Work Plan

Marshall Landfill Groundwater Monitoring

Mashall Landfill
Spokane County, Washington

for
Washington State Department of Ecology

November 17, 2023

GeoEngineers
Earth Science + Technology

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File No. 0504-104-01

November 17, 2023

Prepared for:

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APPENDICES

1.0 INTRODUCTION

This Work Plan describes the procedures to conduct groundwater monitoring activities at the Marshall Landfill facility (herein referred to as "Site") located in Spokane County, Washington as shown in Vicinity Map, Figure 1.

This Work Plan has been prepared by GeoEngineers, Inc. (GeoEngineers) for the Washington State Department of Ecology (Ecology) under Herrera Environmental Consultants, Inc. (Herrera) Client Contract No. C2200149, Amendment 2. The purpose of this sampling is to assess the current groundwater conditions including analyzing groundwater samples for analytes that have previously not been evaluated including per- and polyfluoroalkyl substances (PFAS). The groundwater data generated will be used to inform the remediation design that is currently in process for the Site.

A sampling plan, with a description of field assessment procedures is provided in Appendix A, Field Assessment Procedures; the Quality Assurance Project Plan (QAPP) and the Health and Safety Plan (HASP) are presented in Appendix B and C, respectively. The Work Plan is organized as follows:

- Site Description and Background – Section 2.0
- Field Investigation Activities – Section 3.0
- Schedule – Section 4.0
- References – Section 5.0

2.0 SITE DESCRIPTION AND BACKGROUND

The Marshall Landfill Site is located northwest of Cheney-Spokane Road about 1 mile southwest of the town of Marshall, Washington and 7 miles southwest of Spokane, Washington. The Site is bounded to the north by a gravel pit and privately-owned vacant land, the east by South Cheney-Spokane Road, to the south by a landfill property owned by Spokane County, and to the west by privately-owned vacant land. The Site layout and the locations of groundwater monitoring wells are presented in Site Plan, Figure 2.

The Site consists of two primary historic land use areas: the approximate 25-acre Main Landfill and the Five-Acre Landfill. The landfills are capped with gravel and silt and are generally vegetated. The Site is generally flat to the west and steeply sloped to the east. The Site is described in detail in GeoEngineers' Remedial Investigation (RI) and Feasibility Study (FS) reports (GeoEngineers 2018A and 2018, respectively). Site features are summarized below:

- <u>The Main Landfill:</u> This approximate 25-acre waste disposal area is located within the south-central portion of the site. Sand and gravel removed from the Main Landfill were replaced with waste during the period from 1970 through 1990. The landfilled waste thickness was estimated at 100 feet in the Main Landfill (Fetrow 1991).
- <u>The Five-Acre Landfill:</u> This approximate 5-acre waste disposal area is located within the northwest portion of the site. Waste was disposed within the Five-Acre Landfill during the period from 1980 through 1984. The landfilled waste thickness was estimated at 45 feet in the Five-Acre Landfill (Fetrow 1991).

GeoEngineers identified three hydrostratigraphic units in the RI including:

- The basement rock unit underlying the north portion of the Main Landfill, most of the Five-Acre Landfill, and the central portion of the gravel pit;
- The Columbia River Basalt Group (CRBG) unit underlying the north portions of the Five-Acre Landfill and gravel pit; and
- The glaciofluvial sediments unit underlying the Former Spokane County Landfill, most of the Main Landfill, and the southeast corner of the gravel pit.

Groundwater flow is generally to the east in the basement rock unit and to the northeast in the glaciofluvial sediments and CRBG units. The hydrostratigraphic units are described in detail in the RI (GeoEngineers 2018).

Based on RI/FS results and supplemental groundwater monitoring events conducted by Ecology, groundwater contamination is limited, discontinuous, and variable between monitoring events. Given the limited and sporadic nature of groundwater contamination, there does not appear to be a significant impact to groundwater beneath the Site. However, because the Site contains landfilled waste, further groundwater monitoring in accordance with State regulations has been requested by Ecology to ensure that there are no unacceptable threats to human life and the environment.

There are currently 20 monitoring wells at the Site. Ecology identified 17 of the monitoring wells to be monitored for depth to water readings and potential redevelopment for PFAS sampling as shown in Figure 2. The table below identifies each of the 17 monitoring wells identified by Ecology and describes their positions relative to the Site.

Groundwater Monitoring Well Name	Well Depth (feet below top of casing)	Relative Position to Site
MW-1A	210	Five Acre Landfill (west)
MW-2	83	Downgradient
MW-2A	108	Downgradient
MW-3	118	Downgradient
MW-4A	80	Upgradient
MW-5A	122	Downgradient
MW-7B	299	Main Landfill (north)
MW-7D	298	Main Landfill (north)
MW-8A	122	Downgradient
MW-8B	94	Downgradient
MW-9A	72	Upgradient
MW-11A	243	Upgradient
MW-12A	135	Five-Acre Landfill (east)
MW-14	255	Main Landfill (west)
MW-15	179	Main Landfill (east)
MW-15A	205	Main Landfill (east)
MW-16	89	Spokane County Landfill (east)

3.0 FIELD INVESTIGATION ACTIVITIES

In April 2023, Ecology sent a Request for Quotation (RFQ) to conduct additional groundwater monitoring at the Site to evaluate current groundwater conditions at the Site and assess for potential contaminants that were not previously tested, including PFAS compounds. To evaluate groundwater conditions, GeoEngineers plans to redevelop five monitoring wells, install new, dedicated, PFAS-free low-flow bladder pumps in the wells, and conduct quarterly groundwater monitoring activities and submit groundwater samples for chemical analysis for four consecutive quarters.

The tasks described below reflect the proposed field activities. The specific tasks conducted at the site may change in response to conditions encountered in the field or as additional information is obtained. Adjustments to the tasks listed will be mutually agreed upon by Herrera, Ecology and GeoEngineers and authorized prior to implementation.

3.1. Field Work

This task will include redevelopment and replacement of the existing dedicated sampling equipment with dedicated PFAS-free sampling equipment and four quarterly groundwater sampling events for five monitoring wells:

- MW-2A was selected because it is located downgradient from the Site.
- MW-5A was selected because it is located downgradient from the Main Landfill and previous groundwater monitoring results indicated one or more contaminants of concern (COCs) were present at concentrations greater than the Washington State Model Toxics Control Act (MTCA) Method A cleanup levels.
- MW-7B was selected because it is near the Main Landfill and previous groundwater monitoring results indicated one or more COCs were present at concentrations greater than the MTCA Method A cleanup levels.
- MW-11A was selected because it is upgradient from the Site.
- MW-12A was selected because it is near the 5-Acre Landfill and previous groundwater monitoring results indicated one or more COCs were present at concentrations greater than the MTCA Method A cleanup levels.

Specific tasks are described below:

- Mobilize to/from the Site from Spokane, Washington to conduct one redevelopment event and four groundwater monitoring events.
- Remove existing pumps from MW-2A, MW-5A, MW-7B, MW-11A and MW-12A and redevelop by surging and pumping the monitoring wells. A minimum of five well volumes or a maximum of 90 gallons will be removed from each of the five monitoring wells. Monitoring wells will be redeveloped following the procedures described in Appendix A.
- Install new, dedicated, PFAS-free low-flow bladder pumps in MW-2A, MW-5A, MW-7B, MW-11A and MW-12A following the procedures described in Appendix A.
    - Collect an equipment blank (EB) from one dedicated bladder pump prior to installation following the procedures described in Appendix A.

- Measure depth to groundwater in the 17 existing groundwater monitoring wells during each groundwater sampling event using a water level indicator (WLI). The total depths of MW-2A, MW-5A, MW-7B, MW-11A and MW-12A will be measured before and after redeveloping the wells. The total depths of the remaining 12 groundwater monitoring wells will be measured during the first quarterly groundwater sampling event. Depths to groundwater and total monitoring well depths will be measured relative to the well casing rims' north side following the procedures described in Appendix A.
- Collect groundwater samples from MW-2A, MW-5A, MW-7B, MW-11A and MW-12A on a quarterly basis using low-flow well purging techniques and dedicated bladder pumps following the procedures described in Appendix A. In general, the following tasks will be completed during each sampling event:
    - Document the conditions of the monitoring wells.
    - Measure and record water quality parameters, including pH, specific conductivity, oxidation-reduction potential (ORP), dissolved oxygen (DO), turbidity and temperature, until stabilization has been achieved or a maximum purge time of 30-minutes has been reached.
    - Collect groundwater samples following stabilization or the maximum purge time.
- Submit one groundwater sample from each monitoring well and one duplicate groundwater sample per sampling event (six groundwater samples total per event) to Eurofins Environment Testing Northwest (Eurofins) in Spokane Valley, Washington for chemical analysis on a standard turnaround time (TAT).
- Submit groundwater samples for chemical analysis of following potential analytes:
    - Alkalinity and bicarbonate using Standard Method (SM) 2320B;
    - Total and dissolved arsenic, cadmium, iron, manganese, lead and zinc using Environmental Protection Agency (EPA) Method 6020B;
    - Total and dissolved (field-filtered) mercury using EPA Method 7470A;
    - Total potassium, magnesium and sodium using EPA Method 6010D;
    - Dissolved calcium and magnesium using EPA Method 6010D;
    - Chloride, sulfate, nitrate, & nitrite using EPA Method 300.0;
    - Ammonia as nitrogen using EPA Method 350.1;
    - Total organic carbon (TOC) using SM 5310B;
    - Total dissolved solids (TDS) using SM 2540C;
    - Cyanide (weak acid dissociable) using SM 4500_CN_I_NP;
    - Volatile organic compounds (VOCs) using EPA Method 8260D;
    - Semivolatile organic compounds (SVOCs) using EPA Method 8270E;
    - Herbicides using EPA Method 8151A; and
    - PFAS using EPA Method 1633 (Draft-3).
    - The number of sample analytes may be reduced in some or all of the wells in the second and following sampling events, depending on the results from the first sampling event. Modification to the number of sample analytes will be mutually agreed upon by Herrera, Ecology and GeoEngineers prior to implementation.
- Submit the EB collected from a dedicated bladder pump to Eurofins for chemical analysis of PFAS using EPA Method 1633 (Draft-3).

- Drum and label investigation-derived waste (IDW) produced from redevelopment and groundwater sampling activities. Solid waste including disposable gloves, tubing, etc., will be placed into a garbage bag and disposed in a trash receptacle off site. Analytical data from groundwater monitoring will be used to characterize the IDW. A qualified contractor will be retained to profile and transport the IDW for disposal at a permitted facility. Two separate IDW disposal events will be scheduled:
  - 4th Quarter 2023 to remove the water generated redeveloping the five monitoring wells selected for sampling and purge water from the 4th Quarter 2023 groundwater sampling event. These will be removed before freezing conditions cause bulging and potential bursting of the drums; and
  - 3rd Quarter 2024 after the fourth and final groundwater sampling event to remove the drums of purge water.

3.2. Reporting

GeoEngineers will prepare quarterly groundwater monitoring reports following each groundwater monitoring event, after receiving the analytical data from the laboratory. Specific tasks are described below:

- Redevelopment and equipment replacement activities will be summarized in the 4th Quarter 2023 groundwater monitoring report.
- Compare groundwater chemical analytical results to the cleanup/screening levels identified in the QAPP.
- Prepare a groundwater monitoring report that provides:
  - Changes observed to the monitoring well network;
  - Groundwater measurements, elevations, potentiometric surface maps, hydraulic gradient calculations, and other field data;
  - Laboratory analytical data and data validation results;
  - Comparison of analytical results to cleanup/screening and observed trends;
  - Field notes; and
  - Potential future recommendations, including potential updates to the sample analyte list, if any.
- The report will include supporting data in the form of tables, figures, and appendices.
- Enter laboratory analytical data results into Ecology's Environmental Information Management (EIM) database.

4.0 SCHEDULE

Redevelopment, installation of pumps and the first groundwater monitoring event will occur during the 4th Quarter of 2023. Subsequent quarterly groundwater monitoring events will occur in the 1st, 2nd and 3rd Quarters of 2024.

Draft quarterly groundwater monitoring reports will be provided to Ecology for review and comment within about 4 weeks after receiving the chemical analytical data each quarter. Agreed-upon revisions will be incorporated into a finalized report and submitted to Ecology each quarter.

