Sampling and Analysis Plan

Phase 2.5 Remedial Investigation Activities

Simplot Grower Solutions
South 300 1st Street

Sunnyside, WA
June 10, 2021

Sampling and Analysis Plan for Phase 2.5 Remedial Investigation Activities

Simplot Grower Solutions Facility
South 300 1st Street
Sunnyside, Washington 98944

June 2021

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Acronyms

AO	agreed order
CLARC	Cleanup levels and risk calculation
COPC	contaminant of potential concern
Ecology	Washington State Department of Ecology
EIM	Ecology Environmental Information Management
EPA	U.S. Environmental Protection Agency
HDR	HDR Engineering, Inc.
HSA	Hollow stem auger
HSP	health and safety plan
Phase I RI Report	*Phase 1 Remedial Investigation Report*
Phase I SAP	*Phase 1 Remediation Investigation Sampling and Analysis Plan*
Phase 2 SAP	*Phase 2 Remediation Investigation Sampling and Analysis Plan*
Phase 2.5 SAP	*Phase 2.5 Remediation Investigation Sampling and Analysis Plan*
PID	photo-ionization detector
QA/QC	quality assurance/quality control
QAPP	*Quality Assurance Project Plan*
RI/FS	remedial investigation/feasibility study
RI Work Plan	*Remedial Investigation Work Plan*
SAP	sampling and analysis plan
SGS	Simplot Grower Solutions
Simplot	J.R. Simplot Company
SOP	standard operating procedure
VOC	Volatile organic compound
WAC	Washington Administrative Code

1 Introduction

This Phase 2.5 sampling and analysis plan (SAP) describes field sampling procedures and laboratory analysis to support ongoing remedial investigation (RI) activities. The RI is part of a remedial investigation and feasibility study (RI/FS) being conducted by the J.R. Simplot Company (Simplot) at the Simplot Grower Solutions (SGS) facility at South 300 1st Street, Sunnyside, Washington. An RI/FS is part of Agreed Order (AO) number 16446 between Simplot and the Washington State Department of Ecology (Ecology).

As described in the *Remedial Investigation Work Plan* (RI Work Plan; HDR 2019a), RI activities will be conducted in phases, where information from the current phase will inform the need for additional information and field activities (future phases). Specifics for each phase, such as location and number of samples, are addressed in a SAP that is developed for each phase.

Phase 1 RI activities were conducted in early 2020 in accordance with the *Phase 1 Sampling and Analysis Plan* (Phase I SAP; HDR 2019b) and the Quality Assurance Project Plan (QAPP; HDR 2019c). Findings of the Phase 1 RI activities are summarized in the document *Phase 1 Remediation Investigation Repor*t dated April 2020 (Phase 1 RI Report; HDR 2020). In the Phase 1 RI report, HDR concluded that additional groundwater and soil sampling activities are warranted to better define contaminants of potential concern (COPC). In response to the Phase 1 report, Ecology, in its letter dated April 28, 2020, also recommended that additional groundwater and soil assessments were needed to better define the lateral and vertical extent of constituent impacts to groundwater and soils. In its letter, Ecology made a series of recommendations for additional boring locations based on COPC data from past sampling activities, including the Phase 1 RI.

Phase 2 RI activities were conducted in December 2020 in accordance with the Phase 2 Sampling and Analysis Plan (Phase 2 SAP; HDR 2020) and the Quality Assurance Project Plan (QAPP; HDR 2019c). Findings of the Phase 2 RI activities are summarized in the document Phase 2 Remediation Investigation Report dated April 2020 (Phase 2 RI Report; HDR 2021). In response to the Phase 2 report, Ecology provided comments via email on April 12, 2021 and April 13, 2021 and in a virtual project review meeting on April 29, 2021. Ecology stated the Phase 2 RI cannot be considered fully complete at this time. Specifically, the downgradient water supply protection, vapor intrusion potential, and vadose zone soil contamination needs to be better defined. Appropriate remedial action(s) for the contaminated groundwater and mass (e.g., vapor extraction, air sparging, phreatophyte tree planting) should be identified. This Phase 2.5 SAP addresses Ecology's concerns.

1.1 Purpose and Objectives

The objective of the RI/FS is to meet the requirements of the AO by completing an RI/FS as described in the Model Toxics Control Act (MTCA) Cleanup Regulation (Washington Administrative Code [WAC] 173-340). The RI is designed to characterize site conditions to complete a FS and select a cleanup action as described in WAC 173-340-360 through 173-340-390, because of the presence/discovery of several COPCs in soils and groundwater at the SGS facility.

This SAP presents the field operation and investigation requirements and procedures for carrying out Phase 2.5 RI activities. This SAP includes information on site investigation rationale for sample

type (e.g., soil, groundwater, or soil vapor), sample location, sample procedures, and analytical methods.

1.2 Project Organization

Following is a list of personnel involved in carrying out the RI/FS project plan and this SAP:

- Molly Dimick, J.R. Simplot Company, project manager (208) 235-5682
- Stacey Lamer, HDR Engineering, project manager (208) 387-7034
- Corrie Hugaboom, HDR Engineering, health and safety officer (208) 387-7003
- Adam Kessler, HDR licensed geologist
- Brittany Duarte, HDR field and data manager (603) 508-1409 (cell)
- Environmental West – GeoProbe™ and hollow stem auger drilling
- Analytical Laboratory – Eurofins TestAmerica, Spokane, Washington
- Analytical Laboratory – Eurofins Air Toxics LLC, Folsom, California
- Analytical Laboratory – Kuo Testing Labs, Othello, Washington
- Surveyor – to be determined

Ecology's project coordinator is overseeing the RI/FS:

- Frank Winslow, Washington Department of Ecology, project manager (509) 454-7835

1.3 Project Schedule

See the RI Work Plan for the RI investigation schedule. For Phase 2.5, field activities will be initiated within 45 days following the approval of this Phase 2.5 SAP by Ecology. In addition, Phase 2.5 activities include proposed sampling off site that will require access permission from several landowners. Simplot will initiate access agreements with these landowners upon approval of this SAP by Ecology.

1.4 Site Location

This Phase 2.5 SAP is prepared for the SGS facility at South 300 1st Street, Sunnyside, Washington (**Figures 1** and **2** in Appendix B).

2 Phase 2.5 Field Activities to Support the Remedial Investigation

Field investigation activities are designed to meet investigation objectives described in the AO and the RI Work Plan (HDR 2019a). The sampling strategy and rationale are described in this section. **Table 1** (Appendix A) summarizes Phase 2.5 sample identifications and lists the rationale for each proposed sample location.

The RI will follow a phased investigative approach, where findings of the current phase will inform the need and approach of the next phase.

The following activities will be conducted as part of Phase 2.5 RI activities:

- Monitoring well installation and soil sample collection at two (2) offsite locations near existing monitoring wells MW-6 and MW-7, and groundwater sampling at these new monitoring well locations.
- On-site soil vapor headspace screening investigation using GeoProbe (direct push) at fifty (50) locations on a grid with approximately 50-foot centers with soil vapor headspace screening conducted every four (4) feet to a depth intersecting groundwater (assuming ~12 feet).
- If required, offsite Tier I soil vapor intrusion investigation at ten (10) locations with soil vapor sample collection.
- On-site soil suitability testing for potential future onsite phytoremediation option by collecting soil grab samples at depths of 6 to 12 inches, 12 to 18 inches, and 18 to 24 inches at five (5) locations around the site perimeter.

Subsequent RI phases will be based on the results of Phase 2.5 activities.

2.1 Monitoring Well Installation and Testing

Existing downgradient monitoring wells MW-6 and MW-7 (located on 3rd Street, **Figure 3** in Appendix B) have been below groundwater quality standards for all constituents including nitrate. However, GeoProbe sampling results from January 2020 showed an elevated nitrate level in a soil boring BH2-13 (located on 2nd Street, **Figure 3** in Appendix B). Since MW-6 and MW-7 are relatively shallow with measured depths of water at 12.82 feet and 12.64 feet, respectively, an installation of two (2) additional wells downgradient near MW-6 and MW-7 (MW-6D and MW-7D) are proposed to serve as “deep” wells to evaluate vertical gradient and downgradient groundwater quality and geochemistry (**Figure 4** in Appendix B).

2.1.1 Well Installation and Soil Testing

The following Phase 2.5 monitoring well installation and testing activities will be conducted downgradient of the facility near wells MW-6 and MW-7.

- Two (2) new downgradient monitoring wells will be installed to a depth of 30-40 feet below ground surface to serve as “deep” wells to evaluate vertical gradients and groundwater quality. Proposed monitoring well locations are illustrated on **Figure 4** (Appendix B).
- Both wells will be constructed using a hollow-stem auger (HSA) rig with 2-inch ID Schedule 40 PVC well riser, well screen, with flush-mount road boxes.
- A Washington-licensed surveyor will survey the monitoring wells to the top of the PVC well casing and to the ground surface at the base of the protective well casing. These measurements will be used determine the groundwater elevation and flow direction.
- Soil samples will be collected at 5-foot intervals during drilling and screened using an organic vapor monitor equipped with a photo-ionization detector (PID) with readings recorded in the boring logs.
- Two samples per boring are proposed, one in the vadose zone just above the water table and another in the vadose zone biased by PID/visual indications. It is assumed that, at minimum, two samples per boring, for a total of 4 soil samples (plus 1 blind duplicate) will be

collected for analytical testing following the sampling protocol defined by the Source Removal, Drain Evaluation, Monitoring Well Construction, and Sampling Work Plan (HDR 2012). Soil samples will be sent to Eurofins TestAmerica, Spokane, Washington for the analyses listed in **Table 3** (Appendix A).

- The following samples will be collected for quality assurance/quality control (QA/QC) purposes (HDR 2021b):
    - A trip blank will accompany sample bottles and be run for methods requiring trip blank analysis.
    - One blind duplicate soil sample will be collected from a monitoring well installation boring.
- In total, 4 soil samples, 1 blind duplicate soil sample, and one trip blank per sample shipment will be collected during the monitoring well installation activity.

2.1.2 Groundwater Sample Collection and Testing

Both new groundwater monitoring wells will be sampled twice: (1) immediately after well development, and (2) 30 days later. In addition, a synoptic round of groundwater level measurements will be collected from all monitoring wells (MW-1, MW-2, MW-3, MW-4, MW-5R, MW-6, MW-6D, MW-7, and MW-7D) during the groundwater sampling activities in order to evaluate groundwater flow direction.

The RI Work Plan lists the groundwater COPCs based on exceedance of the most restrictive Washington Cleanup Levels and Risk Calculation (CLARC) values. Phase 2.5 groundwater sampling activity will include the analyses listed in **Table 4** (Appendix A) for both groundwater sampling events.

