to further protect the site.

Do not continue work until DAHP has issued an approval for work to proceed in the area of, or near, the discovery.

DAHP Contacts:

Name: Rob Whitlam, PhD
Title: State Archaeologist
Cell: 360-890-2615
Email: Rob.Whitlam@dahp.wa.gov
Main Office: 360-586-3065

Human Remains/Bones:

Name: Guy Tasa, PhD
Title: State Anthropologist
Cell: 360-790-1633 (24/7)
Email: Guy.Tasa@dahp.wa.gov

4. TRIBAL CONTACTS

In the event cultural resources are discovered, the following tribes will be contacted. See Section 10 for Additional Resources.

Tribe: Muckleshoot Indian Tribe
Name: Laura Murphy
Title: Preservation Program, Cultural Resources
Phone: 253-876-3272
Email: laura.murphy@muckleshoot.nsn.us

Tribe: Sauk-Suiattle Indian Tribe
Name: Kerry Lyste
Title: Tribal Historic Preservation Officer
Phone: (360) 572-7072
Email: klyste@stillaguamish.com

Tribe: Tulalip Tribes
Name: Richard Young
Title: Cultural Resources
Phone: (360) 716-2652
Email: ryoung@tulaliptribes-nsn.gov

Tribe: Snoqualmie Indian Tribe
Name: Steven Mullen-Moses,
Title: Director of Archaeology & Historic Preservation
Phone: 425) 292-0249 x2010
Email: steve@snoqualmietribe.us

Tribe: Suquamish Tribe
Name: Dennis E. Lewarch,
Title: Tribal Historic Preservation Officer
Phone: (360) 394-8529
Email: dlewarch@suquamish.nsn.us

Please provide contact information for additional tribes within your project area, if needed, in Section 11.

5. FURTHER CONTACTS (if applicable)

If the discovery is confirmed by DAHP as a cultural or archaeological resource, or as human remains, and there is a partnering federal or state agency, Ecology or the Project Lead/Organization will ensure the partnering agency is immediately notified.

Federal Agency:

Agency: N/A
Name:
Title:
Phone:
Email:

State Agency:

Agency: N/A
Name:
Title:
Phone:
Email:

6. SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL REMAINS

Any human skeletal remains, regardless of antiquity or ethnic origin, will at all times be treated with dignity and respect. Follow the steps under ***Stop-Protect-Notify.*** For specific instructions on how to handle a human remains discovery, see: *RCW 68.50.645: Skeletal human remains—Duty to notify—Ground disturbing activities—Coroner determination—Definitions*.

Suggestion: If you are unsure whether the discovery is human bone or not, contact Guy Tasa with DAHP, for identification and next steps. Do not pick up the discovery.

Guy Tasa, PhD State Physical Anthropologist
Guy.Tasa@dahp.wa.gov
(360) 790-1633 (Cell/Office)

For discoveries that are confirmed or suspected human remains, follow these steps:

1. Notify law enforcement and the Medical Examiner/Coroner using the contacts below. **Do not call 911** unless it is the only number available to you.

   Enter contact information below (required):

   - Local Medical Examiner or Coroner name and phone: Richard Harruff / 206.731.3232 ext 5
   - Local Law Enforcement main name and phone: Cam Johnson/ 425.486.1254
   - Local Non-Emergency phone number (911 if without a non-emergency number): 425.486.1254

2. The Medical Examiner/Coroner (with assistance of law enforcement personnel) will determine if the remains are human or if the discovery site constitutes a crime scene and will notify DAHP.

3. **DO NOT speak with the media, allow photography or disturbance of the remains, or release any information about the discovery on social media.**
4. If the remains are determined to be non-forensic, cover the remains with a tarp or other materials (not soil or rocks) for temporary protection and to shield them from being photographed by others or disturbed.

Further activities:

- Per RCW 27.44.055, RCW 68.50, and RCW 68.60, DAHP will have jurisdiction over non-forensic human remains. Ecology staff will participate in consultation. The Project Lead/Organization may also participate in consultation.
- Documentation of human skeletal remains and funerary objects will be agreed upon through the consultation process described in RCW 27.44.055, RCW 68.50, and RCW 68.60.
- When consultation and documentation activities are complete, work in the discovery area may resume as described in Section 8.