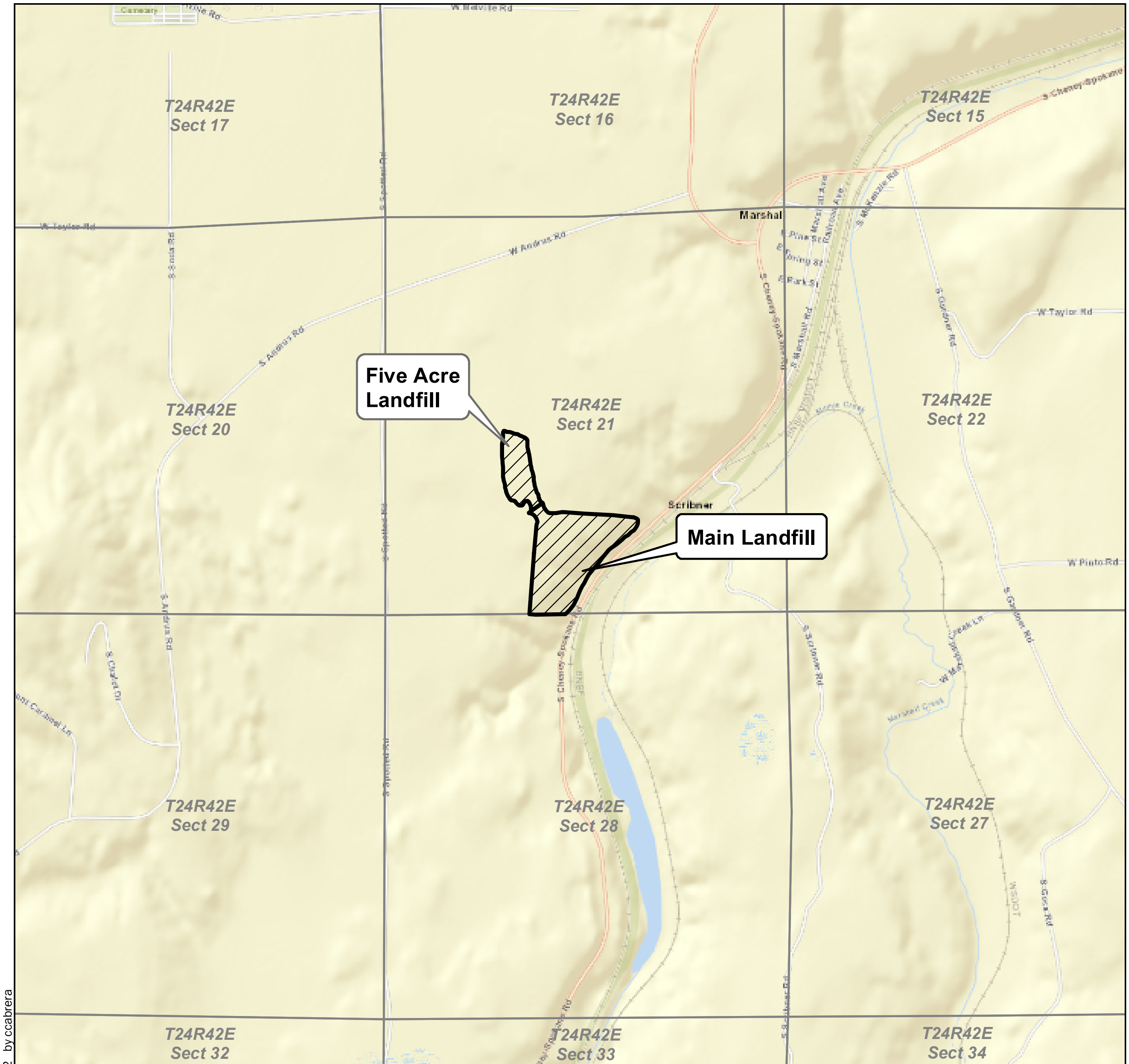
5.0 REFERENCES

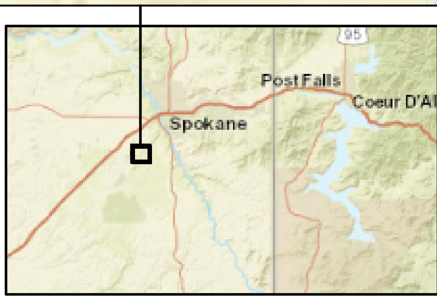
Fetrow, Inc. 1991. Marshall Landfill Site Characterization Study Final Report (Volume 1 and 2). Prepared for Marshall Landfill, Inc.

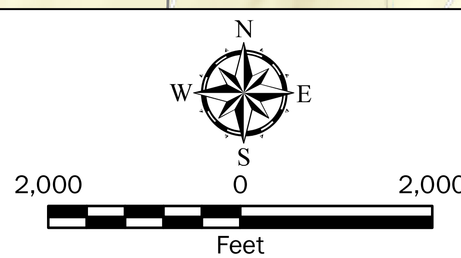
GeoEngineers, Inc. 2018. Feasibility Study, Marshall Landfill Site, Spokane County, Washington. Prepared by GeoEngineers, Inc. of Spokane, Wash. for the Washington State Department of Ecology, Spokane, Washington, May 22.

GeoEngineers, Inc. 2018A. Remedial Investigation, Marshall Landfill Site, Spokane County, Washington. Prepared by GeoEngineers, Inc. of Spokane, Wash. for the Washington State Department of Ecology, Spokane, Washington, May 31.

FIGURES







Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 11N

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Vicinity Map

Marshall Landfill
Spokane County, Washington

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Figure 1

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Legend

MW-7D — Monitoring Wells Selected for Redevelopment and Quarterly Groundwater Monitoring

MW-1A — Monitoring Well Designation and Approximate Location

Approximate Landfill Boundaries[3]

Approximate Limits of Adjacent Landfill or Mining Land Use[3]

Approximate Direction of Groundwater Flow

N W E S

400 0 400

Feet

Data Source: Aerial from ESRI Data Online. Water features from PNW Hydrography.

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Boundaries of landfill and mining land use were adapted from Fetrow Engineering (1991) based on Remedial Investigation explorations and aerial photography. The Former Spokane County landfill boundaries have not been modified from Fetrow Engineering (1991).

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Site Plan

Marshall Landfill
Spokane County, Washington

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Figure 2

APPENDICES

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APPENDIX A
Field Assessment Procedures

APPENDIX A
FIELD ASSESSMENT PROCEDURES

1.0 STANDARD PROCEDURES

This section contains standard procedures for field data collection that are anticipated during groundwater monitoring activities at the Marshall Landfill Site in Spokane County, Washington including the following:

- Per- and polyfluoroalkyl substance (PFAS) sampling procedures;
- Measurement of groundwater elevations and total well depths;
- Monitoring well redevelopment;
- Equipment blank (EB) sample collection;
- Dedicated pump replacement;
- Groundwater sampling;
- Decontamination procedures;
- Field blank preparation procedure;
- Handling of investigation-derived waste (IDW);
- Sample handling and custody requirements;
- Field measurement and observation documentation; and
- Sample identification.

1.1. PFAS Sampling Procedures

Additional care should be taken to minimize cross-contamination when handling equipment designated for PFAS sampling and when collecting samples to be analyzed for PFAS (Ecology 2023). In general, the following steps should be taken to reduce risk of cross-contamination:

- Do not use items containing PFAS during sampling;
- Use new, clean nitrile gloves to collect each sample;
- Use lab-certified PFAS-free water to decontaminate sampling equipment;
- Collect an equipment blank from equipment that may directly contact groundwater to be sampled for PFAS.

The table below describes prohibited items that may be encountered during groundwater sampling and acceptable alternatives. A complete list of prohibited items can be found in the Michigan Department of Environmental Quality (MDEQ) *General PFAS Sampling Guidance, Revised October 16, 2018*.

Prohibited Items	Acceptable Alternatives
Field Equipment	
Teflon-containing or LDPE materials	HDPE or silicone materials
Waterproof field books, plastic clipboards or binders	Loose paper (non-waterproof) on aluminum or Masonite clipboards
Field Clothing and PPE	
New cotton clothing; synthetic water resistant, waterproof clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of natural fibers (preferably cotton)
Boots (e.g., steel-toe or waders) containing Gore-Tex™	Boots made with polyurethane or PVC with no waterproof coating
Cosmetics, shampoo, conditioner, moisturizers, hand cream, waxed dental floss, or other personal care products used on the day of sampling	Use bar soap not containing moisturizers and rinse well on the day of sampling (including for hand washing). Use any other required products the night before (rather than the day of) sampling
No sunscreens or insect repellants except approved 100%	Acceptable sunscreens: “free” or “natural” sunscreens
Sample Containers	
LDPE or glass containers	HDPE containers (or polypropylene if required)
Teflon-lined caps	Unlined HDPE (or polypropylene if required) caps
Equipment Decontamination	
Decon 90	Alconox, Liquinox and/or Citranox
Food Packaging	
Do not handle, consume, or otherwise interact with pre-wrapped foods or snacks, carry-out food, fast food or other food items in the sampling area.	Remove PPE, wash hands and leave the sampling area prior to consuming foods. Wash hands after food consumption before donning new PPE.

1.2. Measurement of Groundwater Elevations and Well Depths

Depths to groundwater relative to the monitoring well casing rims will be measured using an electronic water level indicator (WLI). Depths to water will be measured to the nearest 0.01 foot. Groundwater elevations will be calculated by subtracting the water table depth from the surveyed casing rim elevations.

During the 4th Quarter 2023 well redevelopment, pump replacement and groundwater sampling event, the total depth of each well will be measured using a WLI. Total well depths will be measured to the nearest 0.01 foot.

The electronic water level indicator and any portion of the water level tape that was used in the wells will be decontaminated before obtaining depth to water and total well depth measurements at each well following the decontamination procedures described in Section 1.7 below.

1.3. Monitoring Well Redevelopment

Five monitoring wells (MW-2A, MW-5A, MW-7B, MW-11A and MW-12A) will be redeveloped to prepare for the installation of PFAS-free pumps and tubing. Depth to water and total depth in the monitoring well will be measured and recorded before and after redevelopment of each monitoring well. The monitoring wells will be developed by pumping, surging and bailing using PFAS-free equipment or a combination of these methods. Redevelopment of each well will continue until a minimum of five well volumes or a maximum of 90 gallons is removed. The removal rate and amount of groundwater removed will be recorded during well development procedures. Water generated during development will be drummed, labeled, and stored in a safe location on site until chemical analytical results are obtained. After redevelopment, wells will be allowed to equilibrate a minimum of 72 hours prior to sampling.

1.4. Equipment Blank Sample Collection

Prior to installing the new dedicated, PFAS-free bladder pumps, one EB will be collected from one pump (selected at random) and a section of tubing. PFAS-free water will be poured through the pump and tubing and collected in a laboratory-prepared sample container. The EB will be transported to the lab following procedures described in Section 1.6 below and analyzed for PFAS.

1.5. Dedicated Pump Replacement

New, PFAS-free pumps will be installed in MW-2A, MW-5A, MW-7B, MW-11A and MW-12A following redevelopment activities. A steel cable and PFAS-free tubing will be attached to each pump and the pumps will be lowered into the wells. The intake for each pump will be placed at the midpoint of the submerged portion of the well screen. The cable and tubing will be secured to the top of the well casing using a PFAS-free slip-fit well cap.

1.6. Groundwater Sampling

Groundwater samples will be collected from MW-2A, MW-5A, MW-7B, MW-11A and MW-12A and analyzed as described below. Depth to groundwater relative to the top of the polyvinyl chloride (PVC) well casing will be measured to the nearest 0.01 foot using an electronic water level indicator and recorded in the field notes. The WLI will be decontaminated prior to use in each monitoring well.

Following depth to groundwater measurement, a groundwater sample will be collected from the monitoring well consistent with the EPA's low-flow groundwater sampling procedure, as described in EPA (2017) and Puls and Barcelona (1996). A dedicated low-flow bladder pump will be used for groundwater purging and sampling. During purging activities, water quality parameters, including pH, temperature, conductivity, DO, ORP and turbidity, will be measured using a multi-parameter meter equipped with a flow-through cell. Each monitoring well will be purged until parameters stabilize, or for a maximum of 30 minutes, whichever occurs first, before collecting the sample. Stability is defined as the following:

- pH: +/- 0.1 pH units
- Conductivity: +/- 3 percent milliSiemens per centimeter (mS/cm)
- ORP: +/- 10 millivolts (mV)
- Turbidity: less than 10 NTUs or +/- 10 percent NTUs (when turbidity is greater than 10 NTUs)
- DO: +/- 0.3 milligrams per Liter (mg/L)
- Temperature: +/- 3 percent degrees Celsius

Field water quality measurements and depth-to-water measurements will be recorded on a Well Purging-Field Water Quality Measurement Form. Groundwater samples will be collected in laboratory-prepared sample containers and kept cool during transport to the testing laboratory. Chain-of-custody procedures will be observed from the time of sample collection to delivery to the testing laboratory consistent with the QAPP.

1.7. Decontamination Procedures

The objective of the decontamination procedures described herein is to minimize the potential for cross-contamination between sample locations. A designated decontamination area will be established for decontamination of reusable sampling equipment.

Sampling equipment will be decontaminated in accordance with the following procedures before each sampling attempt or measurement.

1. Remove large particulate matter from the sampling equipment.
2. Wash with non-phosphate detergent solution (Liquinox, Alconox or Citranox and laboratory-provided PFAS-free water).
3. Rinse with PFAS-free water.

1.8. Field Blank Preparation Procedure

The objective of the field blank preparation procedure is to help in maintaining the integrity of the sample collection method to ensure that if any PFAS or other analyte concentration is detected in the samples, it is reflective of the actual conditions of the monitoring well, rather than the influence of external factors.

One field blank will be collected during each quarterly monitoring event by transferring PFAS-free water from the reagent bottle container into empty bottles labeled "field blank," also indicating the monitoring well location. Prepared field blanks will be included in the chain of custody form, and handled with the same procedure as the collected groundwater samples, as stated in Section 1.6 above.

1.9. Handling of IDW

IDW, which consists mainly of development and purge water, will be placed in DOT-approved 55-gallon drums. Each drum will be labeled with the project name, general contents, and generated date. The drummed IDW will be stored on site at a location approved by the site owner pending analysis and disposal.

If PFAS are detected after the first sampling event, IDW from wells where PFAS was detected will be segregated in separate drums during future sampling events.

Disposable items, such as gloves and protective overalls, paper towels, etc., will be placed in plastic bags after use and deposited in trash receptacles for disposal.

1.10. Sample Handling and Custody Requirements

Samples will be handled in accordance with the QAPP (Appendix B). A complete discussion of the sample identification and custody procedures is provided in the QAPP.

1.11. Field Measurements and Observations Documentation

Field measurements and observations will be recorded in a project field notebook. Daily field logs will be dated, and pages will be consecutively numbered. Entries will be recorded directly and legibly in the daily field log and signed and dated by the person conducting the work. If changes are made, the changes will not obscure the previous entry, and the changes will be signed and dated. The field notebook will be maintained by GeoEngineers for at least five years after the completion of the project. At a minimum, the following data will be recorded in the project field notebook:

- Purpose and location of investigation;
- Location of activity;
- Site or sampling area sketch showing sample locations and distances to fixed reference points;
- Date and time of sampling;
- Type of sample (matrix);
- Designation as a discrete or composite sample;
- Sample identification number (should match with what is on jar and COC);
- Soil sample top and bottom depth (bgs);
- Sample preservation (if any);
- Sampling equipment used;
- Field measurements and screening observations (e.g., odor, color, staining, sheens, etc.);
- Field conditions that are pertinent to the integrity of the samples (e.g., weather conditions, performance of the sampling equipment, sample depth control, sample disturbance, etc.);
- Relevant comments regarding field activities; and
- Shipping arrangements (including overnight air bill number, if applicable) and receiving laboratory.