The following will be collected for QA/QC purposes (HDR 2021b):

- A trip blank will accompany sample bottles and be run for methods requiring trip blank analysis.
- One blind duplicate groundwater sample will be collected during each sampling event.
- One rinsate blank will be created by pouring distilled water through the decontaminated monitoring well sampling equipment and collecting the water as a sample for analysis for each sampling event

Groundwater samples will be sent to Eurofins TestAmerica, Spokane, Washington. In all, the following samples will be analyzed for the parameters listed in **Table 4**:

- 4 monitoring well groundwater samples (2 per event)
- 2 blind duplicate samples (1 per event)
- 2 rinsate blanks samples (1 per event)
- one trip blank per sample shipment

2.2 On-site Soil Vapor Headspace Screening Investigation

The following Phase 2.5 onsite soil vapor screening investigation activities will be conducted at on-site locations to evaluate the presence or absence of soil contamination "hot spots" (**Figure 4** in Appendix B):

- Direct-push sampling with a GeoProbe™ will be conducted to visually log soils and gather soil vapor readings using a PID at 50 onsite locations on a grid with approximately 50-foot centers, to a depth intersecting groundwater (assuming approximately12 feet).
- PID grab readings (non-headspace) will be collected from the exposed continuous soil cores to quickly identify potential zones of contamination.
- Up to three (3) soil samples from depths exhibiting signs of soil contamination (e.g., staining, discoloration, high PID grab reading) will be obtained in Ziploc baggies and field-screened for headspace using a PID. If there is no evidence of soil contamination, a soil sample will be analyzed for headspace every 4 feet to the groundwater depth (assuming approximately 12 feet).
- The PID headspace readings at each depth interval will be recorded on a boring log for each soil boring.

2.3 Tier I Soil Vapor Intrusion Assessment and Investigation

The concentrations of constituents detected in groundwater from existing monitoring wells located at the downgradient edge of the site along 2nd Street will be compared to the CLARC VOC groundwater screening values). If the concentrations of VOC constituents detected in groundwater do not exceed the CLARC values, no further action related to soil vapor intrusion investigation will be conducted.

If one or more constituents in groundwater exceeds the VOCs screening values, a Tier I soil vapor intrusion investigation will be conducted adjacent to residences and businesses located downgradient of the site (between 2nd Street and 3rd Street, **Figure 4** in Appendix B).

2.3.1 Tier I Soil Vapor Intrusion Investigation

If required, the following Phase 2.5 Tier I soil vapor intrusion investigation activities would be conducted off-site as follows:

- Up to 10 offsite locations adjacent to residences and businesses located between 2nd Street and 3rd Street will be selected and access will be obtained prior to conducting exterior deep soil gas sampling in accordance with the Guidance for Evaluating Soil Vapor Intrusion in Washington State (Publication No. 09-09-047).
- Exterior deep soil gas samples will be collected from immediately above the water table (estimated depth of 12 feet) at all 10 selected locations using direct-push sampling techniques and temporary soil vapor probes. This sample depth is expected to assess "worst case" concentrations of COPC in soil gas.
- Soil gas samples will be collected over a 20-minute time period in a certified 6-liter steel SUMMA canister that has been evacuated to a vacuum of approximately -30 inches mercury.

- Soil gas samples will be submitted to Eurofins Air Toxics LLC, Folsom, California and analyzed for volatile organics by USEPA Method TO-15.
- Analytical results will be compared to Ecology's Deep Soil Gas screening values as updated in 2015.

2.3.2 Tier I Soil Vapor Intrusion Sample Analysis

If required, all ten (10)- exterior deep soil gas samples collected during the Tier 1 Soil Vapor Intrusion Investigation will be analyzed for VOCs by EPA Method TO-15 (**Table 5**, Appendix A). The following samples will also be collected and analyzed for QA/QC purposes:

- A blind duplicate soil gas sample will be collected from one of the 10 soil gas sample locations.
- An ambient air blank sample will be collected at a frequency of one per day of sampling and be collected simultaneously with soil gas sampling.

In all, 13 samples are proposed as follows:

- 10 soil gas samples.
- 3 QA/QC samples including one blind duplicate soil gas and two ambient air blank samples.

2.4 On-Site Soil Suitability Testing

To determine the soil suitability for potential future onsite phytoremediation options, grab soil samples will be collected from onsite locations around the site perimeter (**Figure 4** in Appendix B).

2.4.1 Soil Suitability Sampling

Grab soil samples from depths of 6 to 12 inches, 12 to 18 inches, and 18 to 24 inches will be collected from five (5) onsite locations around the site perimeter. A total of 15 samples will be collected with either hand augers or Geoprobe™ (to be conducted during on-site soil vapor headspace screening investigation). Grab soil samples will also be screened using a PID with readings recorded in the boring logs.

2.4.2 Soil Suitability Sample Analysis

All fifteen (15) soil samples collected for the soil suitability testing will be analyzed for the parameters listed in **Table 6** (Appendix A).

No QA/QC samples will be collected during the soil suitability testing activity.

2.5 Sample Identification Protocol

The following sample identification protocol will be followed during the Phase 2.5 investigation:

- The two new "deep" monitoring wells will be labeled as MW-6D and MW-7D.
- Soil samples collected from the monitoring well boreholes will be labeled BH2.5-6D-S and BH2.5-7D-S, ("S" for soil) followed by depth of the sample. For example, a soil sample collected at monitoring well borehole for MW-7D at a depth of 12 feet would be labeled BH2.5-7D-S-12.

- Groundwater samples from wells will be identified by the monitoring well the sample was collected from and sampling date. For example, a monitoring well sample collected from MW-7D will be labeled MW-7D-YYYYMMDD.
- Onsite soil vapor headspace screening investigation locations will be labeled SVH2.5-01 through SVH2.5-50 on boring logs. PID headspace readings will be identified by the location label followed by depth. For example, a PID reading from 12 feet at SVH2.5-03 would be labeled SVH2.5-03-12.
- If conducted, soil vapor intrusion investigation locations will be labeled VI2.5-01 through VI2.5-10. Soil gas samples will be identified by the location label followed by depth. For example, a soil gas sample collected from 10 feet at VI2.5-05 would be labeled VI2.5-05-10.
- Shallow soil samples collected for soil suitability treatment testing will be labeled SST2.5-01 through SST2.5-05, followed by depth of the sample in inches. For example, a soil sample collected at soil suitability treatment testing location SST2.5-02 at a depth of 12 to 18 inches would be labeled SST2.5-02-12-18.

Table 2 (Appendix A) summarizes Phase 2.5 sample identifications including QA/QC samples.

2.6 Data Validation and Evaluation

Data validation and evaluation is summarized in the project's QAPP (HDR 2019c), revised for soil and vapor intrusion sampling (HDR 2021b). Data management and documentation will include checking all QA/QC parameters, including holding times, method blanks, surrogate recoveries, spike recoveries, field and laboratory duplicates, completeness, detection limits, laboratory control samples, and chain-of-custody forms. After the data has been checked, it will be entered into the project database with any assigned data qualifiers.

The project electronic database will be in a format compatible with the Ecology Environmental Information Management (EIM) system, and all analytical data will be entered into the EIM system. Results of the sampling and laboratory testing will be summarized in a spreadsheet, plotted on a site map, and the data compared to established site cleanup levels. A report will describe any significant field sampling issues, laboratory QA/QC testing, water level monitoring data and soil, water, and soil gas quality testing results.

3 Field Procedures, Sampling, and Laboratory Testing

Phase 2.5 field and sampling tasks includes HSA drilling with split-spoon soil sampling, monitoring well installation, groundwater sampling, direct push soil sampling and headspace screening, direct push soil gas sampling, and shallow soil sampling. This Phase 2.5 SAP includes the following activities:

- Screening split-spoon soils using a PID during HSA drilling and soil sampling from offsite soil borings;
- Off-site monitoring well installation and development;

- Groundwater sampling from new offsite monitoring wells;
- Screening soil vapor headspace using a PID during direct push probing onsite;
- Sampling soil gas using SUMMA canisters during direct push probing offsite (if conducted based on the Tier I Soil Vapor Intrusion Assessment); and
- Shallow soil sampling onsite collected with hand augers or macro cores with a hydraulic GeoProbe™ type rig.

This Phase 2.5 SAP will be updated as needed to support additional field investigation activities not covered under the bulleted activities above.

3.1 Utility Location

Prior to advancing any ground disturbance activities, Simplot will contact Washington One Call (1-800-424-5555) to locate public utilities. HDR Engineering, Inc. (HDR), contracted by Simplot, will also consult with the facility managers for the SGS property regarding knowledge of utilities. In addition, a private utility locator will check the on-site work area for private underground utilities. Probe and drilling locations will be moved a minimum of 2 feet away from any underground utility. In cases where a utility cannot be confidently located, a vacuum-truck may be used to remove soils to expose utilities.

3.2 HSA Drilling and Direct Push Soil Sampling

The standard operating procedure (SOP) for HSA drilling is presented in Appendix C (SOP-1 HSA DRILLING). This SOP describes techniques for installation of soil borings during the field investigation for those locations where permanent groundwater monitoring wells are proposed and split-spoon soil sample collection associated with HSA drilling. The SOP for direct push sampling is presented in Appendix C (SOP-2 SOIL BORING AND SUBSURFACE SAMPLE COLLECTION). This SOP describes the soil boring method and subsurface soil sample collection techniques using a direct push macro core sampler. Soil cuttings from the macro core or split-spoon sampler will be screened in the field using a PID. Information on screening soil cuttings and taking headspace readings using a PID is included in SOP-2. Standard chain-of-custody procedures will be followed from the time laboratory samples are collected until the samples arrive at the laboratory (see SOP-3, PROJECT CUSTODY DOCUMENTATION). After sampling, samples will be immediately labeled and placed in a clean ice chest and chilled until delivery to the laboratory.

3.2.1 Quality Control Samples

Table 2 (Appendix A) summarizes the types of field QA/QC samples. The QAPP, provided under separate cover (HDR 2021b), includes details on data validation for soil samples, and describes QA/QC requirements for the sample analysis.

3.3 Monitoring Well Installation and Development

Two deep monitoring wells will be installed downgradient of the SGS site. The SOP for monitoring well installation and development is presented in Appendix C (SOP-4 MONITORING WELL INSTALLATION, COMPLETION AND DEVELOPMENT). This SOP provides technical guidance for the design, installation, and development of permanently cased overburden groundwater monitoring

wells. SOP-4 also provides a list of the materials that will be used in the design and construction of these monitoring wells.

3.4 Groundwater Monitoring

Two rounds of groundwater samples will be collected from the two newly installed deep monitoring wells as part of Phase 2.5 activities. SOP-5, SAMPLING MONITORING WELLS, in Appendix C, describes groundwater monitoring well sampling activities.

3.4.1 Quality Control Samples

Table 2 (Appendix A) summarizes QA/QC field samples to be collected as part of the groundwater monitoring well sampling. In addition to the field QA/QC samples described in **Table 2**, the laboratory will follow appropriate laboratory QA/QC procedures as dictated by the U.S. Environmental Protection Agency (EPA) method and the laboratory's SOPs. The QAPP, provided under separate cover (HDR 2021b), includes details on data validation for groundwater samples, and describes QA/QC requirements for the sample analysis.

3.5 Vapor Intrusion Soil Gas Sampling

Soil gas samples using temporary direct push soil gas monitoring probes and SUMMA canisters will be collected during the Phase 2.5 activities, and if required, at 10 downgradient locations. The SOP for vapor intrusion soil gas sampling is presented in Appendix C (SOP-6, SOIL VAPOR SCREENING AND SAMPLING). This SOP provides technical guidance and procedures for soil gas collection for screening and analysis.