If the project occurs on federal lands (such as a national forest or park or a military reservation) the provisions of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) apply and the responsible federal agency will follow its provisions. Note that state highways that cross federal lands are on an easement and are not owned by the state.

If the project occurs on non-federal lands, the Project Lead/Organization will comply with applicable state and federal laws, and the above protocol.

7. DOCUMENTATION OF ARCHAEOLOGICAL MATERIALS

Archaeological resources discovered during construction are protected by state law RCW 27.53 and assumed eligible for inclusion in the National Register of Historic Places under Criterion D until a formal Determination of Eligibility is made.

The Project Lead/Organization must ensure that proper documentation and field assessments are made of all discovered cultural resources in cooperation with all parties: the federal agencies (if any), DAHP, Ecology, affected tribes, and the archaeologist.

An archaeologist will record all prehistoric and historic cultural material discovered during project construction on a standard DAHP archaeological site or isolate inventory form. They will photograph site overviews, features, and artifacts and prepare stratigraphic profiles and soil/sediment descriptions for minimal subsurface exposures. They will document discovery locations on scaled site plans and site location maps.

Cultural features, horizons, and artifacts detected in buried sediments may require the archaeologist to conduct further evaluation using hand-dug test units. They will excavate units in a controlled fashion to expose features, collect samples from undisturbed contexts, or to interpret complex stratigraphy. They may also use a test unit or trench excavation to determine if an intact occupation surface is present. They will only use test units when necessary to gather information on the nature, extent, and integrity of subsurface cultural deposits to evaluate the site's significance. They will

conduct excavations using standard archaeological techniques to precisely document the location of cultural deposits, artifacts, and features.

The archaeologist will record spatial information, depth of excavation levels, natural and cultural stratigraphy, presence or absence of cultural material, and depth to sterile soil, regolith, or bedrock for each unit on a standard form. They will complete test excavation unit level forms, which will include plan maps for each excavation level and artifact counts and material types, number, and vertical provenience (depth below surface and stratum association where applicable) for all recovered artifacts. They will draw a stratigraphic profile for at least one wall of each test excavation unit.

The archaeologist will screen sediments excavated for purposes of cultural resources investigation through 1/8-inch mesh, unless soil conditions warrant 1/4-inch mesh.

The archaeologist will analyze, catalogue, and temporarily curate all prehistoric and historic artifacts collected from the surface and from probes and excavation units. The ultimate disposition of cultural materials will be determined in consultation with the federal agencies (if any), DAHP, Ecology, and the affected tribe(s).

Within 90 days of concluding fieldwork, the archaeologist will provide a technical report describing any and all monitoring and resultant archaeological excavations to the Project Lead/Organization, who will forward the report to Ecology, the federal agencies (if any), DAHP, and the affected tribe(s) for review and comment.

If assessment activities expose human remains (burials, isolated teeth, or bones), the archaeologist and Project Lead/Organization will follow the process described in **Section 6**.

8. PROCEEDING WITH WORK

The Project Lead/Organization shall work with the archaeologist, DAHP, and affected tribe(s) to determine the appropriate discovery boundary and where work can continue.

Work may continue at the discovery location only after the process outlined in this plan is followed and the Project Lead/Organization, DAHP, any affected tribe(s), Ecology, and the federal agencies (if any) determine that compliance with state and federal laws is complete.

9. ORGANIZATION RESPONSIBILITY

The Project Lead/Organization is responsible for ensuring:

- This IDP has complete and accurate information.
- This IDP is immediately available to all field staff at the site and available by request to any party.
- This IDP is implemented to address any discovery at the site.
- That all field staff, contractors, and volunteers are instructed on how to implement this IDP.

10. ADDITIONAL RESOURCES

Informative Video

Ecology recommends that all project staff, contractors, and volunteers view this informative video explaining the value of IDP protocol and what to do in the event of a discovery. The target audience is anyone working on the project who could unexpectedly find cultural resources or human remains while excavating or digging. The video is also posted on DAHP's inadvertent discovery language website.