Information will be recorded in the project field notebook with enough detail so that field activities can be reconstructed without reliance on personnel memory. In addition to the sampling information, the following specific information also will be recorded in the field log for each day of sampling:

- Team members and their responsibilities
- Time of arrival/entry on site and time of site departure
- Other personnel present at the site
- Summary of pertinent meetings or discussions with regulatory agency or contractor personnel
- Deviations from sampling plans, site safety plans and QAPP procedures
- Changes in personnel and responsibilities with reasons for the changes
- Levels of safety protection
- Weather conditions
- Calibration readings for any equipment used and equipment model and serial number

1.12. Sample Identification

Sample identification is important to provide concise data management and to quickly determine sample location and date when comparing multiple samples. Monitoring well samples will have the following general format:

Well ID-MMDDYY

For example, groundwater sampled from monitoring well MW-2A on October 1, 2023 will be labeled as MW-2A-100123.

The equipment blank sample will have the following general format:

EB-MMDDYY

For example, an equipment blank collected on October 1, 2023 will be labeled as EB-100123.

The duplicate sample will have the following general format:

DUP-MMDDYY

For example, a duplicate sample collected on October 1, 2023 will be labeled as DUP-100123.

2.0 REFERENCES

ASTM International (ASTM) D2488. 2017. Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).

Department of Toxic Substances Control. 2012. “Advisory Active Soil Gas Investigation. Department of Toxic Substances Control, California Environmental Protection Agency. Los Angeles Regional Water Quality Control Board. San Francisco Regional Water Quality Control Board.” April 2012.

Michigan Department of Environmental Quality (MDEQ). 2018. “General PFAS Sampling Guidance.” Revised October 16, 2018.

Puls, R. W. and M.J. Barcelona. 1996. “Low-flow (Minimal Drawdown) Ground-water Sampling Procedures.” EPA Ground Water Issue. April. p.1-9.

U.S. Environmental Protection Agency (EPA). 2017. Region 1, “Low Stress (Low-Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells.” EPA SOP No. GW4, Revision No. 4., September 19, 2017.

U.S. Environmental Protection Agency (EPA). 2002. Method 5035A (SW-846). Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples. Draft Revision 1. Washington, D.C. July 2002.

U.S. Environmental Protection Agency (EPA). 1998. “Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW_846).” Revision 5, April.

Washington State Department of Ecology (Ecology). 2004. “Collecting and Preparing Soil Samples for VOC Analysis.”

Washington State Department of Ecology (Ecology). 2023. “Guidance for Investigating and Remediating PFAS Contamination in Washington State.” June 2023. Publication No. 22-09-058.

APPENDIX B
Quality Assurance Project Plan

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) was developed to guide laboratory analyses for groundwater samples collected as part of the assessment conducted for Herrera Environmental Consultants, Inc. (Herrera) and the Washington State Department of Ecology (Ecology) under Herrera Client Contract No. C2200149, Amendment 2. The QAPP presents the objectives, procedures, organization, functional activities and specific Quality Assurance (QA) and Quality Control (QC) activities designed to achieve data quality goals established for the projects. This QAPP is based on Ecology guidelines (Ecology 2016) and the Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA 2001) and related guidelines (EPA 2002).

Throughout the project, environmental measurements will be conducted to produce data that are scientifically valid, of known and acceptable quality and meet established objectives. QA/QC procedures will be implemented so that precision, accuracy, representativeness, completeness and comparability (PARCC) of data generated meet the specified data quality objectives to the extent possible.

1.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Descriptions of the responsibilities, lines of authority and communication for the key positions to QA/QC are provided below. This organization facilitates the efficient production of project work, allows for an independent quality review and permits resolution of QA issues before submittal.

1.1. Project Leadership and Management

The Project Manager’s (PM) duties consist of providing concise technical work statements for project tasks, selecting project team members, determining subcontractor participation, establishing budgets and schedules, adhering to budgets and schedules, providing technical oversight, and providing overall production and review of project deliverables. Justin Orr, Licensed Geologist (LG), and Sydney Bronson, Professional Engineer (PE), are the PMs for activities at the site. The Principal-in-Charge, Scott Lathen, PE, is responsible to Herrera and Ecology for fulfilling contractual and administrative control of the project. Nigel Baummer is the Herrera PM for the project. Christer Loftenius is the Ecology PM for the project.

1.1.1. Health and Safety Leadership and Management

The Health and Safety Manager (HSM) is responsible for implementing and promoting employee participation in the company Health and Safety Program. The HSM has overall responsibility for the general health and safety of GeoEngineers’ personnel. Lucas Miller is GeoEngineers’ HSM.

The Health and Safety Specialist (HSS) is a designated safety specialist. The HSS provides technical support to the PM and SSO to ensure that that GeoEngineers’ staff are following GeoEngineers’ safety program and safe work practices during site activities. Connor Jordan is the HSS for the project.

1.2. Field Coordinator

The Field Coordinator is responsible for the daily management of activities in the field. Specific responsibilities include the following:

- Provides technical direction to the field staff.
- Develops schedules and allocates resources for field tasks.
- Coordinates data collection activities to be consistent with information requirements.
- Supervises the compilation of field data and laboratory analytical results.
- Assures that data are correctly and completely reported.
- Implements and oversees field sampling in accordance with project plans.
- Supervises field personnel.
- Coordinates work with on-site subcontractors.
- Schedules sample shipment, if necessary, with the analytical laboratory.
- Monitors that appropriate sampling, testing and measurement procedures are followed.
- Coordinates the transfer of field data, sample tracking forms, and log books to the PM for data reduction and validation.
- Participates in QA corrective actions, as required.

The Field Coordinator for each work assignment will be drawn from our pool of experienced staff since fieldwork will be conducted concurrently at multiple sites. Staff that will serve as Field Coordinator could include Bryce Hanson, Justin Orr, Lola Otoki and Morea Schofield.

1.3. QA Leader

The GeoEngineers' QA Leader is under the direction of Justin Orr and Scott Lathen, who are responsible for the project's overall QA. The QA Leader is responsible for coordinating QA/QC activities as they relate to the acquisition of field data. Denell Warren is the QA Leader. The QA Leader has the following responsibilities:

- Serves as the official contact for laboratory data QA concerns.
- Responds to laboratory data, QA needs, resolves issues and answers requests for guidance and assistance.
- Reviews the implementation of the QAPP and the adequacy of the data generated from a quality perspective.
- Maintains the authority to implement corrective actions, as necessary.
- Reviews and approves the laboratory QA Plan.
- Evaluates the laboratory's final QA report for any condition that adversely impacts data generation.
- Ensures that appropriate sampling, testing and analysis procedures are followed and that correct QC checks are implemented.
- Monitors subcontractor compliance with data quality requirements.

1.4. Laboratory Management

The Ecology-accredited subcontracted laboratory (Eurofins Environment Testing [Eurofins] of Spokane Valley, Washington) conducting sample analyses for this project is required to obtain approval from the QA

Leader before the initiation of sample analysis to assure that the laboratory QA plan complies with the project QA objectives. The Laboratory's QA Coordinator (Randee Arrington) administers the Laboratory QA Plan and is responsible for QC. Specific responsibilities of this position include:

- Ensures implementation of the QA Plan.
- Serves as the laboratory point of contact.
- Activates corrective action for out-of-control events.
- Issues the final laboratory QA/QC report.
- Administers QA sample analysis.
- Complies with the specifications established in the project plans as related to laboratory services.
- Participates in QA audits and compliance inspections.

2.0 DATA QUALITY OBJECTIVES

The QA objective for technical data is to collect environmental monitoring data of known, acceptable and documentable quality. The QA objectives established for the project are:

- Implement the procedures outlined herein for field sampling, sample custody, equipment operation and calibration, laboratory analysis, and data reporting that will facilitate consistency and thoroughness of data generated.
- Achieve the acceptable level of confidence and quality required so that data generated are scientifically valid and of known and documented quality. This will be performed by establishing criteria for PARCC, and by testing data against these criteria.

The sampling design, field procedures, laboratory procedures and QC procedures are set up to provide high-quality data for use in this project. Specific data quality factors that may affect data usability include quantitative factors (precision, bias, accuracy, completeness and reporting limits) and qualitative factors (representativeness and comparability). The measurement quality objectives (MQO) associated with these data quality factors are summarized in Table B-1 and are discussed below.

2.1. Analytes and Matrices of Concern

Samples of groundwater will be collected from five monitoring wells on a quarterly basis for four consecutive quarters. Table B-2 summarizes the analyses to be performed at the site.

2.2. Detection Limits

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Individual instruments often can detect but not accurately quantify compounds at concentrations lower than the MDL, referred to as the instrument detection limit (IDL). Although results reported near the MDL or IDL provide insight to site conditions, QA dictates that analytical methods achieve a consistently reliable level of detection known as the practical quantitation limit (PQL). The contract laboratory will provide numerical results for all analytes and report them as detected above the PQL or undetected at the PQL.

Achieving a stated detection limit for a given analyte is helpful in providing statistically useful data. Intended data uses, such as comparison to numerical criteria or risk assessments, typically dictate specific project target reporting limits (TRLs) necessary to fulfill stated objectives. The PQLs for contaminants of potential concern (COPCs) at the site are presented in Table B-1. These reporting limits were obtained from Eurofins, the Ecology-accredited lab that will be analyzing the samples. Other criteria include State of Washington (Washington Administrative Code [WAC] 173-201) water quality criteria and federal ambient water quality criteria (AWQC). The analytical methods and processes selected will provide PQLs less than the TRLs under ideal conditions. However, the reporting limits in Table B-1 are considered targets because several factors may influence final detection limits. Analytical procedures may require sample dilutions or other practices to accurately quantify a particular analyte at concentrations above the range of the instrument. The effect is that other analytes could be reported as undetected but at a value much higher than a specified TRL. Data users must be aware that high non-detect values, although correctly reported, can bias statistical summaries and careful interpretation is required to correctly characterize site conditions.

2.3. Precision

Precision is the measure of mutual agreement among replicate or duplicate measurements of an analyte from the same sample and applies to field duplicate or split samples, replicate analyses and duplicate spiked environmental samples (matrix spike duplicates). The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples. Precision will be expressed as the relative percent difference (RPD) for spike sample comparisons of various matrices and field duplicate comparisons for water samples. This value is calculated by:

$$RPD\,(\%) = \frac{|D_1 - D_2|}{(D_1 + D_2)/2} \; X\ 100,$$

Where

D_1 = Concentration of analyte in sample.

D_2 = Concentration of analyte in duplicate sample.

The calculation applies to split samples, replicate analyses, duplicate spiked environmental samples (matrix spike duplicates) and laboratory control duplicates. The RPD will be calculated for samples and compared to the applicable criteria. Precision can also be expressed as the percent difference (%D) between replicate analyses. Persons performing the evaluation must review one or more pertinent documents (EPA 2017a,b) that address criteria exceedances and courses of action. Relative percent difference goals for this effort are no greater than 30 percent in groundwater for all analyses, unless the duplicate sample values are within five times the reporting limit. In this case, the absolute difference is used instead of the RPD. The absolute difference control limit is equal to the lowest reporting limit of the two samples.

2.4. Accuracy

Accuracy is a measure of bias in the analytic process. The closer the measurement value is to the true value, the greater the accuracy. This measure is defined as the difference between the reported value versus the actual value and is often measured with the addition of a known compound to a sample. The amount of known compound reported in the sample, or percent recovery, assists in determining the performance of the analytical system in correctly quantifying the compounds of interest. Since most environmental data collected represent one point spatially and temporally rather than an average of values, accuracy plays a greater role than precision in assessing the results. In general, if the percent recovery is low, non-detect results may indicate that compounds of interest are not present when in fact, these compounds are present. Detected compounds may be biased low or reported at a value less than actual environmental conditions. The reverse is true when recoveries are high. Non-detect values are considered accurate while detected results may be higher than the true value.

Accuracy will be expressed as the percent recovery of a surrogate compound (also known as "system monitoring compound"), a matrix spike (MS) result, or from a standard reference material where:

$$Recovery\,(\%) = \frac{Sample\ Result}{Spike\ Amount}\ X\ 100$$

Persons performing the evaluation must review one or more pertinent documents (EPA 2017a,b) that address criteria exceedances and courses of action. Accuracy criteria for surrogate spikes, MS and laboratory control spikes (LCS) are found in Table B-1 of this QAPP.

2.5. Representativeness, Completeness and Comparability

Representativeness expresses the degree to which data accurately and precisely represent the actual site conditions. The determination of the representativeness of the data will be performed by completing the following:

- Comparing actual sampling procedures to those delineated within the Work Plan and this QAPP.
- Comparing analytical results of field duplicates to determine the variations in the analytical results.
- Invalidating non-representative data or identifying data to be classified as questionable or qualitative. Only representative data will be used in subsequent data reduction, validation and reporting activities.

Completeness establishes whether a sufficient amount of valid measurements were obtained to meet project objectives. The number of samples and results expected establishes the comparative basis for completeness. Completeness goals are 90 percent useable data for samples/analyses planned. If the completeness goal is not achieved, an evaluation will be made to determine if the data are adequate to meet study objectives.

Comparability expresses the confidence with which one set of data can be compared to another. Although numeric goals do not exist for comparability, a statement on comparability will be prepared to determine overall usefulness of data sets, following the determination of both precision and accuracy.

2.6. Holding Times

Holding times are defined as the time between sample collection and extraction, sample collection and analysis, or sample extraction and analysis. Some analytical methods specify a holding time for analysis only. For many methods, holding times may be extended by sample preservation techniques in the field. If a sample exceeds a holding time, then the results may be biased low. For example, if the extraction holding time for volatile analysis of soil sample is exceeded, then the possibility exists that some of the organic constituents have volatilized from the sample or degraded. Results for that analysis will be qualified as estimated to indicate that the reported results may be lower than actual site conditions. Holding times are presented in Table B-2.

2.7. Blanks

According to the *National Functional Guidelines for Organic Data Review* (EPA 2017b), "The purpose of laboratory (or field) blank analysis is to determine the existence and magnitude of contamination resulting from laboratory (or field) activities. The criteria for evaluation of blanks apply to any blank associated with the samples (e.g., method blanks, instrument blanks, trip blanks and equipment blanks)." Trip blanks are placed with samples during shipment; method blanks are created during sample preparation and follow samples throughout the analysis process. Field blanks will also be prepared in the field and transported to the laboratory together with the groundwater samples.