3.5.1 Quality Control Samples

Table 2 (Appendix A) summarizes QA/QC field samples to be collected as part of vapor intrusion sampling. In addition to the field QA/QC samples described in **Table 2**, the laboratory will follow appropriate laboratory QA/QC procedures as dictated by the U.S. Environmental Protection Agency (EPA) method and the laboratory's SOPs. The QAPP, provided under separate cover (HDR 2021b), includes details on data validation for soil gas samples, and describes QA/QC requirements for the sample analysis.

3.6 On-site Shallow Soil Sampling

On-site shallow soil samples from the 6-24-inch depth will be collected at five perimeter locations using a hand auger or direct push macrocore sampling during Phase 2.5 activities. PID readings will be collected from each sample. The SOP for surface soil sample collection is presented in Appendix C (SOP-7, SURFACE SOIL SAMPLING). No QA/QC field samples will be collected.

3.7 Waste Handling Procedures

Soil cuttings, development water, and purge water will be containerized in Department of Transportation-approved 55-gallon drums. Proper labels will be affixed, and the drums will be stored on site pending analysis and disposal. Once laboratory results are obtained, proper disposal of the containers will be determined. Ecology will be notified of the results and recommended disposal options prior to removing drums from the site.

3.8 Laboratory Analyses

Soil and groundwater samples will be sent to Eurofins TestAmerica, Spokane, Washington. Soil gas samples will be sent to Eurofins Air Toxics LLC, Folsom, California. Eurofins is certified in the State of Washington for air, drinking water, non-potable water, and solid and chemical materials. Shallow soil suitability treatment testing samples will be sent to Kuo Testing Labs, Othello, Washington. Laboratory analyses are summarized in **Table 3** (Appendix A) for monitoring well boring soil samples, **Table 4** (Appendix A) for groundwater samples, **Table 5** (Appendix A) for vapor intrusion soil gas samples, and **Table 6** (Appendix A) for shallow soil suitability treatment samples.

3.9 Quality Assurance and Quality Control

The QAPP (HDR 2019c), revised to include soil and vapor intrusion sampling (HDR 2021b,) presented under separate cover, addresses field QA/QC methods (see **Table 2** in Appendix A), laboratory QA/QC, and data validation procedures.

3.10 Health and Safety Plan

HDR personnel conducting this field program are required to follow the health and safety protocol presented in the HDR site-specific health and safety plan (HSP). Subcontractors and other authorized visitors to the site are responsible for their own health and safety. The HSP will be made available to subcontractors and other site visitors who request it. HDR personnel will communicate health and safety precautions to subcontractors during site safety briefings at the beginning of each field day (subcontractors are responsible for their own health and safety). To acknowledge review and comprehension of this plan, HDR personnel must sign the appropriate section included in the back of the document. The HSP is a separate document from this Phase 2.5 SAP and is available upon request.

4 References

HDR Engineering, Inc.

2021b. Quality Assurance Project Plan (QAPP) Revised for Soil and Vapor Intrusion. Simplot Grower Solutions. Sunnyside, WA.

2021. Phase 2 Remedial Investigation Report, Simplot Grower Solutions, Sunnyside, WA.

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2020. Phase 1 Remedial Investigation Report, Simplot Grower Solutions, Sunnyside, WA.

2019a. Remedial Investigation Work Plan. Simplot Grower Solutions. Sunnyside, WA.

2019b. Phase 1 Remediation Investigation Sampling and Analysis Plan. Simplot Grower Solutions. Sunnyside, WA.

2019c. Quality Assurance Project Plan (QAPP). Simplot Grower Solutions. Sunnyside, WA.

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Tables

Table 1. Phase 2.5 Sampling Locations and Rationale

Identification	Monitoring Wells	Monitoring Well Depth (ft bgs)	# Laboratory Samples
MW-6D	Off-site adjacent to MW-6 on 3rd Street to serve as a "deep" well to evaluate vertical gradient and downgradient nature and extent of groundwater quality	30-40	2 (1 per event)
MW-7D	Off-site adjacent to MW-7 on 3rd Street to serve as a "deep" well to evaluate vertical gradient and downgradient nature and extent of groundwater quality	30-40	2 (1 per event)
Identification	**Monitoring Well Soil Borings**	**Sample Depth (ft bgs)**	**# Laboratory Samples**
BH2.5-6D	Co-located with MW-6D for one sample in the vadose zone just above the water table and another in the vadose zone biased by PID/visual indications	12[1], <12[2]	2
BH2.5-7D	Co-located with MW-7D for one sample in the vadose zone just above the water table and another in the vadose zone biased by PID/visual indications	12[1], <12[2]	2
Identification	**On-Site Soil Vapor Headspace Screening**	**Sample Depth (ft bgs)**	**# Screening Samples**
SVH2.5-01 through SVH2.5-50	On-site grid of 50 locations with approximately 50-foot centers and soil vapor headspace screening samples collected from up to three (3) depths biased by PID grab readings and visual indications, or every four (4) feet to groundwater if no contamination is observed.	three depths (variable)	150
Identification	**Tier 1 Off-Site Soil Vapor Sampling (If required)**	**Sample Depth (ft bgs)**	**# Laboratory Samples**
VI2.5-01	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1
VI2.5-02	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1
VI2.5-03	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1
VI2.5-04	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1
VI2.5-05	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1
VI2.5-06	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1
VI2.5-07	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1
VI2.5-08	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1
VI2.5-09	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1

Table 1. Phase 2.5 Sampling Locations and Rationale

Identification	Monitoring Wells	Monitoring Well Depth (ft bgs)	# Laboratory Samples
VI2.5-10	Off-site downgradient adjacent to residences and businesses between 2nd Street and 3rd Street; probe location to be determined based on prior findings and access	12[1]	1
Identification	**On-Site Soil Suitability Testing**	**Grab Sample Depth (inches bgs)**	**# Laboratory Samples**
SST2.5-01	On-site along the perimeter adjacent to the intersection of 1st Street and the railroad to determine the phytoremediation conditions at the northern side of the site	6-12, 12-18, 18-24	3
SST2.5-02	On-site along the perimeter adjacent to 1st Street midway between MW-1 and MW-2 to determine the phytoremediation conditions along the western side of the site	6-12, 12-18, 18-24	3
SST2.5-03	On-site along the perimeter adjacent to the intersection of 1st Street and Zillah Ave between MW-2 and MW-3 to determine the phytoremediation conditions along the south and western side of the site	6-12, 12-18, 18-24	3
SST2.5-04	On-site along the perimeter adjacent to the intersection of Zillah Ave and 2nd Street between MW-2 and MW-3 to determine the phytoremediation conditions along the south and eastern side of the site	6-12, 12-18, 18-24	3
SST2.5-05	On-site along the perimeter adjacent to the intersection of 2nd Street and the railroad to determine the phytoremediation conditions at the north and eastern side of the site	6-12, 12-18, 18-24	3

[1] Sample depth is estimated and will be determined in the field based on the depth of the vadose zone

[2] Sample depth will be selected in the field and biased by to PID/visual indications ft bgs = feet below ground surface

Table 2. QA/QC Field Samples for Phase 2.5 Sampling

Monitoring Well Boring Soil Samples		
QA/QC Type	**Number of Samples**	**Description**
Duplicate Soil	1	Duplicate is collected using the same sampling technique as the original sample for soil.
Trip Blank (method specific)	1	Soil sample taken from the lab to the sampling site and then transported back to the laboratory without having been exposed to sampling procedures (bottles stay sealed the entire time).
Monitoring Well Groundwater Samples		
QA/QC Type	**Number of Samples**	**Description**
Duplicate Groundwater	1 per event	Duplicate is collected using the same sampling technique as the original sample for groundwater.
Equipment Rinsate Blank	1 per event	Equipment rinsate blank taken from sampling equipment after decontamination.
Trip Blank (method specific)	1 per cooler	Water sample taken from the lab to the sampling site and then transported back to the laboratory without having been exposed to sampling procedures (bottles stay sealed the entire time).
Tier I Vapor Intrusion Soil Gas Samples		
QA/QC Type	**Number of Samples**	**Description**
Duplicate Soil Gas	1	Duplicate is collected using the same sampling technique as the original sample for soil gas.
Ambient Air	2	Ambient Air blank will be collected at the frequency of one per day of sampling and be collected simultaneously with soil gas sampling.

No QA/QC samples will be collected during the soil suitability testing event.

Table 3. Analyses for Monitoring Well Boring Soil Samples[1]

Analytical Parameter	Method	Preservative	Holding Times
Volatile Organic Compounds (VOCs) (full list)	EPA 8260D	Methanol and 4°C	48 hours
Ethylene Dibromide (EDB)	EPA 8011	4°C	14 days
Chlorinated Herbicides (full list)	EPA 8151A	4°C	14 days
Resource and Recovery Act (RCRA) Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)	EPA 6020B, EPA 7471A	4°C	28 days
Nitrate+Nitrite, as N	EPA 353.2	4°C	28 days
Ammonia-N	EPA 350.1	4°C	28 days
Northwest Gasoline Range Organics (GRO)	NWTPH-Gx	Methanol and 4°C	14 days
Northwest Diesel Range Organics (DRO)	NWTPH-Dx	4°C	14 days

[1]See RI-Work Plan and supplements for analysis selection for each sample.
EPA=U.S. Environmental Protection Agency.

Table 4. Analyses for Groundwater Samples[1]

Analytical Parameter	Method	Preservative	Holding Times
Volatile Organic Compounds (VOCs) (full list)	EPA 8260D	HCl and 4°C	14 days
Ethylene Dibromide (EDB)	EPA 8011	4°C	14 days
Chlorinated Herbicides (full list)	EPA 8151A	4°C	7 days
Resource and Recovery Act (RCRA) Metals, Dissolved (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Field filtered.	EPA 6020B, EPA 7470A	HNO_3	28 days
Nitrate+Nitrite, as N	EPA 353.2	H_2SO_4 and 4°C	28 days
Ammonia-N	EPA 350.1	H_2SO_4 and 4°C	28 days
Northwest Gasoline Range Organics (GRO)	NWTPH-Gx	HCl and 4°C	14 days
Northwest Diesel Range Organics (DRO)	NWTPH-Dx	HCl and 4°C	14 days

[1]See RI-Work Plan and supplements for analysis selection for each sample.
EPA=U.S. Environmental Protection Agency; HCl=hydrochloric acid; HNO_3=nitric acid; H_2SO_4=sulfuric acid

Table 5. Analyses for Vapor Intrusion Soil Gas Samples

Analytical Parameter	Method	Preservative	Holding Times
Volatile Organic Compounds (VOCs) (low level)	EPA TO-15	Keep out of sunlight	30 days