Ecology's IDP Video (https://www.youtube.com/watch?v=ioX-4cXfbDY)

Informational Resources

DAHP (https://dahp.wa.gov)

Washington State Archeology (DAHP 2003)
(https://dahp.wa.gov/sites/default/files/Field%20Guide%20to%20WA%20Arch_0.pdf)

Association of Washington Archaeologists (https://www.archaeologyinwashington.com)

Potentially Interested Tribes

Tribal Contacts: Interactive Map of Tribes by Area
(https://dahp.wa.gov/archaeology/tribal-consultation-information)

Tribal Contacts - WSDOT Tribal Contact Website
(https://wsdot.wa.gov/tribal/TribalContacts.htm)

11. ADDITIONAL INFORMATION

Please add any additional contact information or other information needed within this IDP.

Implement the IDP if you see…

Chipped stone artifacts.

Examples are:

- Glass-like material.
- Angular material.
- “Unusual” material or shape for the area.
- Regularity of flaking.
- Variability of size.

Stone artifacts from Oregon.

Stone artifacts from Washington.

Biface-knife, scraper, or pre-form found in NE Washington. Thought to be a well knapped object of great antiquity. Courtesy of Methow Salmon Rec. Foundation.

Implement the IDP if you see…

Ground stone artifacts.

Examples are:

- Unusual or unnatural shapes or unusual stone.
- Striations or scratching.
- Etching, perforations, or pecking.
- Regularity in modifications.
- Variability of size, function, or complexity.

Above: Fishing Weight - credit CRITFC Treaty Fishing Rights website.

Artifacts from unknown locations (left and right images).

Implement the IDP if you see…

Bone or shell artifacts, tools, or beads.

Examples are:

- Smooth or carved materials.
- Unusual shape.
- Pointed as if used as a tool.
- Wedge shaped like a “shoehorn”.
- Variability of size.
- Beads from shell (dentalium) or tusk.

Upper Left:*Bone Awls from Oregon.*

Upper Center: *Bone Wedge from California.*

Upper Right: *Plateau dentalium choker and bracelet, from Nez Perce National Historical Park, 19th century, made using Antalis pretiosa shells Credit: Nez Perce - Nez Perce National Historical Park, NEPE 8762, Public Domain.*

Above: *Tooth Pendants.*

Right: Bone Pendants. Both from Oregon and Washington.

Implement the IDP if you see…

Culturally modified trees, fiber, or wood artifacts.

Examples are:

- Trees with bark stripped or peeled, carvings, axe cuts, de-limbing, wood removal, and other human modifications.
- Fiber or wood artifacts in a wet environment.
- Variability of size, function, and complexity.

Left and Below: *Culturally modified tree and an old carving on an aspen (Courtesy of DAHP). These are examples of above ground cultural resources.*

Right, Top to Bottom: *Artifacts from Mud Bay, Olympia: Toy war club, two strand cedar rope, wet basketry*.

Implement the IDP if you see…

Strange, different, or interesting looking dirt, rocks, or shells.

Human activities leave traces in the ground that may or may not have artifacts associated with them. Examples are:

- "Unusual" accumulations of rock (especially fire-cracked rock).
- "Unusual" shaped accumulations of rock (such as a shape similar to a fire ring).
- Charcoal or charcoal-stained soils, burnt-looking soils, or soil that has a "layer cake" appearance.
- Accumulations of shell, bones, or artifacts. Shells may be crushed.
- Look for the "unusual" or out of place (for example, rock piles in areas with otherwise few rocks).

Shell Midden pocket in modern fill discovered in sewer trench.

Underground oven. Courtesy of DAHP.

Shell Midden with fire cracked rock.

Hearth excavated near Hamilton, WA.

Implement the IDP if you see…

Historic period artifacts (historic archaeology considered older than 50 years).

Examples are:

- Agricultural or logging equipment. May include equipment, fencing, canals, spillways, chutes, derelict sawmills, tools, etc.
- Domestic items including square or wire nails, amethyst colored glass, or painted stoneware.

Left: Top to Bottom: *Willow pattern serving bowl and slip joint pocket knife discovered during Seattle Smith Cove shantytown (45-KI-1200) excavation.*

Right: *Collections of historic artifacts discovered during excavations in eastern Washington cities.*

Implement the IDP if you see…

Historic period artifacts (historic archaeology considered older than 50 years).

Examples are:

- Railway tokens, coins, and buttons.
- Spectacles, toys, clothing, and personal items.
- Items helping to understand a culture or identity.
- Food containers and dishware.