Analytical results for blanks will be interpreted in general accordance with *National Functional Guidelines for Organic Data Review* and professional judgment.

3.0 SAMPLE COLLECTION, HANDLING AND CUSTODY

Sampling procedures are provided in Section 3, Field Investigation Activities and Appendix A, Field Assessment Procedures of this Work Plan.

3.1. Sampling Equipment Decontamination

Sampling equipment decontamination procedures are described in Appendix A of the Work Plan.

3.2. Sample Containers and Labeling

The Field Coordinator will establish field protocol to manage field sample collection, handling, and documentation. Groundwater samples obtained during this study will be placed in appropriate laboratory-prepared containers. Sample containers and preservatives are listed in Table B-2.

Sample containers will be labeled with the following information at the time of collection:

- Project name and number;
- Sample name, which will include a reference to depth if appropriate;
- Name of person collecting the sample; and
- Date and time of collection.

The sample collection activities will be noted in the field logbooks. The Field Coordinator will monitor consistency between the Work Plan, sample containers/labels, field logbooks and the chain-of-custody (COC).

3.3. Sample Storage

Samples will be placed in a cooler with "blue ice" or double-bagged "wet ice" immediately after they are collected. The objective of the cold storage will be to attain a sample temperature of 4 degrees Celsius (within plus/minus 2 degrees Celsius). Holding times will be observed during sample storage. Holding times for the project analyses are summarized in Table B-2.

3.4. Sample Shipment

The samples will be transported and delivered to the analytical laboratory in the coolers. Field personnel will transport and hand-deliver samples that are being submitted to a local laboratory for analysis. Samples that are being submitted from a remote location for analysis will be transported by a commercial express mailing service on an overnight basis or returning field personnel. The Field Coordinator will monitor that the shipping container (cooler) has been properly secured using clear packing tape and custody seals.

Measures will be implemented to minimize the potential for sample breakage, which includes packaging materials and placing sample bottles in the cooler in a manner intended to minimize damage. Sample bottles will be wrapped with bubble wrap or other protective material before being place in coolers. Trip blanks will be included in coolers with groundwater samples.

3.5. Chain-of-Custody Records

Field personnel are responsible for the security of samples from the time the samples are taken until the samples have been received by the shipper or laboratory. A COC form will be completed at the end of each field day for samples being shipped to the laboratory. Information to be included on the COC form includes:

- Project name and number.
- Sample identification number.
- Date and time of sampling.
- Sample matrix (water) and number of containers from each sampling point, including preservatives used.
- Analyses to be performed.
- Names of sampling personnel and transfer of custody acknowledgment spaces.
- Shipping information including shipping container number.

The original COC record will be signed by a member of the field team and bear a unique tracking number. Field personnel shall retain carbon copies and place the original and remaining copies in a sealed plastic bag, placed within the cooler or taped to the inside lid of the cooler before sealing the container for shipment. This record will accompany the samples during transit by carrier to the laboratory.

3.6. Laboratory Custody Procedures

The laboratory will follow their standard operating procedures (SOPs) to document sample handling from time of receipt (sample log-in) to reporting. Documentation will include at a minimum, the analyst's name or initial, time and date.

4.0 CALIBRATION PROCEDURES

4.1. Field Instrumentation

Equipment and instrumentation calibration facilitate accurate and reliable field measurements. Field and laboratory equipment used on the project will be calibrated and adjusted in general accordance with the manufacturer's recommendations. Methods and intervals of calibration and maintenance will be based on the type of equipment, stability characteristics, required accuracy, intended use and environmental conditions. The basic calibration frequencies are described below.

A YSI multi-parameter meter and flow-through cell (YSI) will be used to collect groundwater quality data. The YSI will be calibrated daily in general accordance with the manufacturer's specifications.

4.2. Laboratory Instrumentation

For analytical chemistry, calibration procedures will be performed in general accordance with the methods cited and laboratory SOPs. Calibration documentation will be retained at the laboratory and readily available for a period of 6 months.

5.0 DATA REPORTING AND LABORATORY DELIVERABLES

Laboratories will report data in formatted hardcopy and digital form. Analytical laboratory measurements will be recorded in standard formats that display, at a minimum, the field sample identification, the laboratory identification, reporting units, qualifiers, analytical method, analyte tested, analytical result, extraction and analysis dates, and detection limit (PQL only). Each sample delivery group will be accompanied by sample receipt forms and a case narrative identifying data quality issues. Laboratory electronic data deliverable (EDD) formats will be established by GeoEngineers, Inc., with the contract laboratory. Final results will be sent to the PM.

6.0 INTERNAL QC

Table B-3 summarizes the types and frequency of QC samples to be collected during the site characterization, including both field QC and laboratory QC samples.

6.1. Field QC

Field QC samples serve as a control and check mechanism to monitor the consistency of sampling methods and the influence of off-site factors on environmental samples. Off-site factors include airborne volatile organic compounds (VOCs).

6.1.1. Field Duplicates

In addition to replicate analyses performed in the laboratory, field duplicates also serve as measures for precision. Under ideal field conditions, field duplicates (referred to as splits), are created when a volume of the sample matrix is thoroughly mixed, placed in separate containers and identified as different samples. Analysis of duplicates test both the precision and consistency of laboratory analytical procedures and methods, and the consistency of the sampling techniques used by field personnel.

One field duplicate will be collected during each groundwater sampling event. The duplicate sample will be analyzed for the COPCs specified for the given well.

6.1.2. Equipment Blanks

Equipment blanks serve to confirm that the equipment used to collect the samples does not contain analytes of concern.

During well redevelopment and new pump installation, one equipment blank will be collected and analyzed for per- and fluoroalkyl substances (PFAS) following the procedures described in Appendix A of this Work Plan.

6.1.3. Trip Blanks

Trip blanks will accompany groundwater sample containers submitted for VOC analyses during shipment and sampling periods. Trip blanks will be analyzed on a one per cooler basis.

6.1.4. Field Blanks

Field blanks consist of analyte free water poured into a sampling container. Field blanks are taken in the field to detect on-site contamination in sample handling. A field blank will be collected during each monitoring event.

6.2. Laboratory QC

Laboratory QC procedures will be evaluated through a formal data validation process. The analytical laboratory will follow standard method procedures that include specified QC monitoring requirements. These requirements will vary by method but generally include:

- Method blanks
- Internal standards
- Calibrations
- MS/matrix spike duplicates (MSD)
- LCS/laboratory control spike duplicates (LCSD)
- Laboratory replicates or duplicates
- Surrogate spikes

6.2.1. Laboratory Blanks

Laboratory procedures employ the use of several types of blanks but the most commonly used blank for QA/QC assessments are method blanks. Method blanks are laboratory QC samples that consist of either a soil-like material having undergone a contaminant destruction process or high-performance liquid-chromatography (HPLC) water. Method blanks are extracted and analyzed with each batch of environmental samples undergoing analysis. Method blanks are particularly useful during volatiles analysis since VOCs can be transported in the laboratory through the vapor phase. If a substance is found in the method blank, then one (or more) of the following occurred:

- Measurement apparatus or containers were not properly cleaned and contained contaminants.
- Reagents used in the process were contaminated with a substance(s) of interest.
- Contaminated analytical equipment was not properly cleaned.
- Volatile substances in the air with high solubility or affinities toward the sample matrix contaminated the samples during preparation or analysis.

It is difficult to determine which of the above scenarios took place if blank contamination occurs. However, it is assumed that the conditions that affected the blanks also likely affected the project samples. Given method blank results, validation rules assist in determining which substances in samples are considered "real," and which ones are attributable to the analytical process. Furthermore, the guidelines state, "…there may be instances where little or no contamination was present in the associated blank, but qualification of the sample is deemed necessary. Contamination introduced through dilution water is one example."

6.2.2. Calibrations

Several types of calibrations are used, depending on the method, to determine whether the methodology is 'in control' by verifying the linearity of the calibration curve and to assure that the sample results reflect accurate and precise measurements. The main calibrations used are initial calibrations, daily calibrations and continuing calibration verification.

6.2.3. MS/MSD

MS/MSD samples are used to assess influences or interferences caused by the physical or chemical properties of the sample itself. For example, extreme pH affects the results of semi-volatile organic compounds (SVOCs). Or the presence of a compound may interfere with accurate quantitation of another analyte. MS/MSD data is reviewed in combination with other QC monitoring data to determine matrix effects. In some cases, matrix affects cannot be determined due to dilution and/or high levels of related substances in the sample. A MS is evaluated by spiking a known amount of one or more of the target analytes ideally at a concentration of 5 to 10 times higher than the sample result. A percent recovery is calculated by subtracting the sample result from the spike result, dividing by the spiked amount and multiplying by 100.

The samples for the MS and MSD analyses should be collected from a boring or sampling location that is believed to exhibit low-level contamination. A sample from an area of low-level contamination is needed because the objective of MS/MSD analyses is to determine the presence of matrix interferences, which can best be achieved with low levels of contaminants. Additional sample volume will be collected for these analyses. This MS/MSD sample will be a composite to achieve a level of representativeness and reproducibility in the data.

6.2.4. LCS/LCSD

Also known as blanks spikes, LCSs are similar to MSs in that a known amount of one or more of the target analytes are spiked into a prepared media and a percent recovery of the spiked substances are calculated. The primary difference between a MS and LCS is that the LCS media is considered "clean" or contaminant free. For example, HPLC water is typically used for LCS water analyses. The purpose of an LCS is to help assess the overall accuracy and precision of the analytical process including sample preparation, instrument performance and analyst performance. LCS data must be reviewed in context with other controls to determine if out-of-control events occur.

6.2.5. Laboratory Replicates/Duplicates

Laboratories often utilize MS/MSDs, LCS/LCSDs and/or replicates to assess precision. Replicates are a second analysis of a field-collected environmental sample. Replicates can be split at varying stages of the sample preparation and analysis process, but most commonly occur as a second analysis on the extracted media.

6.2.6. Surrogate Spikes

The purposes of using a surrogate are to verify the accuracy of the instrument being used and extraction procedures. Surrogates are substances similar to, but not one of, the target analytes. A known concentration of surrogate is added to the sample and passed through the instrument, noting the surrogate recovery. Each surrogate used has an acceptable range of percent recovery. If a surrogate recovery is low, sample results may be biased low and depending on the recovery value, a possibility of false negatives may exist. Conversely, when recoveries are above the specified range of acceptance a possibility of false positives exist, although non-detected results are considered accurate.

7.0 DATA REDUCTION AND ASSESSMENT PROCEDURES

7.1. Data Reduction

Data reduction involves the conversion or transcription of field and analytical data to a usable format. The laboratory personnel will reduce the analytical data for review by the QA Leader and PM.

7.2. Field Measurement Evaluation

Field data will be reviewed at the end of each day by following the QC checks outlined below and procedures in the Work Plan. Field data documentation will be checked against the applicable criteria as follows:

- Sample collection information.
- Field instrumentation and calibration.
- Sample collection protocol.
- Sample containers, preservation, and volume.
- Field QC samples collected at the frequency specified.
- Sample documentation and COC protocols.
- Sample shipment.

Cooler receipt forms and sample condition forms provided by the laboratory will be reviewed for out-of-control incidents. The final report will contain what effects, if any, an incident has on data quality. Sample collection information will be reviewed for correctness before inclusion in a final report.

7.3. Field QC Evaluation

A field QC evaluation will be conducted by reviewing field logbooks and daily reports, discussing field activities with staff and reviewing field QC samples (trip blanks and field duplicates). Trip blanks will be evaluated using the same criteria as method blanks.

7.4. Laboratory Data QC Evaluation

The laboratory data assessment will consist of a formal review of the following QC parameters:

- Holding times
- Method blanks
- MS/MSD
- LCS/LCSD
- Surrogate spikes
- Replicates

In addition to these QC mechanisms, other documentation such as cooler receipt forms and case narratives will be reviewed to fully evaluate laboratory QA/QC.

8.0 REFERENCES

U.S. Environmental Protection Agency). 2001. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. EPA/240/B-01/003. Office of Environmental Information, Washington, D.C. March 2001.

U.S. Environmental Protection Agency). 2002. Guidance for Quality Assurance Project Plans. EPA QA/G-5. EPA/240/R-02/009. Office of Environmental Information, Washington, D.C. December 2002.

U.S. Environmental Protection Agency. 2017a. National Functional Guidelines for Inorganic Superfund Methods Data Review. 540-R-2017-001. Office of Superfund Remediation and Technology Innovation. Washington, D.C. January 2017.

U.S. Environmental Protection Agency. 2017b. National Functional Guidelines for Organic Superfund Methods Data Review. Office of Superfund Remediation and Technology Innovation. Washington, D.C. 540-R-2017-002. January 2017.

Washington State Department of Ecology. 2016. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. Publication No. 04-03-030. July 2004 (revised December 2016).