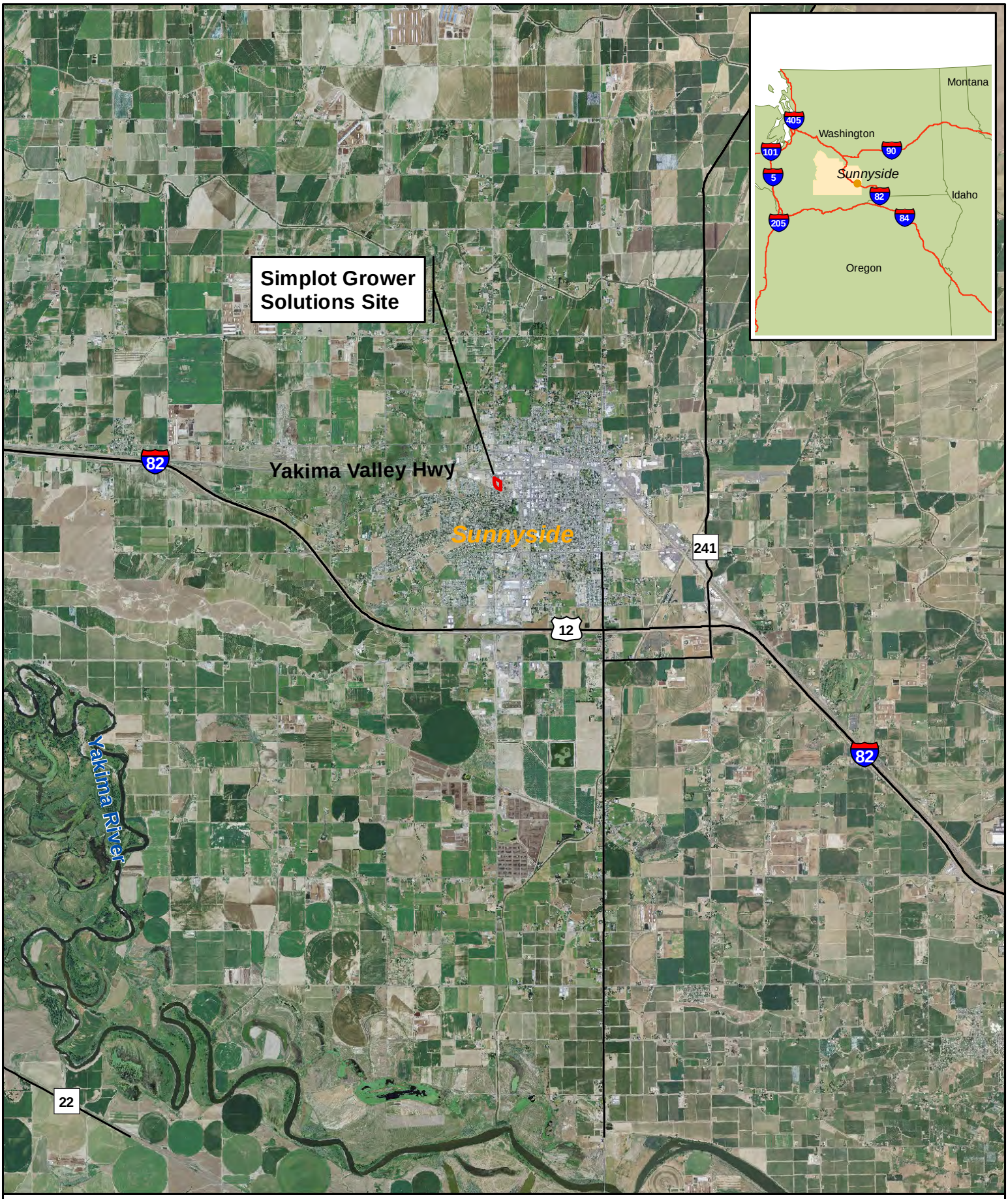
Table 6. Analyses for Shallow Soil Suitability Treatment Testing Samples

Analytical Parameter	Method	Preservative	Holding Times[1]
pH	Complete Analysis (E1)	None	None
Soluble Salts	Complete Analysis (E1)	None	None
% Organic Matter	Complete Analysis (E1)	None	None
Nitrate	Complete Analysis (E1)	None	None[2]
Ammonium	Complete Analysis (E1)	None	None[3]
Phosphorous	Complete Analysis (E1)	None	None
Potassium	Complete Analysis (E1)	None	None
Sulfur	Complete Analysis (E1)	None	None
Calcium	Complete Analysis (E1)	None	None
Magnesium	Complete Analysis (E1)	None	None
Sodium	Complete Analysis (E1)	None	None
Zinc	Complete Analysis (E1)	None	None
Copper	Complete Analysis (E1)	None	None
Manganese	Complete Analysis (E1)	None	None
Iron	Complete Analysis (E1)	None	None
Boron	Complete Analysis (E1)	None	None
Electric Conductivity	Complete Analysis (E1)	None	None
% Lime	CCE (S19)	None	None
Sodium Absorption Ratio	SAR (S21)	None	None
Carbonates	Bicarbonate (S20)	None	None
Chloride	Chlorides (S6)	None	None

[1] No lab-specified holding times, but for best results samples should be sent to lab within one to two days of sampling event, three days at most.

B

Figures



0 0.5 1 1.5
Miles

Figure 1: Vicinity Map

Simplot Grower Solutions, Sunnyside, WA

Imagery: 2009 NAIP 1 meter resolution
Source: NRCS/USDA Digitial Gateway

Map Date: Friday, May 18, 2012
Q:\Simplot\Sunnyside\map_docs\SiteMap.mxd

0 200 400
Feet

Figure 2: Site Map 2018
Simplot Grower Solutions, Sunnyside, WA

Imagery: ESRI World Imagery Map Service, Image Date 10/18/2018
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Map Date: Monday, August 5, 2019
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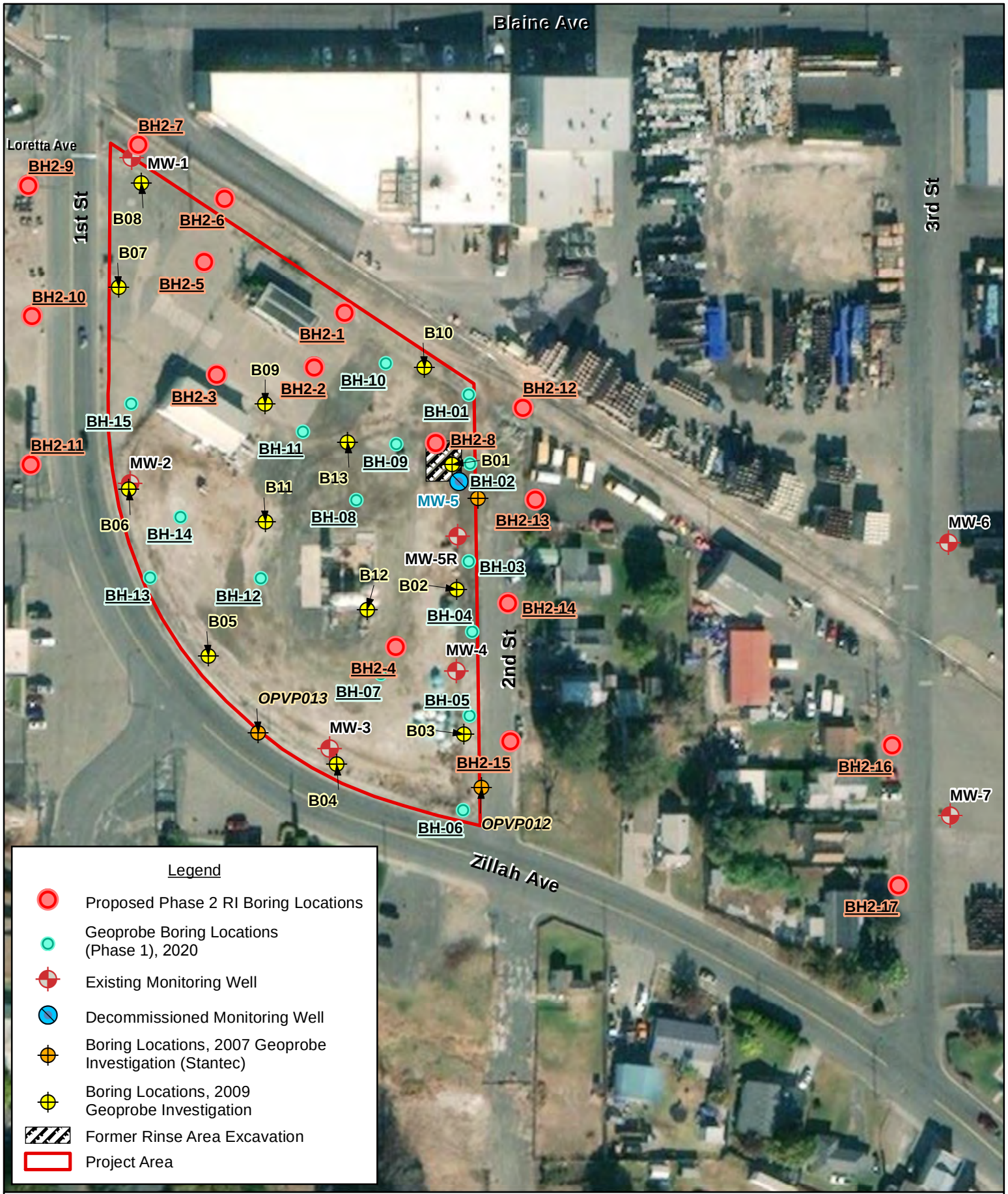
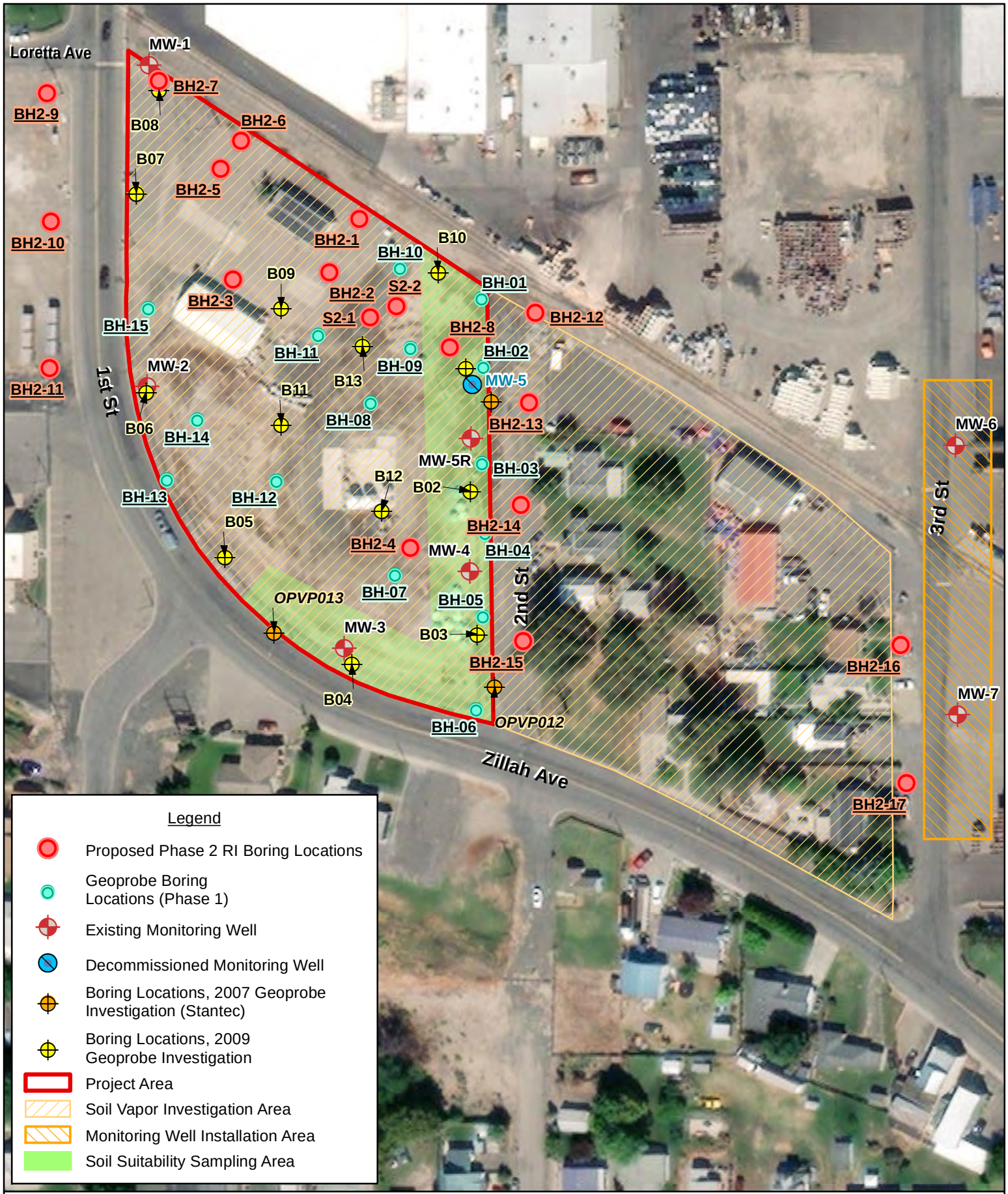