Main Image: *Dishes, bottles, work boot found at the North Shore Japanese bath house (ofuro) site, Courtesy Bob Muckle, Archaeologist, Capilano University, B.C. This is an example of an above ground resource.*

Right, from Top to Bottom: *Coins, token, spectacles and Montgomery Ward pitchfork toy discovered during Seattle Smith Cove shantytown (45-KI-1200) excavation.*

Implement the IDP if you see…

- Old munition casings – if you see ammunition of any type – ***always assume they are live and never touch or move!***
- Tin cans or glass bottles with an older manufacturer's technique – maker's mark, distinct colors such as turquoise, or an older method of opening the container.

Far Left: *.303 British cartridge found by a WCC planting crew on Skagit River.* ***Don't ever touch something like this!***

Left: *Maker's mark on bottom of old bottle.*

Right: *Old beer can found in Oregon. ACME was owned by Olympia Brewery. Courtesy of Heather Simmons.*

Logo employed by Whithall Tatum & Co. between 1924 to 1938 (Lockhart et al. 2016).

Can opening dates, courtesy of W.M. Schroeder.

Implement the IDP if you see…

Historic foundations or buried structures.

Examples are:

- Foundations.
- Railroad and trolley tracks.
- Remnants of structures.

Counter Clockwise, Left to Right: *Historic structure 45KI924, in WSDOT right of way for SR99 tunnel. Remnants of Smith Cove shantytown (45-KI-1200) discovered during Ecology CSO excavation, City of Spokane historic trolley tracks (above ground historic resources) uncovered during stormwater project, intact foundation of historic home that survived the Great Ellensburg Fire of July 4, 1889, uncovered beneath parking lot in Ellensburg.*

Implement the IDP if you see…

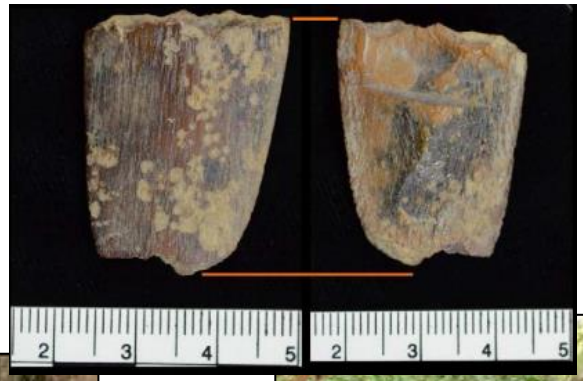
Potential human remains.

Examples are:

- Grave headstones that appear to be older than 50 years.
- Bones or bone tools--intact or in small pieces. It can be difficult to differentiate animal from human so they must be identified by an expert.
- These are all examples of animal bones and are not human.

Center: *Bone wedge tool, courtesy of Smith Cove Shantytown excavation (45KI1200).*

Other images (Top Right, Bottom Left, and Bottom) Center: Courtesy of DAHP.



Directly Above: *This is a real discovery at an Ecology sewer project site.*

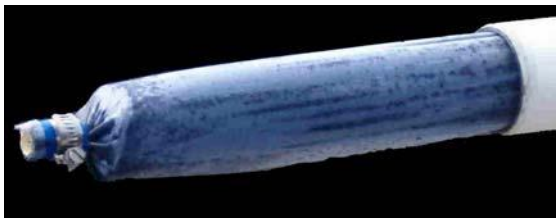
What would you do if you found these items at a site? Who would be the first person you would call?

Hint: *Read the plan!*

Attachment 5
Passive Flux Meter Protocol Manual

Passive Flux Meter Protocol Manual

EnviroFlux, LLC



The following documents current methods for construction, storage, transport, deployment, sampling and analysis of passive flux meters for site assessment.

PFM CONSTRUCTION

PFM Storage: If the PFMs are constructed for transport to the field site, the PFMs will be stored in tubes and cooled. PFM storage tubes are constructed using PVC pipe the same diameter as the packing tube. The bottom of storage tube is sealed by a gas tight mechanical plug. The PFM is then extruded from the packing tube into the storage tube. A section of threaded rod or PVC pipe is used to push the PFM out of the packing tube and into the storage tube. The top of the storage tube is then sealed. The PFM are then placed in cold storage (4 C) until transport.

PFM Transport: The PFMs are transported in cardboard boxes to the site for FedEx shipments.