Table B-1

Groundwater Measurement Quality Objectives and Target Reporting Limits

Marshall Landfill

Spokane County, Washington

Analyte	Method	Units	MDL	PQL	LCS/LCSD			MS/MSD			MTCA Cleanup Levels[2]
					Lower	Upper	RPD	Lower	Upper	RPD	
VOCs											
1,1,1,2-Tetrachloroethane	EPA 8260D	µg/L	0.480	1.00	80	131	17	80	131	17	240
1,1,1-Trichloroethane	EPA 8260D	µg/L	0.165	1.00	71	138	17	71	138	17	200
1,1,2,2-Tetrachloroethane	EPA 8260D	µg/L	0.319	2.00	60	150	17	60	150	17	160
1,1,2-Trichloroethane	EPA 8260D	µg/L	0.431	2.00	80	128	15	80	128	15	32
1,1-Dichloroethane	EPA 8260D	µg/L	0.291	1.00	80	125	20	80	125	20	1,600
1,1-Dichloroethene	EPA 8260D	µg/L	0.202	1.00	65	141	19	65	141	19	400
1,1-Dichloropropene	EPA 8260D	µg/L	0.500	1.00	82	123	20	82	123	20	240
1,2,3-Trichlorobenzene	EPA 8260D	µg/L	0.327	1.00	70	137	30	70	137	30	NE
1,2,3-Trichloropropane	EPA 8260D	µg/L	0.501	2.00	65	142	34	65	142	34	32
1,2,4-Trichlorobenzene	EPA 8260D	µg/L	0.160	1.00	76	131	24	76	131	24	80
1,2,4-Trimethylbenzene	EPA 8260D	µg/L	0.306	1.00	78	131	16	78	131	16	80
1,2-Dibromo-3-Chloropropane	EPA 8260D	µg/L	1.53	10.0	53	142	29	53	142	29	1.6
1,2-Dibromoethane (EDB)	EPA 8260D	µg/L	0.200	1.00	80	124	14	80	124	14	0.01
1,2-Dichlorobenzene	EPA 8260D	µg/L	0.233	1.00	80	120	14	80	120	14	720
1,2-Dichloroethane	EPA 8260D	µg/L	0.310	1.00	80	120	14	80	120	14	5
1,2-Dichloropropane	EPA 8260D	µg/L	0.231	1.00	79	122	15	79	122	15	32
1,3,5-Trimethylbenzene	EPA 8260D	µg/L	0.316	1.00	76	129	17	76	129	17	80
1,3-Dichlorobenzene	EPA 8260D	µg/L	0.143	1.00	80	122	15	80	122	15	NE
1,3-Dichloropropane	EPA 8260D	µg/L	0.213	2.00	78	129	17	78	129	17	160
1,4-Dichlorobenzene	EPA 8260D	µg/L	0.282	1.00	80	120	14	80	120	14	560
2,2-Dichloropropane	EPA 8260D	µg/L	0.656	2.00	73	140	18	73	140	18	NE
2-Chlorotoluene	EPA 8260D	µg/L	0.363	1.00	74	129	19	74	129	19	160
4-Chlorotoluene	EPA 8260D	µg/L	0.256	1.00	79	125	16	79	125	16	160
Benzene	EPA 8260D	µg/L	0.0930	0.400	80	120	15	80	120	15	5
Bromobenzene	EPA 8260D	µg/L	0.279	1.00	73	125	16	73	125	16	64
Bromochloromethane	EPA 8260D	µg/L	0.442	2.00	71	136	21	71	136	21	NE
Bromodichloromethane	EPA 8260D	µg/L	0.289	1.00	80	120	16	80	120	16	160
Bromoform	EPA 8260D	µg/L	0.664	5.00	73	139	17	73	139	17	160
Bromomethane	EPA 8260D	µg/L	0.757	5.00	66	149	24	66	149	24	11
Carbon tetrachloride	EPA 8260D	µg/L	0.397	1.00	72	138	28	72	138	28	32
Chlorobenzene	EPA 8260D	µg/L	0.321	1.00	80	124	14	80	124	14	160
Chloroethane	EPA 8260D	µg/L	0.404	2.00	64	134	24	64	134	24	NE
Chloroform	EPA 8260D	µg/L	0.242	1.00	80	123	18	80	123	18	80
Chloromethane	EPA 8260D	µg/L	0.501	3.00	19	150	35	19	150	35	NE
cis-1,2-Dichloroethene	EPA 8260D	µg/L	0.227	1.00	80	122	17	80	122	17	16
cis-1,3-Dichloropropene	EPA 8260D	µg/L	0.248	1.00	80	121	16	80	121	16	NE
Dibromochloromethane	EPA 8260D	µg/L	0.327	2.00	80	130	15	80	130	15	160
Dibromomethane	EPA 8260D	µg/L	0.500	2.00	80	122	16	80	122	16	NE
Dichlorodifluoromethane	EPA 8260D	µg/L	0.636	2.00	30	150	22	30	150	22	1,600
Ethylbenzene	EPA 8260D	µg/L	0.198	1.00	80	122	35	80	122	35	700
Hexachlorobutadiene	EPA 8260D	µg/L	0.207	2.00	77	132	25	77	132	25	8
Isopropylbenzene	EPA 8260D	µg/L	0.240	1.00	80	122	16	80	122	16	NE
m,p-Xylene	EPA 8260D	µg/L	0.280	2.00	80	125	35	80	125	35	NE
o-Xylene	EPA 8260D	µg/L	0.162	1.00	80	130	35	80	130	35	NE
Xylenes, total	Derived as the sum of m, p and o isomers										1,000
Methyl tert-butyl ether	EPA 8260D	µg/L	0.160	1.00	68	134	18	68	134	18	20
Methylene Chloride	EPA 8260D	µg/L	2.23	5.00	30	150	25	30	150	25	5
Naphthalene	EPA 8260D	µg/L	0.632	2.00	61	140	25	61	140	25	160
n-Butylbenzene	EPA 8260D	µg/L	0.203	1.00	75	121	16	75	121	16	400
N-Propylbenzene	EPA 8260D	µg/L	0.250	1.00	73	136	18	73	136	18	800
p-Isopropyltoluene	EPA 8260D	µg/L	0.268	1.00	78	128	17	78	128	17	NE
sec-Butylbenzene	EPA 8260D	µg/L	0.223	1.00	73	138	17	73	138	17	800
Styrene	EPA 8260D	µg/L	0.238	1.00	79	134	17	79	134	17	1,600
tert-Butylbenzene	EPA 8260D	µg/L	0.120	1.00	76	131	18	76	131	18	800
Tetrachloroethene	EPA 8260D	µg/L	0.217	1.00	80	139	20	80	139	20	5
Toluene	EPA 8260D	µg/L	0.312	1.00	80	129	35	80	129	35	1,000
trans-1,2-Dichloroethene	EPA 8260D	µg/L	0.201	1.00	73	137	18	73	137	18	160
trans-1,3-Dichloropropene	EPA 8260D	µg/L	0.453	1.00	73	138	17	73	138	17	NE
Trichloroethene	EPA 8260D	µg/L	0.199	1.00	80	123	14	80	123	14	5
Trichlorofluoromethane	EPA 8260D	µg/L	0.200	1.00	71	147	24	71	147	24	2,400
Vinyl chloride	EPA 8260D	µg/L	0.130	0.400	50	150	26	50	150	26	0.2
Metals											
Arsenic	6020B	mg/L	0.00102	0.00500	80	120	20	80	120	20	0.005
Cadmium	6020B	mg/L	0.000185	0.00200	80	120	20	80	120	20	0.005
Iron	6020B	mg/L	0.0667	0.500	80	120	20	80	120	20	11
Lead	6020B	mg/L	0.000200	0.00200	80	120	20	80	120	20	0.015
Manganese	6020B	mg/L	0.00230	0.0100	80	120	20	80	120	20	0.75
Zinc	6020B	mg/L	0.00464	0.0350	80	120	20	80	120	20	4.8
Mercury	7470A	µg/L	0.0900	0.200	80	120	20	80	120	20	2
Magnesium	6010D	mg/L	0.131	1.00	80	120	20	75	125	20	NE
Potassium	6010D	mg/L	0.294	0.500	80	135	20	75	125	20	NE
Sodium	6010D	mg/L	0.196	0.500	80	154	20	75	125	20	NE
Alkalinity											
Alkalinity	2320B	mg/L	5.00	20.0	90	110	20	80	120	20	NE
Anions, Ion Chromatography											
Chloride	300 ORGFM 28D	mg/L	0.420	0.800	90	110	20	80	120	10	NE
Sulfate	301 ORGFM 28D	mg/L	0.128	0.500	90	110	20	80	120	10	NE
Nitrate as N	301 ORGFM	mg/L	0.0570	0.200	90	110	20	80	120	12.1	26
Nitrite as N	302 ORGFM	mg/L	0.0689	0.200	90	110	20	80	120	10	1.6
Ammonia											
Ammonia as Nitrogen	350.1	mg/L	0.0290	0.100	90	110	10	90	110	10	NE

Analyte	Method	Units	MDL	PQL	LCS/LCSD			MS/MSD			MTCA Cleanup Levels[2]
					Lower	Upper	RPD	Lower	Upper	RPD	
TOC											
TOC	SM 5310B	mg/L	0.345	1.00	88	112	15	88	112	15	NE
TDS											
TDS	2540C Calcd	mg/L	13.0	25.0	80	120	20	--	--	--	NE
Cyanide											
Weak acid dissociable cyanide	4500 CN I NP	mg/L	0.00500	0.0100	75	120	20	75	120	20	0.005
SVOCs											
1-Methylnaphthalene	8270E	µg/L	0.0500	1.00	36	120	35	36	120	35	160
2-Methylnaphthalene	8270E	µg/L	0.0600	0.400	35	120	35	35	120	35	
Naphthalene	8270E	µg/L	0.160	0.400	42	120	35	42	120	35	
1,2,4-Trichlorobenzene	8270E	µg/L	0.0900	0.400	21	120	35	21	120	35	80
1,2-Dichlorobenzene	8270E	µg/L	0.0500	0.400	20	120	35	20	120	35	720
1,3-Dichlorobenzene	8270E	µg/L	0.0400	0.400	20	120	35	20	120	35	NE
1,4-Dichlorobenzene	8270E	µg/L	0.0400	0.400	20	120	35	20	120	35	560
2,4,5-Trichlorophenol	8270E	µg/L	0.100	0.400	45	120	35	45	120	35	1,600
2,4,6-Trichlorophenol	8270E	µg/L	0.100	0.600	43	120	35	43	120	35	16
2,4-Dichlorophenol	8270E	µg/L	0.200	1.00	45	120	35	45	120	35	48
2,4-Dimethylphenol	8270E	µg/L	0.160	4.00	37	120	35	37	120	35	48
2,4-Dinitrophenol	8270E	µg/L	0.450	5.00	10	146	35	10	146	35	32
2,4-Dinitrotoluene	8270E	µg/L	0.100	1.00	51	120	35	51	120	35	14
2,6-Dinitrotoluene	8270E	µg/L	0.100	0.400	52	120	35	52	120	35	14
2-Chloronaphthalene	8270E	µg/L	0.0700	1.00	35	120	35	35	120	35	NE
2-Chlorophenol	8270E	µg/L	0.0500	1.00	44	120	35	44	120	35	40
2-Methylphenol	8270E	µg/L	0.0500	0.600	30	120	35	30	120	35	NE
2-Nitroaniline	8270E	µg/L	0.100	1.00	43	120	35	43	120	35	160
2-Nitrophenol	8270E	µg/L	0.0700	1.00	44	120	35	44	120	35	NE
3 & 4 Methylphenol	8270E	µg/L	0.100	0.600	29	120	35	29	120	35	NE
3,3'-Dichlorobenzidine	8270E	µg/L	0.120	1.00	33	150	35	33	150	35	0.19
3-Nitroaniline	8270E	µg/L	0.160	3.00	10	138	35	10	138	35	64
4,6-Dinitro-2-methylphenol	8270E	µg/L	0.550	2.00	29	136	35	29	136	35	NE
4-Bromophenyl phenyl ether	8270E	µg/L	0.0600	0.600	53	120	35	53	120	35	NE
4-Chloro-3-methylphenol	8270E	µg/L	0.130	0.600	36	120	35	36	120	35	NE
4-Chloroaniline	8270E	µg/L	0.150	2.00	10	150	35	10	150	35	64
4-Chlorophenyl phenyl ether	8270E	µg/L	0.0500	0.600	41	120	35	41	120	35	NE
4-Nitroaniline	8270E	µg/L	0.210	2.00	38	133	35	38	133	35	64
4-Nitrophenol	8270E	µg/L	1.70	10.0	10	120	35	10	120	35	NE
Acenaphthene	8270E	µg/L	0.0500	0.400	41	120	35	41	120	35	480
Acenaphthylene	8270E	µg/L	0.0600	1.00	43	120	35	43	120	35	NE
Anthracene	8270E	µg/L	0.0500	1.00	58	120	35	58	120	35	2,400
Benzo[a]anthracene	8270E	µg/L	0.0500	0.250	48	131	35	48	131	35	NE
Benzo[a]pyrene	8270E	µg/L	0.0400	0.250	55	125	35	55	125	35	0.1
Benzo[b]fluoranthene	8270E	µg/L	0.0400	0.250	54	124	35	54	124	35	NE
Benzo[g,h,i]perylene	8270E	µg/L	0.0400	0.250	46	124	35	46	124	35	NE
Benzo[k]fluoranthene	8270E	µg/L	0.0500	0.250	52	132	35	52	132	35	NE
Benzoic acid	8270E	µg/L	1.34	10.0	10	120	35	10	120	35	64,000
Benzyl alcohol	8270E	µg/L	0.180	5.00	10	120	35	10	120	35	1,600
Bis(2-chloroethoxy)methane	8270E	µg/L	0.0500	0.600	38	120	35	38	120	35	48
Bis(2-chloroethyl)ether	8270E	µg/L	0.0300	0.100	39	120	35	39	120	35	0.04
Bis(2-ethylhexyl) phthalate	8270E	µg/L	0.740	3.00	41	150	35	41	150	35	320
bis(chloroisopropyl) ether	8270E	µg/L	0.0600	0.250	20	139	35	20	139	35	NE
Butyl benzyl phthalate	8270E	µg/L	0.270	4.00	40	150	35	40	150	35	3,200
Carbazole	8270E	µg/L	0.100	0.600	61	150	35	61	150	35	NE
Chrysene	8270E	µg/L	0.0900	0.250	57	125	35	57	125	35	NE
Dibenz(a,h)anthracene	8270E	µg/L	0.0700	0.250	48	126	35	48	126	35	NE
Dibenzofuran	8270E	µg/L	0.100	0.400	45	120	35	45	120	35	8
Diethyl phthalate	8270E	µg/L	0.150	1.00	60	121	35	60	121	35	13,000
Dimethyl phthalate	8270E	µg/L	0.0600	0.600	54	120	35	54	120	35	NE
Di-n-butyl phthalate	8270E	µg/L	2.97	10.0	55	150	35	55	150	35	NE
Di-n-octyl phthalate	8270E	µg/L	0.130	1.00	48	140	35	48	140	35	160
Fluoranthene	8270E	µg/L	0.0600	0.250	60	121	35	60	121	35	640
Fluorene	8270E	µg/L	0.0500	0.250	20	120	35	20	120	35	320
Hexachlorobenzene	8270E	µg/L	0.0800	0.600	49	120	35	49	120	35	6.4
Hexachlorobutadiene	8270E	µg/L	0.0800	1.00	10	130	35	10	130	35	8
Hexachlorocyclopentadiene	8270E	µg/L	0.140	1.00	10	125	35	10	125	35	48
Hexachloroethane	8270E	µg/L	0.0500	1.00	10	130	35	10	130	35	NE
Indeno[1,2,3-cd]pyrene	8270E	µg/L	0.130	0.400	39	124	35	39	124	35	NE
Isophorone	8270E	µg/L	0.100	0.400	41	120	35	41	120	35	NE
Nitrobenzene	8270E	µg/L	0.0400	1.00	38	120	35	38	120	35	3,200
N-Nitrosodi-n-propylamine	8270E	µg/L	0.0600	0.400	39	120	35	39	120	35	0.013
N-Nitrosodiphenylamine	8270E	µg/L	0.0700	1.00	52	120	35	52	120	35	18
Pentachlorophenol	8270E	µg/L	0.510	5.00	18	135	35	18	135	35	80
Phenanthrene	8270E	µg/L	0.120	1.00	54	120	35	54	120	35	NE
Phenol	8270E	µg/L	0.160	1.00	13	120	35	13	120	35	4,800
Pyrene	8270E	µg/L	0.0400	1.00	57	120	35	57	120	35	240
cPAH TEC[1]	Calculated based on concentrations of cPAHs										0.1
Herbicides											
2,4,5-T	8151A	µg/L	0.212	0.500	28	180	20	41	125	40	NE
2,4,5-TP (Silvex)	8151A	µg/L	0.136	0.500	--	--	--	--	--	--	130
2,4-D	8151A	µg/L	1.96	5.00	10	180	20	39	125	40	NE
2,4-DB	8151A	µg/L	3.51	5.00	10	180	20	10	179	40	NE
Dalapon	8151A	µg/L	4.73	12.5	--	--	--	--	--	--	480
Dicamba	8151A	µg/L	0.285	0.500	--	--	--	--	--	--	480
Dichlorprop	8151A	µg/L	1.96	5.00	--	--	--	--	--	--	NE
Dinoseb	8151A	µg/L	2.17	2.50	--	--	--	--	--	--	16
MCPA	8151A	µg/L	348	500	--	--	--	--	--	--	NE
MCPP	8151A	µg/L	305	500	--	--	--	--	--	--	NE
2,4-Dichlorophenylacetic acid	8151A	µg/L	--	--	--	--	--	--	--	--	--	160