Figure 3: Boring Locations (Phase 2)

Simplot Grower Solutions, Sunnyside, WA

Imagery: ESRI World Imagery Map Service, Image Date 10/18/2018
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Map Date: Tuesday, June 9, 2020
Q:\Simplot\Sunnyside\map_docs\SiteMap2020.mxd



0 100 200
Feet

Figure 4: New Monitoring Wells (Phase 2.5)

Simplot Grower Solutions, Sunnyside, WA

N

Imagery: ESRI World Imagery Map Service, Image Date 10/18/2018
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Map Date: Wednesday, June 9, 2021
Q:\Simplot\Sunnyside\map_docs\SiteMap2020_fig4.mxd

C

Standard Operating Procedures

SOP-1: Hollow Stem Auger Drilling
SOP-2: Soil Boring and Subsurface Sample Collection (GeoProbe™)
SOP-3: Project Custody Documentation
SOP-4: Monitoring Well Installation
SOP-5: Sampling Monitoring Wells
SOP-6: Soil Vapor Screening and Sampling
SOP-7: Surface Soil Sampling

SOP-1
STANDARD OPERATING PROCEDURE
HOLLOW STEM AUGER DRILLING

Updated May 18, 2021

PURPOSE

This procedure describes techniques for installation of soil borings during the field investigation for those locations where permanent groundwater monitoring wells are proposed and split spoon soil sample collection associated with this type of drilling. Any variation from this SOP must be approved by the Project Manager prior to implementation and a description of the variance will be documented in the field logbook.

EQUIPMENT AND MATERIALS

- Hollow Stem Auger-capable drill rig
- Augers
- Split-spoon stainless steel samplers
- Stainless steel spoons and bowls
- 55-gallon drums
- Shovel
- Wrenches
- Ratchets

PROCEDURE

Utility Clearances and Permits

Details regarding utility clearances and permits are provided in the SOP for Mobilization and Demobilization.

Borehole Drilling

Hollow Stem Auger (HSA) drilling allows for drilling and casing a borehole simultaneously, thereby eliminating cave in problems and contamination of soil samples from units above. HSA drilling can be used along with split spoon soil samplers to collect soil samples and install a borehole that will allow sufficient annular space between the bore wall and the sides of a centered monitoring well riser and screen.

Borehole advancement will be conducted using continuous five-foot flights of 4.25-inch inner diameter (ID) HSAs in two-foot intervals to allow for the collection of split spoon samples. Auger flights will be added, and this procedure will be repeated until bedrock refusal or the borehole has reached the completion depth as defined by the project. (Note: wrenches and ratchets may be used to loosen/tighten auger flights). If refusal is met prematurely, due to the presence of a boulder, landfill waste (construction rubble, metal, etc.), etc., then the hole will be offset and attempted again. The original location will be backfilled with cuttings and/or cement-bentonite grout to the surface.

Screening of the breathing air near the borehole will be conducted at regular intervals using a PID. The work area will be scanned for the presence of vapors before initiating work, during drilling and after each 4 or 5-foot interval.

Technical oversight will be provided during all drilling and well installation activities. The person providing the oversight will fully describe and record all tasks performed in the field logbook. This person will be responsible for the rig, including logging of soils, monitoring of drilling operations, recording of groundwater data, preparing the geologic soil boring logs and well construction diagrams, and recording the well installation procedures of the rig.

All quantities of drilling footage and materials used on a daily basis will be documented for reconciliation with the drilling subcontract invoices.

Split Spoon Soil Sample Collection

1. Borehole will be drilled to the desired sampling depth. A split-spoon sampler will be driven into the undisturbed soil to be sampled in accordance with ASTM D 1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils."
2. Samples will be collected continuously with a 2 foot split-barrel sampler, also referred to as a split-spoon, to characterize subsurface conditions.
3. A stainless steel 2-inch (or 3-inch if more volume is required for sample collection) split-spoon sampler, will be driven with blows from a 140-pound hammer falling 30 inches until either approximately 2 feet has been penetrated or 100 blows within a 6-inch interval have been applied.
4. The number of blows required for each 6 inches of penetration or fraction thereof will be recorded. The first 6 inches is considered to be a seating drive. For a 2-inch split-spoon sampler and a 140-lb hammer, the sum of the number of blows required for the second and third 6 inches of penetration is termed the penetration resistance. If the sampler is driven less than 2 feet, the penetration resistance is that for the last 1 foot of penetration. (If less than 1 foot is penetrated, the logs will state the number of blows and the fraction of 1 foot penetrated).
5. The sampler will be brought to the surface and both ends and one half of the split-spoon will be removed so that the recovered soil rests in the remaining half of the barrel. The split-spoon will be placed on clean poly sheeting. The sample will be screened using a PID and soil samples collected for chemical chemical/geotechnical analysis as required of the project.

Soil Classification

Soil samples will be visually classified as required of the contract. Where a classification system is not specified, soil shall be classified and described using the Unified Soil Classification System (USCS) as required in ASTM D 2488 "Standard Practice for Description and Identification of Soils".

Sub-Samples for Chemical/Geotechnical Analysis

Samples will be collected as required of the project.

The VOC sample will be collected as a grab sample from the center of the core. The remaining material will be homogenized with a stainless-steel spoon and bowl for the remaining analysis required.

Any portion of the split-spoon sample that is judged to be slough will not be included with the sample. If the sample volume is not adequate, another split spoon sample will be collected from immediately below the previous sample or from the same depth in a boring drilled immediately adjacent to the boring in which the sample failed.

Sample labels will be completed and attached to the outside of sample containers.

Chain of custody forms will be completed, and sample information will be recorded in the field logbook.

Analytical samples will be placed in coolers and cooled to 4°C for shipment to the laboratory.

Borehole Protection

Surface runoff or other fluids will not be allowed to enter any boring or well during or after drilling/construction. Likewise, fluids generated during drilling (e.g. purged groundwater) will be contained in the work area during installation of borings and not allowed to runoff onto surrounding areas. The drill rig and associated equipment will be maintained in good working order and will not be allowed to leak fluids in the work area.

Materials from Field Activities

All drill cuttings, leftover soil from sampling, and PPE will be handled in accordance with the SOP for Investigation-Derived Waste. The drilling contractor will be responsible for containerizing all drill cuttings and other waste generated by the drilling. Cuttings will be shoveled into 55-gallon drums and transported to the site staging area for storage on wooden pallets until disposal.

Borehole Abandonment

Upon completion of the boring if a permanent groundwater monitoring well is not installed and completed, the borehole will be backfilled with cuttings (unless gross contamination is encountered) and grouted with cement-bentonite grout.

Note: no grease will be used. Decontamination of the drilling equipment will be performed in accordance with the SOP for Decontamination.

All disturbance (such as ruts from equipment, tracks etc.) as a result of the investigation work will be backfilled and repaired to pre-investigation conditions.

REFERENCES

ASTM D 1586, “Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.”

ASTM D 2488 “Standard Practice for Description and Identification of Soils”.

ATTACHMENTS

None

SOP-2
STANDARD OPERATING PROCEDURE
SOIL BORING AND SUBSURFACE SAMPLE COLLECTION
(GeoProbe™)

Updated October 9, 2019

PURPOSE

This procedure describes the soil boring method and subsurface soil and groundwater sample collection techniques for GeoProbe™ operations that should be followed to ensure acceptable, consistent collection of subsurface samples for chemical and physical analysis and physical description.

APPLICABILITY

The requirements of this procedure are applicable to project activities involving soil borings, soil sample collection, groundwater sample collection, sample logging, examination, and classification.

The extent of project activities identified by this procedure is controlled at the direction of the project manager.

These are standard (i.e., typically applicable) operation procedures that may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

REFERENCES

- Project Health and Safety Plan
- Remedial Investigation Work Plan (RI Work Plan)

PROCEDURES

Site Mobilization and Set-Up

- Inspect the GeoProbe™ rig and materials to ensure they arrived on site in a clean condition and are free of oil, grease, and debris. The field manager shall inspect the rig for any significant fluid leaks. If leaking fluids are present, repair or contain them.

- Ensure that the probes, drills, and accessories are steam-cleaned prior to the start of drilling. Inspect the cleaned materials for residues such as machine oils. If residues are observed, steam-clean the equipment until such residues are removed.

- Perform decontamination procedures between probing.

- Set up the decontamination area for sampling equipment, and decontaminate any non-disposable sampling equipment prior to use.

- Use potable water for decontamination.

- If required, obtain the anticipated number of solid and liquid 55-gallon drums required to contain the soil and decontamination waste, and have drums ready for drilling activities.

Soil Probing

- Notify the Washington Utilities Coordinating Council (Call Before You Dig, 1-800-424-5555) to identify utilities prior to soil probing.
- Mobilize the GeoProbe™ to the boring location; prepare the exclusion or safety zone.
- If required, adjust the proposed probe locations in the field, based on site access, property boundaries, and/or surface obstructions.
- Review the safety level for soil probing and related activities in the site-specific health and safety plan.
- Drill soil borings as per this procedure using a GeoProbe™ rig (e.g., Model 5400).
- If concrete or asphalt is present, use the boring or drill hammer equipment, present on most GeoProbe™ rigs, to penetrate the material in order to access soil and groundwater.
- Collect continuous samples with a soil-sampling tube attached to a probe rod. (Note: Check the RI Work Plan for additional requirements or exceptions). An on-site geologist or other authorized personnel will examine and classify the soil sample.
- Standard sampling tube is in 4-foot lengths.
- Continue probing to the depth specified in the RI Work Plan.
- Decontaminate the GeoProbe™ rig between relocations to boreholes as specified in the following "Soil Sampling" section.