INSTALLATION PROCEDURES

PFM Deployment: At the field site the PFM in the packing tube or storage tube is prepared for PFM insertion into the well casing. A rope (or in some cased a steel cable) is attached to the top of the PFM using a safety carabineer. The tube is lined up with the top of the well casing and a section of push rod is used to push the PFM from the tube into the top section of well casing. Additional push rods are attached to continue pushing the PFM to the screen interval. If multiple PFMs are deployed on a single line, short sections of cable (about 5.5ft long) are thread through the upper PFM to link the PFMs together well. When inserting the PFM some back pressure may build since the water in the well casing must flow through the center tube as the PFM is inserted. Proceed slowly as pressure builds. The PFM rope (or steel cable) attached to the sock assembly is then secured to the well lid or others to ensure that it will not be lost to the well head.

1) PFMs are shipped to the site via FedEx Overnight.

2) Lay the PFMs for the first well onto saw horse legs.

3) Remove end caps from PVC transport tubes.

4) Remove well lid and cap.

5) Attach retrieval rope (or wires) to the top of each PFM using a carabineer connector.

6) Install PFMs by setting transport tube over monitoring well and using Geoprobe rods to push PFM out of the transport tube and into the well.

ail: info@enviroflux.com

7) Push PFM into position in the well using Geoprobe rods while holding retrieval wire tight.

8) Repeat steps 5 through 7 for each PFM that is to be installed in the well.

9) Replace well lid and cap (wire ropes are cut to a length such that two feet of each retrieval wire will remain outside the well).

10) Repeat steps 2 through 9 for each well.

RETRIEVAL AND SAMPLING PROCEDURES

Preparation of Sampling Vials: 120 ml jars are used for AC sampling. Jars are filled with activated carbon making sure to seal tightly with no carbon grains on the lip of the jar.

PFM Retrieval: PFMs are retrieved using the rope. The top PFM in the well is extracted first by gently pulling up on the rope (heavy work gloves should be worn when pull on rope or stainless wire cable). The PFM should be pulled to the top of the well casing. When the PFM is at the top of the well casing untangle any rope (or wires) that are twisted at the well head. Thread the retrieval cable through a 5ft storage (or transport) PVC pipe and place the pipe over the well to guide and contain the extruded PFM. Move the PFM to the sampling work station.

PFM Sampling: A tarpaulin acts as a 'protective flooring' for the work zone. A portable table is used as a work zone for sampling the PFMs. Nitrile protective gloves and necessary other protective clothing will be worn by all samplers. A lined bucket (5gal) is placed under the work area to capture un-sampled residual activated carbon from the retrieved PFM. The sock is extruded from the PVC pipe to the sampling interval extent. The flexible mesh packing material is cut and the sorbent (activated carbon) captured in plastic or stainless steel mixing bowls for homogenization using a stainless steel spatula. A sub-sample is then transferred into 120 mL jars. The jars are stored in a cooler for transport back to the laboratory for analysis. The center tube and viton washers are measured to obtain the sample interval lengths in the PFM. Sampling materials, spatula, scissors, mixing bowls are wiped clean to remove carbon particles prior to retrieving the next PFM.

Transportation and Storage: Sorbent (GAC) samples are stored on-site in coolers then shipped via overnight air express (e.g., FedEx) to the EnviroFlux laboratory. Samples are stored in a cold storage room or refrigerator at 4^{o}C until extraction and analysis.

1) Retrieve PFM from well by pulling up on the attached rope (or wire). The PFM is pulled from the well pipe directly into a PVC tube of the same diameter.

2) Place tube on table and expose the first segment by pulling on the bottom end of the PFM.

3) Using scissors, cut open the nylon socks and flexible red mesh covering the first segment and pour the exposed sorbent(GAC) mixture into a mixing bowl.

4) Stir the mixture vigorously in the bowl to homogenize

5) Sub-sample the mixture and place into 120mL jar and seal tightly (make sure no carbon particles are on the lip of the jar).

6) Measure the interval length of the PFM segment

7) Repeat for steps 3-8 for remaining segments of PFM

8) After all PFMs are sampled, place 120 mL jars into cooler(s) and ship back for analysis

9) Excess sorbent is collected in a plastic-lined container for proper hazardous waste disposal.