Analyte	Method	Units	MDL	PQL	LCS/LCSD			MS/MSD			MTCA Cleanup Levels[2]
					Lower	Upper	RPD	Lower	Upper	RPD	
PFAS											
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	1633	ng/L	0.818	8.00	46	156	20	46	156	20	NE
13C2 4:2 FTS	1633	ng/L	--	--	25	200	20	25	200	20	NE
13C2 6:2 FTS	1633	ng/L	--	--	25	200	20	25	200	20	NE
13C2 8:2 FTS	1633	ng/L	--	--	25	200	20	25	200	20	NE
13C2 PFDoA	1633	ng/L	--	--	10	150	20	10	150	20	NE
13C2 PFTeDA	1633	ng/L	--	--	10	130	20	10	130	20	NE
13C3 HFPO-DA	1633	ng/L	--	--	25	160	20	25	160	20	NE
13C3 PFBS	1633	ng/L	--	--	25	150	20	25	150	20	NE
13C3 PFHxS	1633	ng/L	--	--	25	150	20	25	150	20	NE
13C4 PFBA	1633	ng/L	--	--	10	130	20	10	130	20	NE
13C4 PFHpA	1633	ng/L	--	--	40	150	20	40	150	20	NE
13C5 PFHxA	1633	ng/L	--	--	40	150	20	40	150	20	NE
13C5 PFPeA	1633	ng/L	--	--	40	150	20	40	150	20	NE
13C6 PFDA	1633	ng/L	--	--	20	140	20	20	140	20	NE
13C7 PFUnA	1633	ng/L	--	--	20	140	20	20	140	20	NE
13C8 PFOA	1633	ng/L	--	--	30	140	20	30	140	20	NE
13C8 PFOS	1633	ng/L	--	--	20	140	20	20	140	20	NE
13C8 PFOSA	1633	ng/L	--	--	10	130	20	10	130	20	NE
13C9 PFNA	1633	ng/L	--	--	30	140	20	30	140	20	NE
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	1633	ng/L	1.41	8.00	63	152	20	63	152	20	NE
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	1633	ng/L	1.65	8.00	67	146	20	67	146	20	NE
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	1633	ng/L	1.07	8.00	61	151	20	61	151	20	NE
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	1633	ng/L	6.53	50.0	50	138	20	50	138	20	NE
3-Perfluoropentylpropanoic acid (5:3 FTCA)	1633	ng/L	5.54	50.0	63	134	20	63	134	20	NE
3-Perfluoropropylpropanoic acid (3:3 FTCA)	1633	ng/L	0.860	10.0	62	129	20	62	129	20	NE
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	1633	ng/L	1.67	8.00	68	146	20	68	146	20	NE
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid(9Cl-PF3ONS)	1633	ng/L	0.757	8.00	56	156	20	56	156	20	NE
d3-NMeFOSAA	1633	ng/L	--	--	10	200	20	10	200	20	NE
d3-NMePFOSA	1633	ng/L	--	--	10	130	20	10	130	20	NE
d5-NEtFOSAA	1633	ng/L	--	--	10	200	20	10	200	20	NE
d5-NEtPFOSA	1633	ng/L	--	--	10	130	20	10	130	20	NE
d7-N-MeFOSE-M	1633	ng/L	--	--	10	150	20	10	150	20	NE
d9-N-EtFOSE-M	1633	ng/L	--	--	10	150	20	10	150	20	NE
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	1633	ng/L	1.85	8.00	63	144	20	63	144	20	24
N-ethylperfluorooctane sulfonamide (NEtFOSA)	1633	ng/L	0.365	2.00	65	139	20	65	139	20	NE
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	1633	ng/L	1.86	20.0	69	137	20	69	137	20	NE
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	1633	ng/L	0.554	2.00	59	146	20	59	146	20	NE
N-methylperfluorooctane sulfonamide (NMeFOSA)	1633	ng/L	0.453	2.00	63	145	20	63	145	20	NE
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	1633	ng/L	2.33	20.0	71	136	20	71	136	20	NE
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	1633	ng/L	0.735	2.00	58	144	20	58	144	20	NE
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	1633	ng/L	0.630	4.00	48	161	20	48	161	20	NE
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	1633	ng/L	0.730	4.00	56	151	20	56	151	20	NE
Perfluoro-3-methoxypropanoic acid (PFMPA)	1633	ng/L	0.578	4.00	51	145	20	51	145	20	NE
Perfluoro-4-methoxybutanoic acid (PFMBA)	1633	ng/L	0.608	4.00	55	148	20	55	148	20	NE
Perfluorobutanesulfonic acid (PFBS)	1633	ng/L	0.289	2.00	62	144	20	62	144	20	4,800
Perfluorobutanoic acid (PFBA)	1633	ng/L	0.941	8.00	58	148	20	58	148	20	8,000
Perfluorodecanesulfonic acid (PFDS)	1633	ng/L	0.328	2.00	51	147	20	51	147	20	NE
Perfluorodecanoic acid (PFDA)	1633	ng/L	0.810	2.00	52	147	20	52	147	20	NE
Perfluorododecanesulfonic acid (PFDoS)	1633	ng/L	0.431	2.00	36	145	20	36	145	20	NE
Perfluorododecanoic acid (PFDoA)	1633	ng/L	0.603	2.00	64	142	20	64	142	20	NE
Perfluoroheptanesulfonic acid (PFHpS)	1633	ng/L	0.395	2.00	55	152	20	55	152	20	NE
Perfluoroheptanoic acid (PFHpA)	1633	ng/L	0.501	2.00	54	154	20	54	154	20	NE
Perfluorohexanesulfonic acid (PFHxS)	1633	ng/L	0.393	2.00	57	146	20	57	146	20	160
Perfluorohexanoic acid (PFHxA)	1633	ng/L	0.454	2.00	55	152	20	55	152	20	8,000
Perfluorononanesulfonic acid (PFNS)	1633	ng/L	0.402	2.00	52	148	20	52	148	20	NE
Perfluorononanoic acid (PFNA)	1633	ng/L	0.657	2.00	59	149	20	59	149	20	40
Perfluorooctanesulfonamide (PFOSA)	1633	ng/L	0.346	2.00	61	148	20	61	148	20	NE
Perfluorooctanesulfonic acid (PFOS)	1633	ng/L	0.441	2.00	58	149	20	58	149	20	48
Perfluorooctanoic acid (PFOA)	1633	ng/L	0.367	2.00	52	161	20	52	161	20	48
Perfluoropentanesulfonic acid (PFPeS)	1633	ng/L	0.351	2.00	59	151	20	59	151	20	NE
Perfluoropentanoic acid (PFPeA)	1633	ng/L	0.552	4.00	54	152	20	54	152	20	NE
Perfluorotetradecanoic acid (PFTeDA)	1633	ng/L	0.554	2.00	47	161	20	47	161	20	NE
Perfluorotridecanoic acid (PFTrDA)	1633	ng/L	0.478	2.00	49	148	20	49	148	20	NE
Perfluoroundecanoic acid (PFUnA)	1633	ng/L	0.609	2.00	48	159	20	48	159	20	NE

Notes:

[1]TEC = Total toxic equivalent concentration calculated per WAC 173-340-708 and *Guidance on Remediation of Petroleum Contaminated Sites*; ND results will be treated as 0.5PQL

[2]Washington State Model Toxics Control Act (MTCA) Method A/B cleanup levels.

EPA = Environmental Protection Agency

LCS = laboratory control spike

LCSD = laboratory control spike duplicate

MDL = method detection limit

MS = matrix spike

MSD = matrix spike duplicate

NE = Not established

PFAS = per- and polyfluoroalkyl substances

Practical quantitation limits (PQLs) based on information provided by Eurofins Environment Testing.

RPD = relative percent difference

SVOCs = semivolatile organic compounds

TDB = total dissolved solids

TOC = total organic carbon

VOCs = volatile organic compounds

μg/L = micrograms per liter

"--" = not provided by laboratory.

Table B-2

Groundwater Test Methods, Sample Containers, Preservation and Holding Time[1]

Marshall Landfill

Spokane County, Washington

Analysis	Matrix	Method	Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times
VOCs	Water	EPA 8260D	40 mL	2 - 40 mL VOA vials preserved with HCL	HCL; Cool <6°C	14 days
Metals (Total)	Water	EPA 6000/7000 Series	50 mL	250 mL poly	HNO3	180 days; 28 days for mercury
Metals (dissolved)	Water	EPA 6000/7000 Series	50 mL	250 mL poly	HNO3	180 days; 28 days for mercury
Alkalinity	Water	EPA 2320B	200 mL	250 mL poly	Cool <6°C	14 days
Anions, ion chromatography	Water	300_ORGFM_28D	20 mL	250 mL poly	Cool <6°C	28 days
	Water	300_ORGFMS	20 mL	250 mL poly	Cool <6°C	48 hours
Ammonia	Water	EPA 350.1	100 mL	250 ml amber glass	H_2SO_4; Cool <6°C	28 days
TOC	Water	SM5310B	100 mL	250 ml amber glass	H_2SO_4; Cool <6°C	28 days
TDS	Water	2540C_Calcd	200 mL	250 mL poly	Cool <6°C	7 days
Cyanide	Water	4500_CN_I_NP	250 mL	250 mL poly	NaOH; Cool <6°C	14 days
SVOCs	Water	EPA 8270E	2,000 mL	2 - 1 L amber glass	Cool <6°C	7 days
Herbicides	Water	EPA 8151A	1,000 mL	1 L amber glass	Cool <6°C	7 days
PFAS	Water	EPA 1633	250 mL	250 mL poly	Cool <6°C	28 days

Notes:

[1]Holding times are based on elapsed time from date of collection.

C = Celsius; mL = milliliters;

H2SO4 = sulfuric acid; HCl = hydrochloric acid; NaOH = sodium hydroxide; PFAS = per- and polyfluoroalkyl substances

SVOCs = semivolatile organic compounds; TDS = total dissolved solids

TOC = total organic carbon

VOA = volatile organic analysis; VOCs = volatile organic compounds

Table B-3

Quality Control Samples Type and Frequency

Marshall Landfill
Spokane County, Washington

Parameter	Field QC			Laboratory QC			
	Field Duplicate	Trip Blanks	Field Blanks	Method Blanks	LCS	MS / MSD	Lab Duplicates
VOCs	1 per groundwater event	1 per groundwater event	1/well sampled	1/batch	1/batch	1/batch	1/batch
Metals (Total and Dissolved)	1 per groundwater event	None	1/well sampled	1/batch	1/batch	1/batch	1/batch
Alkalinity	1 per groundwater event	None	1/well sampled	1/batch	1/batch	1/batch	1/batch
Anions, ion chromatography	1 per groundwater event	None	1/well sampled	1/batch	1/batch	1/batch	1/batch
Ammonia	1 per groundwater event	None	1/well sampled	1/batch	1/batch	1/batch	1/batch
TOC	1 per groundwater event	None	1/well sampled	1/batch	1/batch	1/batch	1/batch
TDS	1 per groundwater event	None	1/well sampled	1/batch	1/batch	1/batch	1/batch
Cyanide	1 per groundwater event	None	1/well sampled	1/batch	1/batch	1/batch	1/batch
SVOCs	1 per groundwater event	None	1/well sampled	1/batch	1/batch	1/batch	1/batch
PFAS	1 per groundwater event	None	1/well sampled	1/batch	1/batch	1/batch	1/batch

Notes:

No more than 20 field samples can be contained in one batch.