Soil Sampling

- To collect intact subsurface soil samples from boreholes, advance the probe at 4-foot intervals or other intervals as specified in the RI Work Plan. Drive the probe rod and sampler to a designated depth and then retract the probe rod from the hole to recover the sample tube.
- For each sample, record the following in the field logbook:
    - Date and time of collection
    - Depth of sample collection
    - Sample recovery
    - Qualitative description of the soil sample
- As specified in the RI Work Plan, collect a representative sample and place it in the appropriate sample container(s).
- Obtain the soil samples for volatile organic analyses first (use Terra Core for sampling method to be supplied by the laboratory along with appropriately preserved bottles).
- Sampling personnel shall remove outer gloves (latex) and discard them between borings to minimize the potential for sample cross-contamination.

- Decontaminate the sampling equipment between each sampling interval as described in the following “Groundwater Sampling” section.

Soil Screening Using Photo-ionization Detector (PID)

When using PID instrument for screening soils for volatile organic compounds, the following procedure is used:

- PID instruments shall be operated and calibrated to yield "total organic vapors" in parts per million. PID instruments should be operated with a 10.2 eV Version 2.0 (3/18/2003) 2 lamp source. Calibration must be checked/adjusted daily. In addition, manufacturers’ requirements for instrument calibration must be followed.
- Half-fill either a glass jar or Ziploc® baggie. When using glass jars fill jars with a total capacity of 8 oz. or 16 oz. Seal each jar with sheet of aluminum foil with the screw cap applied to secure the aluminum foil. When using Ziploc® baggies fill half fill from the probe or the excavation and close zip.
- Vigorously shake the sample jars or bags for at least 30 seconds once or twice in a 10-15 minute period to allow for headspace development.
- If ambient temperatures are below 32^0 Fahrenheit, then heat headspace within a heated vehicle or building.
- Quickly insert the PID sampling probe through the aluminum foil. If plastic bags are used, unzip the corner of the bag approximately one to two inches and insert the probe or insert the probe through the plastic.
- Record the maximum meter response (should be within the first 2-5 seconds). Erratic responses should be discounted as a result of high organic vapor concentrations or conditions of elevated headspace moisture.
- If sample jars are to be re-used in the field, jars must be cleaned according to field decontamination procedures for cleaning of bailers. In addition, headspace readings must be taken to ensure no residual organic vapors exist in the cleaned sample jars. Plastic bags should not be re-used.

Groundwater Sampling

- To collect groundwater samples using the GeoProbe™, advance the probe, equipped with a mill-slotted well rod or sealed-screen sampler, to the desired depth. Collect a groundwater grab sample by placing 1/4-inch tubing with an attached foot valve down in the well and conveying water to the surface with an up-and-down motion of the foot valve. Other alternatives for conveying water are by using a manual bailer or a peristaltic pump attached to 1/4-inch tubing. The field team manager will select the sampling device based on type of constituents being sampled and depth to groundwater. Directly pump water by mechanical action to the surface and into laboratory-supplied sample bottles. Use new tubing for each borehole, and clean and decontaminate the rods, sampler, and screen after sampling each borehole.

- For each groundwater sample, record the following in the field logbook:

    - Date and time of collection
    - Depth of sample collection

- Qualitative description of the water sample (turbidity, odor, color, etc.)

Field Duplicate Samples

If duplicate samples are specified in the RI Work Plan, collect them from the same stainless steel, tempered glass, or aluminum container as the routine field sample.

Sample Handling, Labeling and Documentation

- See SOP-3 for project documentation.

Decontamination

- Pressure wash the GeoProbe™ rig, probes, tools, bits, and samplers used during drilling to prevent cross contamination between each test boring. Inspect the rig for any residues after washing. If the equipment is not clean, repeat the cleaning procedure. If sampling sleeves are not used, the rinse the probe and any samplers with distilled water prior to use.

SOP-3
STANDARD OPERATING PROCEDURE
PROJECT CUSTODY DOCUMENTATION

Updated October 9, 2019

PURPOSE

The purpose of this procedure is to describe the requirements for completing a chain-of-custody record in order to ensure that there is an accurate and complete record of the custody and transfer of custody for samples collected that require custody documentation.

APPLICABILITY

This procedure is applicable to those project activities involving the acquisition of samples for laboratory analysis. The scope of activities identified by this procedure is limited to work conducted under the authorization of a project manager. These are standard (i.e., typically applicable) operation procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. The actual procedures used should be documented and described in an appropriate site report.

REFERENCES

- Quality Assurance Project Plan

DEFINITIONS

Chain-of-Custody Record: The Chain-of-Custody Record is a form designed to identify samples, sample location, sample type, sample analysis, samplers and to document the transfer of samples from the field to the laboratory. As such, the form is designed to summarize the contents of the shipment, the dates and time of any custody transfer, and signatures of parties relinquishing and receiving the samples.

PROCEDURES

Legal Considerations

Samples collected and personal observations made during the performance of client services may ultimately end up in a court of law as evidence. Evidence may consist simply of a person's impressions and opinions formed while at the scene. It also may consist of tangible objects. A person conveys impressions and opinions by testifying as a witness in a hearing. Tangible objects are displayed for the judge, jury, or hearing officer, who forms impressions and opinions about the objects. Tangible objects are either self-displaying (i.e., samples) or are recording (i.e., photographs, tape recordings, computer records, documents or chain-of-custody records). In addition, evidence may be facts judicially or officially noticed, such as scientific principles or geographical landmarks.

Chain-of-Custody Procedures

As in any other activity that may be used to support litigation, the sampler must be able to provide the chain of possession and custody of any samples which are offered for evidence or which form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed. The primary objective of this procedure is to create an accurate written record which can be used to trace

the possession and handling of the sample from the moment of its collection through analysis and its introduction as evidence. In addition, other information such as sample holding times from the field to the laboratory can be verified.

It is necessary to demonstrate that a sample is the same sample that was taken at the site and that it has not been changed or altered (except for the portion that has been analyzed) since the time of sampling. A written record is kept for this purpose. This record, a trail, unambiguously shows that the sample was in custody every step of the way. A sample is in someone's custody if:

- It is in a person's actual physical possession; or
- It is in a person's view, after being in a person's physical possession; or
- It is in a person's physical possession and then locked up so that no one can tamper with it; or
- It is kept in a secured area, restricted to authorized personnel only.

The custody record must be signed twice: when a sample is created and when a sample is surrendered.

Custody Transfer Record Requirements

1. A chain-of-custody form shall be initiated and completed during collection of the sample. (Refer to attached example.)
2. Possession of every sample shall be recorded from the time of collection until the analytical results are fully documented by the laboratory.
3. The field manager shall be responsible for proper completion of the chain-of-custody form.
4. A copy of the completed chain-of-custody form shall be retained by the field manager following shipment/delivery of samples to the laboratory and given to the project manager upon returning to the office or within several days of collecting the sample, whichever is sooner.

Completing the Chain-of-Custody Form

1. Use a ball point pen. Press firmly; form may have multiple pages.
2. Record the appropriate project number in the space designated for "Project No." Samples from only one site may be recorded on each chain-of-custody.
3. Record the project name in the space designated for "Project Name."
4. Record analytical laboratory name and address the samples that are being shipped for analysis in the space designated for "Lab Address."
5. Complete field sample identification code (Reference) in the block labeled "Field Sample Number". List each sample once and only once. Be especially careful when more than one bottle is required to meet analytical requirements. Distinguish the number zero from the letter O by drawing a slash through the number zero.
6. Field replicate samples are assigned unique sample identification numbers and are considered separate samples, therefore, record each field replicate sample on a separate line.

7. Record the collection date for each sample.
8. Record the number of sample containers for "No. of Containers."
9. Determine if sample is a composite or grab sample and mark appropriate box with an "X."
10. Record the preservation methods under the heading "Notes/Comments." This includes the addition of ice to coolers (e.g., 6° C).
11. List parameters on the chain-of-custody form that the samples are being analyzed for under the “Analysis Requested” section. Use a separate column for each analysis. If extra space is needed, use an asterisk and describe the analysis under the heading "Remarks/Special Instructions."
12. Use a check to designate the analyses requested for each sample. A separate check is required for each sample; do not use arrows to identify the analysis requested.

Documenting Changes and Errors Prior to Custody Transfer

1. Cross out and initial any information incorrectly entered on the chain-of-custody form, such as for samples that have not actually been collected or, will not be included in this particular shipment.
2. Cross out and initial any entries which have errors or are illegible. Legibility is very important. Rewrite correct and legible entry on a separate line.
3. Verify numbers prior to custody transfer.

Quality Review in the Field

1. Cross check the sample identification numbers on the chain-of-custody form with those on the labels of the sample containers.
2. The field manager shall conduct a detailed review of the completed chain-of-custody form.
3. Verify the legibility of the bottom page of the chain-of-custody form.

Documenting Transfer of Sample Custody

1. In the case of more than one cooler per shipment, the coolers to be prepared for shipment shall be numbered on the outside of the coolers and recorded in the field logbook. ** NOTE: Samples from only one project site shall be in each cooler.
2. The chain-of-custody form shall accompany the samples while the samples are in transit.
3. Individuals relinquishing and receiving samples shall sign, date, and indicate the time in the lower portion of the chain-of-custody form. ** NOTE: For remote field sites where complex logistics are required to ship coolers, the field manager will generally seal the chain-of-custody form into the coolers, and document the mode of cooler transportation (e.g., field staff, courier service, FedEx) in the field notes. In these cases, the chain-of-custody form is only signed again before its receipt at the laboratory if the coolers are opened (e.g., repacked with fresh ice).
4. The field manager shall maintain a copy (photocopy or scan) of the chain-of-custody form as a record of field custody transfer.

Custody Transfer in the Laboratory

1. The sample custodian shall receive the samples at the laboratory. The individual relinquishing the samples will sign and date the release, and the sample custodian shall sign the chain-of-custody form, indicating acceptance of the samples.
2. The chain-of-custody form shall accompany samples sent to subcontracting laboratories for analysis. Sample custody shall be documented by individuals relinquishing and receiving samples.
3. The original copy of the completed chain-of-custody form shall be maintained at the laboratory until submittal of analytical results, at which time the original copy, or a photocopy if other laboratories are involved, is remitted with the analytical results. A copy of the completed chain-of-custody shall be maintained by the project.

Documenting Changes after Custody Transfer

1. Errors on the chain-of-custody, discovered after custody transfer, can be corrected by contacting project manager/field manager and notifying the laboratory immediately. Any corrections to the chain-of-custody form once original field custody has been relinquished must be documented in project records: emails, phone records, and the case narrative from the lab if applicable. Corrections shall be documented with organizations with whom the data will be submitted.

QA RECORDS

- Field log books
- Field data sheets and records

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www.alsglobal.com

COC Set____of____
COC#_____

Project Name	Project Number:
Project Manager	
Company	
Address	
Phone #	email
Sampler Signature	Sampler Printed Name

CLIENT SAMPLE ID	LABID	SAMPLING Date	SAMPLING Time	Matrix	NUMBER OF CONTAINERS	7D		14D				28D							90D		180D				999D							Remarks
						160.2 / TSS	SM 2540 C / TDS	SM 2320 B / Alkalinity Titr	SM 2320 B / Bicarb Alk	SM 2320 B / Carbonate Alk	SM 4500-CN- E / CN T LL	1632 / As3	300.0 / Chloride	300.0 / F	300.0 / SO4	350.1 / Ammonia T	351.4 / TKN	353.2 / NO2 NO3 T	1631E / Hg LL D	1631E / Hg LL T	6010C / Metals D	6010C / Metals T	6020A / Metals D	6020A / Metals T	351.4/353.2 / TN Calc	SM 2340 B / Hardness Calc	1	2	3	4	5	
1.																															
2.																															
3.																															
4.																															
5.																															
6.																															
7.																															
8.																															
9.																															
10.																															

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

Invoice Information

P.O.#_____
Bill To:_____

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
___ Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____(Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature	Signature	Signature	Signature	Signature
Printed Name	Printed Name	Printed Name	Printed Name	Printed Name	Printed Name
Firm	Firm	Firm	Firm	Firm	Firm
Date/Time	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

SOP-4
STANDARD OPERATING PROCEDURE
MONITORING WELL INSTALLATION, COMPLETION & DEVELOPMENT
Updated: May 18, 2021

PURPOSE

This document provides technical guidance for the design and installation of permanent cased overburden groundwater monitoring wells. This SOP also provides a list of the materials that will be used in the design and construction of these monitoring wells.

EQUIPMENT AND MATERIAL

- Hollow Stem Auger Drill rig
- Well screens (typically 2-inch diameter Schedule 40 polyvinyl chloride (PVC) (0.010-inch slot) with flush threaded bottom caps)
- Well risers (2-inch diameter Schedule 40 PVC pipe)
- Strap wrench
- All sections of PVC screen/riser will be threaded, flush-joint design
- Spring type stainless steel well centralizers
- Portland Type I or Type II neat cement
- Certified bentonite (solvent free, sodium-bentonite pellets)
- Pre-sampled and approved water
- Certified clean silica sand for screen filter pack (10 x 20)
- Lockable expanding compression caps (watertight)
- Water Level Indicator Probe
- Weighted tape
- Well Construction Diagram
- Mechanical mixer
- Non-corrosive steel or aluminum casing
- Vented caps
- Locking caps
- Brass locks (keyed alike)
- 2-inch diameter or larger concrete-filled steel posts (bollards)
- Blaze orange paint
- Manhole covers
- Submersible Pump (i.e., Whale pump)
- 12 V battery
- Polyethylene tubing
- Surge block
- 55-gallon drums
- Horiba U-22, or equivalent
- Water level indicator
- Field logbook

PROCEDURE

All monitoring wells will be installed, completed, and developed according to requirements discussed in the following sections.

Utility Clearances and Permits

Utility clearances and permits will be obtained in accordance with the project Work Plan or Sampling and Analysis Plan.

Borehole Drilling

Overburden Borehole: drilling for the installation of monitoring wells will be completed in accordance with Hollow Stem Auger Drilling SOP-1. The borehole will be completed using a 4.25-inch inside diameter hollow stem augers which will provide sufficient diameter to permit at least two inches of annular space between the boring wall and the sides of the riser and screen.

Monitoring Well Materials Specifications and Design

Standard monitoring well materials (10-slot screen and 10 x 20 silica sand filter pack) will be used unless otherwise required for the project. All screens, casing, and fittings will be delivered to the site in factory sealed protective wrapping. In the event that the protective wrapping has been compromised, the well materials will be decontaminated at the site and wrapped in plastic sheeting until installed.

Well Riser

Well riser will consist of Schedule 40 PVC. PVC pipe will be new, threaded, flush joint, and conform to the requirements of ASTM F 480. Threaded flush-joint couplings with chemically inert O-rings, to form watertight unions, will join casing sections. A single spring type stainless steel centralizer will be attached to the riser pipe approximately mid-point of the borehole. Adhesives or solvents will not be used to join the casing sections. Teflon tape on threaded joints, if used, will be noted on the well construction log. No lead shot or lead wool will be employed in producing seals at any point in the well.

Well Screen

Well screens will consist of flush-threaded, 2-inch diameter (nominal size), Schedule 40 PVC with factory machined 0.010 inch size screen slotting (10-slot). All screens will have a flush threaded bottom cap. The screen material will be non-contaminating, non-clogging design. All screen sections will be threaded, flush joint design. Unless otherwise required by the project, the screen length will be ten feet, installed five feet into the water table, which will allow for normal, seasonal fluctuations in the water table elevation so that monitoring will be possible throughout an average year. For wells completed to bedrock, the bottom ten feet of each well will be screened. Sediment traps (sumps, tailpipe) will not be used below the screened portion in monitoring wells unless specifically called for by the project requirements. Field-slotted screen will not be used.

Filter Pack

The annular space around the well screen will be backfilled with clean, washed, well-rounded silica sand sized to perform as a filter between the formation material and the well screen. Certified clean silica sand (10 x 20) compatible with 10-slot well screen and the aquifer materials will be used in the filter pack around the well screen. The grain size of the filter pack that is used will be included on the well construction log. The filter pack material will be tremied into place to avoid bridging and ensure a continuous filter pack throughout the screened interval of the well. The filter pack will extend approximately 1 foot below, and 3 to 5 feet above the well screen. Relative depths and thicknesses will be recorded in the field logbook.

Bentonite Seal

A 3- to 5-foot-thick bentonite seal will be placed in the annular space above the well screen and filter pack sand. The seal will be composed of commercially manufactured, solvent-free, sodium-bentonite pellets. Bentonite pellets will not exceed one-half inch diameter. Where the bentonite seal is positioned above the water table, the bentonite will be installed in 1-foot lifts with each hydrated a minimum of 30 minutes between lifts before proceeding. Clean, potable water will be added to

hydrate the bentonite. After the placement of the final lift, the bentonite seal will be allowed to hydrate a minimum of an additional two hours or until HDR's field geologist is confident the seal will function as designed before grouting begins. The bentonite seal will be placed immediately after installing the filter pack. Relative depths and thicknesses will be recorded in the field logbook.

Annular Seal - Grout

Cement grout will be placed above the bentonite seal to the ground surface. The cement grout will consist of a mixture of Portland cement (ASTM C 150) and water in the proportion of not more than 7 gallons of approved water per bag of cement (94 pounds). Additionally, 3 to 5 percent by weight of sodium bentonite powder will be added.

Grout will be placed by pumping through a side discharging tremie pipe with the lower end of the tremie pipe located within 3 feet of the top of the bentonite seal. Pumping will continue until undiluted grout flows from the boring at the ground surface. The annular seal will be placed within 48 hours, but no sooner than two hours after the final lift of the bentonite seal installation. Prior to surface completion, the grout annular seal will be filled to design elevation.

Monitoring Well Completion

Each monitoring well installed will be completed in accordance with the following procedure:

1. A fitting cap will be installed to prevent material from entering the well.

2. Stick-up Well Completion – the well riser will be surrounded by a larger diameter protective non-corrosive steel or aluminum casing rising 2 to 3 feet above ground level and set an equal distance below the ground surface into the cement grout backfill. The casing will be installed in a manner that does not hinder access to the monitoring well for purposes of cap removal, sample collection or water level measurements. The north side of the casing will be notched as a reference point for horizontal and vertical control and for groundwater measurements. The outside protective casing will be painted blaze orange.

3. The protective casing will be provided with a locking cap and lock. The cap will be designed to prevent water from entering the protective casing. All locks will be brass and keyed alike.

4. A concrete (cement, aggregate and water) pad, 2 feet by 2 feet by 4 inches thick (minimum), sloped away from the well will be constructed around the well casing with the top outer edge at the final ground level elevation.

5. A weep hole of 1/8 inch diameter will be drilled into the outer protective casing within three inches above the pad to permit drainage of fluids that may accumulate.

6. Flush-Mount Well Completion – a flush mounted manhole protective casing will be installed over the PVC well casing. The north side of the casing will be notched as a reference point for horizontal and vertical control and for groundwater measurements. The collar of the manhole will be filled with sand as a weep for accumulated rainwater. The manhole will be set in a concrete pad as described in step 5 above and the pad will be sloped from the center to direct drainage away from the well.

Monitoring Well Development

Each monitoring well will be developed within one week but not less than 48 hours after completion in accordance with the following procedure:

1. Development will a) assure that groundwater enters the well screen freely, thus yielding a representative groundwater sample and an accurate water level measurement b) remove 3 to 5 times the well volume and volume introduced or lost during drilling and well installation, c) remove very fine-grained sediment in the filter pack and nearby formation so that groundwater samples are not highly turbid and so that silting of the well does not occur.

2. Development will consist of alternating cycles of mechanical surging and pumping or bailing until little or no sediment enters the well.

3. Well development will continue for a minimum of 2 hours. Sediment that enters the well during this time will be removed. At the end of this time, the well will be continuously pumped using an electric submersible pump (i.e., Whale pump).

4. Temperature, pH, specific conductivity, and turbidity will be monitored during pumping (one reading per well volume). Pumping will continue until these parameters have stabilized (10 percent change for the other parameters between four consecutive readings) and the water is clear and free of fines. If the parameters do not stabilize after 4 hours of continuous pumping, then the Project Manager should be contacted for further instruction based on the project requirements.

5. If the addition of water is required to facilitate surging and pumping/bailing, only formation water from the well shall be used. If this is not practical due to tightness of the formation then only bailing will be done.

6. In all cases, the utmost care will be taken to not collapse well screens during development activities and at least 3 times the water introduced or lost during drilling shall be removed from each well.

7. The entire well cap and interior of the well casing above the water table will be washed using water from the well. This will be conducted during development, not after development is complete. Washing will not be performed if free phase contamination is present.

8. Well Development records shall be recorded in the field logbook and include the following information:

    a. Name of project and site, well ID number and date

    b. Date, time, and elevation of static water level and bottom of the well before development

    c. Method used for development including equipment size, type and make of bailer or pump used

    d. Time spent developing the well by each method, to include pumping rate used

    e. Volume and physical character of the water removed, to include changed during development in clarity, color, particulates and odor

    f. Volume of source water added to the well

g. Volume and physical character of sediment removed form the well

h. Clarity of water before, during and after development

i. Total depth of well and static water level measurement immediately after and no later than the following day after development

j. Field parameter measurements recorded before, during and after development

9. Development water will be containerized in 55 gallon drums and handled in accordance with the IDW SOP.

REFERENCES

"Standard Specification for Portland Cement," ASTM C 150

"Handbook of Suggested Practices for the Design and Installation of Ground Water Monitoring Wells", EPA 600/4-89/034, 1989

"Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites", USACE EM1110-1-4000 (Nov. 98)

"Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in standard Dimension Ratios", ASTM F 480

ATTACHMENTS

None

SOP-5
STANDARD OPERATING PROCEDURE
SAMPLING MONITORING WELLS

Updated: October 9, 2019

SAMPLING

- **Measurement of static water level elevation** – Using a water level sounder, whose tip has been rinsed with distilled water, the depth to water below the top of casing or other permanent reference point on the well will be measured and recorded in the field logbook or field sheets. Measurements will be taken to the nearest one-hundredth of a foot. Water level measurements will be made prior to any sampling to reduce the amount of time between measurements.