LCS = Laboratory control sample

MS = Matrix spike sample

MSD = Matrix spike duplicate sample

PFAS = per- and polyfluoroalkyl substances

SVOCs = semivolatile organic compounds

TDS = total dissolved solids

TOC = total organic carbon

VOCs = volatile organic compounds

APPENDIX C
Health and Safety Plan

APPENDIX C.
GEOENGINEERS, INC.
SITE HEALTH AND SAFETY PLAN
MARSHALL LANDFILL GROUNDWATER MONITORING
FILE NO. 0504-104-01

This Health and Safety Plan (HASP) is to be used in conjunction with the GeoEngineers, Inc. (GeoEngineers) Safety Programs. Together, the written GeoEngineers' safety programs and this HASP constitute the site safety plan for this subject site. This HASP is required by the Hazardous Waste Operations and Emergency Response (HAZWOPER) regulation (29 Code of Federal Regulations [CFR] 1910.120) when preforming mandatory or voluntary clean-up operations and initial investigations conducted to determine the presence or absence of hazardous substances unless the employer can demonstrate that the work does not involve employee exposure to safety and health hazards from hazardous substances at the site. This HASP is to be used by GeoEngineers' personnel on this site and must be available on site, as well as in project Safety folder on Sharepoint.

Standard HASPs will have to be reviewed and approved at least by the GeoEngineers' Project Manager (PM) and the Site Safety Officer (SSO). The PM will need to send an email to GeoEngineers' Health and Safety Manager (HSM) indicating the availability of the final copy of the approved standard HASP on SharePoint for review and/or reference.

All HASPs and/or HCPs are to be used in conjunction with current standards and policies outlined in the GeoEngineers' Health and Safety Programs.

Liability Clause: *If requested by subcontractors, this site HASP may be provided for informational purposes only. In this case, Form 1 of this HASP shall be signed by the subcontractor. Please be advised that this site-specific HASP is intended for use by GeoEngineers' employees only. Nothing herein shall be construed as granting rights to GeoEngineers' subcontractors or any other contractors working on this site to use or legally rely on this HASP. GeoEngineers specifically disclaims any responsibility for the health and safety of any person not employed by the company.*

1.0 GENERAL PROJECT INFORMATION

Project Name:	Marshall Landfill Groundwater Monitoring
Project Number:	0504-104-01
Type of Project:	Groundwater monitoring
Start/Completion:	October 2023 / December 2024
Subcontractors:	Eurofins, Able
Client:	Herrera, Washington State Department of Ecology

Chain of Command	Title		Name		Telephone Numbers (O & C)
1	**Current Property Owner (c/o Herrera Project Manager)**		Nigel Baumer		O: 443.517.9787
2	**Principal-in-Charge**		Scott Lathen		O: 509.209.2843 C: 509.251.5239
3	**Health and Safety Manager (HSM)**		Lucas Miller		O: 509.209.2830 C: 270.978.6222
4	**Health and Safety Specialist (HSS)**		Connor Jordan		O: 253.722.2426 C: 530.210.5462
6	**Project Manager (PM)**		Justin Orr Sydney Bronson		O: 509.570.0779 C: 406.890.1310 O: 425.861.6086 C: 509.951.9058
7	**Site Safety Officer (SSO)**		Justin Orr Bryce Hanson Lola Otoki Morea Schofield		See above C: 360.269.3237 C: 361.777.6086 C: 509.999.6413
8	**Field Personnel**		Justin Orr Bryce Hanson Lola Otoki Morea Schofield		See above See above See above See above
10	**Subcontractor(s)**		Eurofins Able		509.924.9200 509.466.5255

1.1. Functional Responsibility

1.1.1. Health and Safety Manager (HSM)

GeoEngineers' Health and Safety Manager (HSM) is responsible for implementing and promoting employee participation in the company Health and Safety Program. The HSM has overall responsibility for the general health and safety of GeoEngineers' personnel. The HSM issues directives, advisories and information regarding health and safety to the technical staff. Additionally, the HSM has the authority to audit on-site compliance with HASPs, suspend work or modify work practices for safety reasons, and dismiss from the site any GeoEngineers' or subcontractor employees whose conduct on the site endangers the health and safety of themselves or others.

1.1.2. Health and Safety Specialist (HSS)

GeoEngineers' Health and Safety Specialist (HSS) is a designated safety specialist. The HSS provides technical support to the PM and SSO to ensure that that GeoEngineers' staff are following GeoEngineers' safety program and safe work practices during site activities. The HSS works with the PM and SSO to ensure the subcontractors' crews are following the site general HASPs, the activities HASP/JHAs and safe work practices. The HSS may periodically go on-site to perform safety observations and mentor on-site personnel on safety behavior practices. Additionally, the HSS has the authority to suspend work or modify work practices for safety reasons and dismiss from the site any GeoEngineers' or subcontractor employees whose conduct on the site endangers the health and safety of themselves or others. The HSS shall keep the PM and HSM informed of the project's health- and safety-related matters, as necessary.

1.1.3. Project Manager (PM)

A PM is assigned to manage the activities of various projects and is responsible to the principal-in-charge of the project. The PM has the responsibility of ensuring the safety of all GeoEngineers' personnel on job sites. The PM is responsible for assessing the hazards present at a job site and incorporating the appropriate safety measures for field staff protection into the field briefing and/or Site Safety Plan. He or she is also responsible for assuring that appropriate HASPs are developed. The PM will provide a summary of chemical analysis to personnel completing the HASP. PMs shall also see that their project budgets consider health and safety costs. The PM shall keep the HSM and HSS or Health and Safety Coordinator (HSC) informed of the project's health- and safety-related matters as necessary. The PM shall designate the project SSO and help the SSO implement the specifications of the HASP. The PM is responsible for communicating information in site safety plans and checklists to appropriate field personnel. Additionally, the PM and SSO shall hold a site safety briefing before any field activities begin. The PM is responsible for transmitting health and safety information to the SSO when appropriate.

1.1.4. SSO/HAZWOPER

The SSO will have the on-site responsibility and authority to modify and stop work or remove GeoEngineers' personnel from the site if working conditions change that may affect on-site and off-site health and safety. The SSO will be the main contact for any on-site emergency situation. The SSO is First Aid and cardiopulmonary resuscitation {CPR} qualified and has current HAZWOPER training when working at hazardous waste sites. The SSO is responsible for implementing and enforcing the project safety program and safe work practices during site activities. The SSO shall conduct daily safety meetings, perform air monitoring as required, conduct site safety inspections as required, coordinate emergency medical care, and ensure personnel are wearing the appropriate personal protective equipment (PPE). The SSO shall have advanced fieldwork experience and shall be familiar with health and safety requirements specific to the project. The SSO has the authority to suspend site activities if unsafe conditions are reported or observed.

Duties of the SSO include the following:

- Implementing the HASP in the field and monitoring staff compliance with its guidelines.
- Ensuring that all GeoEngineers' field personnel have met the training and medical examination requirements. Advising other contractor employees of these requirements.
- Maintaining adequate and functioning safety supplies and equipment at the site.
- Setting up work zones, markers, signs and security systems, if necessary.
- Performing or supervising air quality measurements. Communicating information on these measurements to GeoEngineers' field staff and subcontractor personnel.
- Lead the pre-entry briefing (at the beginning of the site activities) and the site safety meetings (daily and/or weekly), with onsite personnel. These meetings should include a discussion of emergency response, site communications and site hazards associated with the planned activities.
- Communicating health and safety requirements and site hazards to field personnel, subcontractors and contractor employees, and site visitors.
- Directing personnel to wear PPE and guiding compliance with all health and safety practices in the field.

- Consulting with the PM regarding new or unanticipated site conditions, including emergency response activities. If monitoring detects concentrations of potentially hazardous substances at or above the established exposure limits, notify/consult with the PM. Consult with the PM, the HSC or HSS, and the HSM regarding new or unanticipated site conditions, including emergency response activities. If field monitoring indicates concentrations of potentially hazardous substances at or above the established exposure limits, the HSM must be notified, and corrective action taken.
- Documenting all site accidents, injuries, illnesses and unsafe activities or conditions and/or near misses, and reporting them to the PM, HSC or HSC and the HSM as soon as practical, but no later than the end of the day.
- Directing decontamination operations of equipment and personnel.

1.1.5. Field Employees

All employees working on site that have the potential of coming in contact with hazardous substances or chemical, biological and/or physical hazards are responsible for participating in the health and safety program and complying with the site-specific health and safety plans. These employees are required to:

- Read, participate and be familiar with the GeoEngineers' health and safety programs located in SharePoint. Attend to applicable specific safety training.
- Notify the SSO that when there is need to stop work to address an unsafe situation.
- Comply with the HASP and acknowledge understanding of the plan discussed during the health and safety pre-entry briefing.
- Review applicable Job Hazard Analysis (JHAs) prior starting a new activity and follow the recommended critical actions to mitigate hazards.
- Perform Task Safety Analysis (TSA) at the beginning of a new task, before changing tasks, when conditions changes and after a near miss or incident.
- Report to the SSO, PM or HSM any unsafe conditions and all facts pertaining to near misses, incidents or accidents that could result in physical injury or exposure to hazardous materials and/or equipment damage.
- Participate in health and safety training, including initial 40-hour HAZWOPER course, annual 8-hour HAZWOPER refresher, and First Aid/CPR training.
- Participate in the medical surveillance program, if applicable.
- Schedule and take a respirator fit test annually.
- Any field employee working on site may stop work if the employee believes the work is unsafe.

1.1.6. Contractors Under GeoEngineers Supervision

GEOENGINEERS WILL HIRE CONTRACTORS FOR THIS PROJECT? YES ☒ NO ☐

Contractors working on the site directly for the Client will have their own HASPs or JHAs. Subcontractors working on the site under GeoEngineers' supervision that have the potential of coming in contact with hazardous substances or chemical, biological and/or physical hazards shall have their own health and safety programs and safety plan that is generally consistent with the requirements of this HASP.

Contractor Name		Predicted start/end dates
1. Eurofins Environment Testing		Oct. 2023 – Dec. 2024
Contractor Scope Summary:	Laboratory analysis	
2. Able Cleanup Technologies, Inc.		Nov. 2023 – Dec. 2024
Contractor Scope Summary:	IDW disposal	

1.2. GeoEngineers Field Personnel Qualifications and Readiness Status

Name of Employee on Site	Level of HAZWOPER Training (24-hr/40-hr)	Date of last 8-Hr Refresher Training	Last First Aid/ CPR Training Date
Justin Orr	40-hr	1/20/2023	11/1/2022
Bryce Hanson	40-hr	3/8/2023	11/1/2022
Lola Otoki	40-hr	6/5/2023	6/29/2023
Morea Schofield	40-hr	7/13/2023	--

1.3. Personnel Medical Surveillance

FIELD PERSONNEL ON THIS JOB SITE ARE ☐; ARE NOT ☒ ENTERED IN A GEOENGINEERS PROVIDED MEDICAL SURVEILLANCE PROGRAM.

2.0 WORK SITE

2.1. Site Description

The Marshall Landfill Site is located northwest of Cheney-Spokane Road about 1 mile southwest of the town of Marshall, Washington and 7 miles southwest of Spokane, Washington. The Site consists of two primary land use areas, including the approximate 25-acre Main Landfill and the Five-Acre Landfill. The landfills are generally capped and vegetated with steep slopes to the east. Access roads at the Site are generally unpaved and partially vegetated. Monitoring wells are located around the perimeter of the landfills. There is an active gravel pit to the north of the Site; trucks from the gravel pit use the main access road.

2.2. Site Map

See Figure 2, Site Plan, included with the Work Plan for the site layout and work areas.

2.3. Site History

The Main Landfill operated between 1970 and 1990 and the Five-Acre Landfill operated between 1980 and 1984. The Site history is described in the main body of this Work Plan.

2.4. Previous Investigations

GeoEngineers completed Remedial Investigation (RI) and Feasibility Study (FS) activities between 2016 and 2018. Based on RI/FS results and supplemental groundwater monitoring events conducted by Ecology, groundwater contamination is limited, discontinuous, and variable between monitoring events. Given the limited and sporadic nature of groundwater contamination, there does not appear to be a significant impact to groundwater beneath the Site.

The following table presents the most recent available data of contaminants of concern and was/were collected during the historical Site Investigation(s) conducted at the subject Site.

PREVIOUS INVESTIGATION CONTAMINANTS DATA

Key Study (Name/Company/Date [year])	Main Contaminants of Concern (TPH, VOCs, PAHs, Metals, PCBs, PFAS etc.)	Media (soil, groundwater, sediments, air)
Remedial Investigation, GeoEngineers 2018	Minor/intermittent cyanide, metals, nitrate, SVOCs, pesticidesVOCs, SVOCs, PAHs, metals, pesticides, herbicides	Groundwater

3.0 GEOENGINEERS SCOPE OF WORK

3.1. Summary of Project Scope

In April 2023, Ecology sent a Request for Quotation (RFQ) to conduct additional groundwater monitoring at the Site to evaluate current groundwater conditions at the site. To evaluate groundwater conditions, GeoEngineers plans to redevelop five monitoring wells (MW-2A, MW-5A, MW-7B, MW-11A and MW-12A), install new, dedicated, PFAS-free low-flow bladder pumps in the wells, and conduct quarterly groundwater monitoring activities and submit groundwater samples for chemical analysis for four consecutive quarters.

3.2. Primary Field Tasks

Indicate the primary field tasks to be completed during the scope of this project (delete or add rows as needed). Refer back to this table for development of hazard mitigation strategies in the sections that follow.

3.2.1. Primary Field Tasks to be Performed by GeoEngineers

Task #	Primary Field Task	Predicted start/end dates
1	Redevelop wells and install new dedicated bladder pumps	Oct. 2023 – Dec. 2023
	Task Description: Five monitoring wells will be redeveloped and new dedicated, PFAS-free pumps will be installed.	
2	Groundwater depth gauging	Oct. 2023 – Dec. 2024
	Task Description: Groundwater and total depth readings will be obtained at 17 monitoring wells before groundwater samples are collected.	
3	Groundwater Sampling	Oct. 2023 – Dec. 2024
	Task Description: Five monitoring wells will be sampled using low-flow techniques.	