- **Well purging –** Prior to obtaining water samples, the wells will be purged by pumping until there is less than a 10 percent variance in parameter measurements (pH, specific conductance, and temperature) after three consecutive readings or a minimum of three static casing volumes have been removed, or until the well is dry. Well purging will be done using permanently installed submersible pumps, by using a disposable hand bailer and disposable rope in wells that have low recharge, or by using a peristaltic pump with new disposable tubing. The installed pumps use stainless steel construction. The discharge pipe will be threaded PVC pipe and submersible cable will have a plastic covering. The well head is completed using standard well seal with the discharge pipe fitted with a valve. The peristaltic pump will use new, disposable polyethylene and silicone tubing at each well that will be disposed of after use. For wells where the pump can no longer provide sufficient volume, the well pump will be pulled and the well will be purged and sampled using a disposable bailer. Purge water will be containerized. Laboratory analysis will be used to determine the appropriate method of disposal.

  For wells that are purged dry, the well will be allowed to recharge to 18 to 24 hours. A sample will then be collected after this waiting period. If there is insufficient sample after 24 hours, the well will be considered dry.

- **Sample withdrawal –** Samples will be collected from the discharge line of the pump at the wells or using a disposable bailer. Purge rates will not exceed 0.25 gallons per minute. Well will be sampled immediately after purging if adequate volume is available. If there is not sufficient volume, sampling will occur as soon as the well has recovered sufficient volume but generally within 24-hours.

- **VOC-Sampling** – For the sampling and handling of volatile organic compounds (VOCs), the following procedures are followed to minimize the loss of VOC:

  - Fill the vials, with no aeration, to just overflowing such that the water surface forms a meniscus. The filling rate should, ideally, not exceed 100 milliliters per minute. Care must be taken not to rinse out any HCl preservative in the vial.

  - Place the cap directly over the top of the vial with the Teflon® side of the septum toward the sample.

- Screw the cap on firmly but not so tightly that the septum bulges out.
- Invert the vial and tap lightly and observe the presence of any trapped air bubbles.
- Any air bubbles that are present must be eliminated from the sample container. Consideration should be given to discarding and refilling the sample container to eliminate air bubbles (using a new container for samples requiring HCL). In cold weather, actions should be taken to prevent the VOC vials from freezing.

- **In-situ or field analyses** – Field measurements of pH, specific conductance, and temperature will be collected between the removal of each casing volume. Standard operating procedures for these measurements are presented below.

- **Decontamination** – The only equipment requiring decontamination between wells is the depth sounder and applicable field parameter equipment. The sounder, pH electroprobe, temperature probe, and conductivity probe will be decontaminated with a generous rinse of distilled water. None of these instruments are to come into direct contact with water samples that are submitted to the laboratory for analysis.

SAMPLE PRESERVATION AND HANDLING

1. **Sample containers -** Samples for field measurement of pH, temperature, and specific conductance will be collected in a disposable plastic cup or the instrument sample chamber, or through the use of continuous flow measuring equipment. Samples for analysis will be collected in laboratory-supplied glass or plastic bottles fitted with Teflon-lined screened caps (see Remedial Investigation Work Plan (RI Work Plan) for list of parameters).

2. **Sample preservation and holding times –** All samples will be iced or refrigerated at less than 4 degrees Celsius from the time of sampling until the analysis is complete, and maintained at these conditions away from light. All samples will be transported in ice chests with ice packs or fresh, wet ice. See QAPP for list of holding times and preservative requirements by analytical method. The laboratory provides proper sample bottles and preservatives.

CHAIN-OF-CUSTODY PROCEDURES

- See SOP-3 for project documentation.

ANALYTICAL PROCEDURES

Laboratory analyses will be performed by a laboratory that complies with U.S. Environmental Protection Agency (EPA) methods using appropriate quality assurance/quality control (QA/QC) measures. All samples will be analyzed for the constituents in listed in the RI Work Plan and consistent with the project QAPP. Samples will be analyzed within holding times specified for each method.

FIELD AND LABORATORY QUALITY ASSURANCE/QUALITY CONTROL MEASURES

1. **Field QA/QC** – A duplicate sample will be submitted with each round of groundwater samples. See QAPP for criteria for comparing duplicate sample with parent sample.

2. **Laboratory QA/QC** – Standards, laboratory blanks, duplicates, and spiked samples will be analyzed as stated for each method. Data from analyses of standards blanks, and duplicates and spiked samples will be submitted with groundwater sample results (see QAPP).

FIELD MEASUREMENT OF pH, CONDUCTIVITY, AND TEMPERATURE

Field measurements of pH, conductivity, and temperature will be collected during well purging. Field parameters and other relevant information will be recorded in a notebook or sample sheets.

Determination of pH, specific conductance, and temperature will be made in an aliquot contained in a disposable plastic cup or the instrument sample chamber, or through the use of continuous flow measuring equipment. Meters will be calibrated prior to well purging in accordance with specifications of the *Operations and Maintenance Manual*.

SOP-6
STANDARD OPERATING PROCEDURE
SOIL VAPOR SCREENING AND SAMPLING

Updated: May 18, 2021

PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe procedures for soil gas sampling. Any variation from this SOP must be approved by the Project Manager prior to implementation and a description of the variance will be documented in the field logbook.

EQUIPMENT AND MATERIALS

The following materials will be used for sediment sample collection and processing:

- Hand auger or Macro Core
- DPT rig, if not being done by hand
- Soil vapor probe
- Temperature and pressure gauge
- Inert sample tubing
- Glass beads or clean coarse gravel
- Bentonite slurry
- Clean backfill/sand
- Summa canister and regulator
- Tracer gas (i.e., helium)
- Field Log book

PROCEDURE

Soil Gas Surveys

1. Record ambient air temperature and barometric pressure.

2. Advance soil boring using an appropriate method such as a direct-push technology (DPT) rig (or equivalent), manually driven auger, or soil corer to the required soil gas sample depth. Soil gas samples will be collected from a depth of approximately 12 feet bgs. The depth may be modified based upon the soil conditions and the depth to groundwater at the sample location.

3. Install a soil vapor probe/implant attached to inert tubing such as Teflon®, polyethylene, stainless steel, or nylon (specific tubing material may be required by different agencies). A porous inert material such as glass beads or clean coarse gravel should be used to create a sampling zone (1-2 ft) in the area of the vapor probe at the bottom of the boring.

4. The soil vapor probe should be sealed above the sample zone with a bentonite slurry for a minimum distance of 3 ft if possible to prevent outdoor air infiltration. The remainder of the borehole can be filled with clean backfill material.

5. The soil vapor probe will be purged 1-3 volumes (probe and tubing volume) with a low flow sampling pump (less than 0.2 liters per minute) and then the tubing will be securely attached to

a Summa® canister outfitted with a regulator set to an appropriate flow rate for the required sample interval (e.g., 20-minute, 4-hr, or 8-hr sample interval).

6. After the tubing is attached to the regulator inlet the valve on the Summa® canister will be opened to begin the sample collection. The Summa® canister and regulator serial numbers will be recorded for each sample location.

7. The starting pressure will be recorded. The technician will check regulator vacuum during sample collection period to ensure sample flow rate is set correctly. Technician will stop sample run and close Summa® canister valve before the canister is at ambient pressure (there should be a small vacuum remaining in the canister when it is shut down).

8. Sample will be analyzed by a contract laboratory using an appropriate analytical method (e.g. EPA Method TO-15 for VOCs).

9. If necessary, a tracer gas (e.g. butane or helium) will be introduced to flood the area above where the soil gas tubing exits the ground. The sample will be checked for the tracer gas with a portable meter prior to the start of the sample collection with the Summa® canister or by the analytical laboratory as part of the Summa® canister analysis to determine if there is any outdoor air infiltration.

Materials from Field Activities

All materials generated during field activities that are segregated as potentially contaminated will be handled in accordance with Investigation-Derived Waste SOPs. Excess sediment collected for sampling, will be released at the sample source.

REFERENCES

None

ATTACHMENTS

None

SOP-7
STANDARD OPERATING PROCEDURE
SURFACE SOIL SAMPLING

Updated: May 18, 2021

PURPOSE

This procedure describes techniques for collecting surface soil samples. Surface soil samples are herein defined as soil samples collected from the ground surface to a depth of 24 inches below the ground surface. Samples for VOC analysis should be collected from the 6- to 12-inch interval, while samples for other parameters cay be collected from any depth throughout the upper 24 inches of soil. Any variation from this SOP must be approved by the Project Manager prior to implementation and a description of the variance will be documented in the field logbook.

EQUIPMENT AND MATERIALS

- Stainless steel trowels or spoons (decontaminated and foil wrapped)
- Stainless steel bowls (decontaminated and foil wrapped)
- Encore Samplers
- Clean polyethylene sheeting
- Photo Ionization Detector (PID)
- Decontamination supplies
- Logbook
- Sample containers
- Sample tags or labels and chain-of-custody forms
- Procedure

Sample Collection

The number and location of samples to be collected will be described in the project work plan and QAPP.

The VOC sub-sample will be collected as a grab sample from the 6- to 12-inch interval and/or soil that exhibits signs of VOC contamination as indicated by PID screening or odor. This sample will be collected directly from the sample location, using an EnCore sampler in accordance with the SOP for EnCore sampling.

The remaining material from the 0 to 24-inch interval will be homogenized for analysis of the remaining parameters required. Soil samples will be homogenized using the quartering technique to achieve sample consistency.

1. Collect a sufficient volume of soil for all of the required analytical parameters with a decontaminated stainless steel trowel or spoon and place in a stainless steel bowl

2. Remove twigs, leaves, roots, rocks gravel size or greater and other miscellaneous debris.

3. Split the sample into four equal quarters and individually homogenize each quarter.

4. Combine the quarters into halves and homogenize each half individually

5. Combine the halves together and homogenize the entire sample volume

6. The process should result in a consistent physical appearance. If it does not, repeat the process an additional one to two times to achieve a consistent sample.

7. Transfer the required volume to the appropriate sample containers and seal.

Complete sample labels and attach to the outside of containers and place in an iced cooler as soon as practical.

Complete chain-of-custody forms and record sample information in the field logbook.

Analytical sub-samples will be kept at a 4°C for shipment to the laboratory.

Soil Classification

Soil samples will be visually classified and described in accordance with the classification system required by the contract. If not specified, field staff shall use the Unified Soil Classification System (USCS) as required in ASTM D 2488 “Standard Practice for Description and Identification of Soils”.

Materials from Field Activities

PPE and other investigation derived waste material will be handled in accordance with the SOP for Investigation-Derived Waste.

REFERENCES

None

ATTACHMENTS

None