4.0 HAZARD ANALYSIS

From within the Primary Field Tasks (Section 3.2.1 Primary Field Tasks to be Performed by GeoEngineers, above), identify activities which may pose an elevated risk to worker's health. A list of activities that GeoEngineers recognizes as Elevated Risk Activities (ERA) are included in the dropdowns in table below. If this project has ERA that are not present there, they are to be added. Each ERA triggers the completion of a separate ERA JHA (Form 3).

General Safe Work Practices

- Utility check: there may be site-specific procedures for preventing drilling or digging into utilities. Add these procedures to the standard GeoEngineers' utility check list. Implement additional utilities clearance activities, if deemed necessary (typically if disturbing drilling work is within 2, 5 and/or 10 feet of underground utilities, for Lower, Medium and Higher Risks, respectively)
- Lifting hazards: use proper techniques, mechanical devices where appropriate.
- Terrain obstacles: Terrain could be soft, and activities will be conducted to minimize lawn damage and the potential for vehicles to get stuck.
- Personnel will wear high-visibility vests for increased visibility by vehicle and equipment operators.
- At the beginning of the day conduct a tail gate safety meeting discussing the jobs, the hazards, exclusion zone(s) surrounding work area(s), utilities clearance and actions that will be taken to prevent injury and reduce risk. Discuss "Stop Work Authority" as it applies to each site member. Discuss appropriate PPE including high visibility clothing such as reflective vests. Discuss Competent Person's responsibilities and support of excavation (SOE) protective system(s) and potential de-watering.

4.1. Elevated Risk Activities

DOES THIS PROJECT HAVE ELEVATED RISK ACTIVITIES? YES ☐ OR NO ☒

4.2. General Hazard Review

The Primary Field Tasks identified in Section 3.2.1 are included in the following Primary Field Task Hazard Analysis Tables. The tables list the commonly encountered field hazards for the work we do at GeoEngineers. Hazards are divided into three categories: (A) Chemical; (B) Biological; and (C) Physical.

4.3. Primary Field Task Hazard Analysis

Primary Field Tasks	
# 1	Chemical, Biological, Physical
# 2	Chemical, Biological, Physical
# 3	Chemical, Biological, Physical

Task Hazard Recognition – evaluate primary field tasks for hazards					
Chemical Hazards	**Task #s**	**Biological Hazards**	**Task #s**	**Physical Hazards**	**Task #s**
Dermal Exposure Potential	All	Snakes	All	Lifting or Repetitive Motions	All
		Insects	All	Heat Exposure Risk	All
		Ticks	All	Cold Exposure Risk	All
		Wildlife (other)	All	Trip/Fall Hazards	All

Hazard Details and Controls - include those items checked above		
Chemical Hazards		
Hazard	**When/How Exposure May Occur**	**Critical Actions to Mitigate Hazards**
Known or Expected Human Carcinogens	Anytime during sampling activities, especially when redeveloping wells and collecting groundwater samples	Wear gloves when handling potentially contaminated media Wash hands prior to leaving site and/or eating or drinking

Dermal Exposure Potential	Anytime during sampling activities, especially when redeveloping wells and collecting groundwater samples	Wear gloves when handling potentially contaminated media			
Biological Hazards					
Hazard	**When/How Exposure May Occur**	**Critical Actions to Mitigate Hazards**			
Snakes	Anytime during sampling activities, especially in the summer	Wear long sleeve clothing, check surroundings before sitting or setting down equipment.			
Insects	Anytime during sampling activities, especially in the summer	Wear long sleeve clothing, check surroundings before sitting or setting down equipment. Because PFAS are contaminants of concern, insect repellant may not be used when collecting samples.			
Ticks	Anytime during sampling activities, especially in the summer	Wear long sleeve clothing, check surroundings before sitting or setting down equipment. Because PFAS are contaminants of concern, insect repellant may not be used when collecting samples.			
Wildlife (other)	Anytime during sampling activities, especially in the summer	Wear long sleeve clothing, check surroundings before sitting or setting down equipment.			
Physical Hazard					
Hazard	**When/How Exposure May Occur**	**Critical Actions to Mitigate Hazards**			
Lifting or Repetitive Motions	Anytime, especially during well redevelopment and pump installation.	Use correct lifting practices (i.e. lift with your legs, do not lift more than 50 lbs, etc.)			
Heat Exposure Risk	Work days may be hot	Take breaks and monitor hydration. Know the symptoms of heat stress/exhaustion/stroke. Because PFAS are contaminants of concern, sunscreen may not be used when collecting samples.			
Cold Exposure Risk	Work days may be cold	Dress in layers. Take breaks when necessary.			
PPE (PFAS-Free)	**Task #s**	**Equipment**	**Task #s**	**Tools**	**Task #s**
☐ Hard Hat		☐ Safety Beacons		☒ Cell Phone/Satellite	All
☒ Eye Protection	All	☒ First Aid Kit	All	☒ Digital Camera	All
☐ Hearing Protection		☒ Fire Extinguisher	All	☐ Radio/Spare Batteries	
☒ Gloves	All	☒ Sunglasses/Sunscreen	All	☐ Flashlight	
☒ High Visibility Vest	All	☒ Drinking Water	All	☒ Hands Tools	All
☒ Steel Toe Boots	All	☐ Survival Gear		☐ Other	
☐ Face Shield		☒ Eye Wash Kit	All	☐	
☐		☐ Other		☐	

4.4. Chemical Hazards

The following table is a summary of the chemicals identified at the Site during previous groundwater sampling events and their associated occupational exposure limits (OEL). This table may be revised if additional chemicals are identified based on the groundwater sampling results.

4.4.1. Summary of Chemical Hazard Exposure Limits

Chemical Compound/ CAS #	Primary Field Task or Elevated Risk Activity With Potential Exposures	OSHA Permisible Exposure Limit (PEL)	WA-DOSH (PEL)	ACGIH Exposure Limits (TLV and/or TWA)	NIOSH Exposure Limits (REL and/or IDLH)
Cadmium	All	TWA 0.005 mg/m3 IDLH 9 mg/m3		TLV –TWA = 0.002 mg/m3	
Lead	All	PEL: 0.05 mg/m3 50 µg/m^3	AL: 30 µg/m^3 PEL: 0.05 mg/m3 50 µg/m^3	TLV 0.05 mg/m^3	REL 0.05 mg/m^3 IDLH 100 mg/m^3
Cyanide	All	TWA 11 mg/m^3			REL 5 mg/m^3 IDLH 50 ppm
1,4-Dioxane	All	TWA 100 ppm 360 mg/m^3		TLV-TWA 20 ppm	C 1 ppm 3.6 mg/m^3 IDLH 500 ppm
Bis(2-Ethylhexyl) Phthalate	All	TWA 5 mg/m3			TWA 5 mg/m3 ST 10 mg/m3
2,6-Dinitrotoluene	All	TWA 1.5 mg/m^3			TWA 1.5 mg/m^3 IDLH 50 mg/m^3
Mecoprop (MCPP)	All	Not established			

Notes:

*If a State has established a PEL more restrictive than the OSHA limits, then the applicable State limit becomes the legal limit.

IDLH = immediately dangerous to life or health

OSHA = Occupational Safety and Health Administration

ACGIH = American Conference of Governmental Industrial Hygienists

NIOSH = National Institute of Occupational Safety & Health

mg/m3 = milligrams per cubic meter (dust or particulate conc.)

TWA = time-weighted average (Over 8 hrs.), basis of most exposure limits

PEL = permissible exposure limit, legally enforceable

TLV = threshold limit value (over 8 hrs)

REL= recommended exposure limit (over 10 hrs)

STEL = short-term exposure limit (15 min)

Ceiling (C) – concentration never to be exceeded

ppm = parts per million (vapor conc.)

4.4.2. Descriptive Summaries of Chemicals Present

Chemical Compound	Physical Characteristics of Chemical	Acute ☒ and/or Chronic ☒ Symptoms of Exposure
Cadmium	Soft, silvery-white metal. Usually found as dust	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]
Lead	Soft heavy metal that is silvery with a hint of blue; it tarnishes to a dull gray color when exposed to air	Lassitude (weakness, exhaustion), insomnia, facial pallor, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, wrist and ankle paralysis, encephalopathy, kidney disease, irritated eyes, hypotension
Cyanide	Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor.	Asphyxia; lassitude (weakness, exhaustion), headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and gasping; thyroid, blood changes
1,4-Dioxane	Colorless liquid with a faint sweet odor	Irritated eyes, skin, nose, throat; drowsiness, headache; nausea, vomiting; liver damage; kidney failure; (potential occupational carcinogen)
Bis(2-Ethylhexyl) Phthalate	Colorless, oily liquid with a slight odor	Irritation eyes, mucous membrane; in animals: liver damage; teratogenic effects; (potential occupational carcinogen)
2,6-Dinitrotoluene	Orange-yellow crystalline solid with a characteristic odor.	Anoxia, cyanosis; anemia, jaundice; reproductive effects; [potential occupational carcinogen]
Mecoprop (MCPP)	Colorless to brown crystalline powder	Burning sensation; cough; nausea; redness of eyes and skin, abdominal point, nausea; weakness; unconsciousness
Where and how exposure may occur:	Handling potentially contaminated media while purging groundwater and while collecting groundwater samples	

5.0 AIR MONITORING PLAN

AIR MONITORING FOR PERSONAL EXPOSURES WILL ☐, WILL NOT ☒ BE IMPLEMENTED AS PART OF THIS HASP.

6.0 OTHER PERSONAL PROTECTIVE EQUIPMENT

The appropriate PPE will be selected on a daily or task-specific basis. These PPE selections will be communicated to field personnel during the pre-work briefing **before** the start of Site operations.

Gloves	Clothing
☒ Nitrile ☐ Latex ☐ Liners ☒ Cold Weather	☒ High-vis Vest ☐ Tyvek ☐ Saranex ☐ Snake Chaps
☐ Leather ☒ General Construction Gloves ☐ Cut resistant/Kevlar ☐ Rubber ☐ Other	☐ Fire Retardant Clothing ☒ Long Pants ☒ PFAS-free rain gear ☐ Long Sleeve Shirt ☐ Other

Gloves	Clothing
Head	**Eye & Face**
☐ Hard Hat ☐ Climbing Helmut ☒ Sunhat	☒ Safety Glasses ☐ Face Shield ☐ Goggles ☐ Sun Glasses
Hearing Protection	**Feet**
☒ Ear Plugs ☐ Ear Muffs ☐ Flanges	☒ Safety Toe Work Boot/Shoe ☐ Safety Toe Rubber Boot ☐ Hiking Boot ☐ Hip Wader ☐ Chest Wader

6.1. Personal Protective Equipment Inspections

PPE ensemble shall be selected daily or before each separate task to provide protection against known or anticipated hazards. To obtain maximum performance from PPE, site personnel shall be trained in the proper use and inspection of PPE.

7.0 SITE CONTROL PLAN

7.1. Traffic or Vehicle Access Control Plans

WILL VEHICLES, HEAVY EQUIPMENT AND/OR PEDESTRIANS TRAFFIC BE CONTROLLED ON THIS SITE? YES ☐ NO ☒.

7.2 Site Work Zones

Exclusion zones will be established within approximately 10 to 15 feet around each working area. Only persons with the appropriate training will enter this perimeter while work is being conducted in these exclusion zones.

In addition, an exclusion zone, contamination reduction zone and support zone should be established when the project involves significant chemical contamination and potential of for exposure to contaminants to on-Site personnel. Passage through zones or out of the Site should be consistent with the level of decontamination required.

Decontamination, at a minimum, should include removing and disposing of PPE when exiting the exclusion zone and washing your hands. Decontamination may also consist of removing outer protective gloves and washing soiled boots and gloves using bucket and brush provided on site in the contamination reduction zone. If needed, inner gloves will then be removed, and hands and face will be washed in either a portable wash station or a bathroom facility at the site. Employees will perform decontamination procedures and wash before eating, drinking, or leaving the Site.

The contamination reduction zone, at a minimum, should consist of garbage bags into which used PPE should be disposed. Personnel should wash hands before eating or leaving the reduction zone.

Drinking, eating, smoking, and using phones are not allowed in the Exclusion and Reduction Zones.

A site control/site layout map was included in Section 2.2 Site Map. Yes ☒ or No ☐.

7.1.1. Work Zone Parameters and Decontamination Procedures

Zone	Size/Location of Zone	Steps Required to Enter	Steps Required to Exit
Exclusion	15 feet around current well	Level D PPE and nitrile gloves	Discard nitrile gloves, make sure boots are clean
Reduction	Trash bags	Throw away disposable PPE and sampling equipment	Wash hands
Support Zone	Site area more than 15 feet from current well	Notify SSO	Notify SSO

Equipment or tools operated or maintained by GeoEngineers on a contaminated site may need to undergo decontamination procedures as they travel through Site work zones. The following table summarizes the steps needed to safely move these items through zones.

7.1.2. Work Zone Parameters for Equipment or Tools

Zone	Steps Required to Enter	Steps Required to Exit
Exclusion	Wear PPE	Knock large debris off equipment near the well
Reduction	Large debris has been removed from equipment	Decontaminate equipment per instructions in the Work Plan
Support Zone		

7.3 Buddy System

Personnel on site should use the buddy system (pairs), particularly whenever communication is restricted. If only one GeoEngineers' employee is on Site, a buddy system can be arranged with subcontractor/ contractor personnel.

7.4 Site Communication Plan

Communication Equipment	Location Used	Phone #s/Channels
Cell phones	Site	See contact information (Section 1.0)

Positive communications (within sight and hearing distance or via radio) should be maintained between workers on Site, with the pair remaining in proximity to assist each other in case of emergencies. The field team should prearrange other emergency signals for communication when voice communication becomes impaired (including cases of dropped cell phone or radio breakdown) and an agreed upon location for an emergency assembly area.

Personnel from GeoEngineers and subcontractor(s) should be made aware of safety features during safety tailgate meetings (drill rig shutoff switch, location of fire extinguishers, cell phone numbers, etc.).

On-Site personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus (drilling rig, CPT unit and/or excavator) only when they are certain the operator has indicated it is safe to do so. ("Show My Hands Technique" or another agreed sign language).

7.5. Investigative Derived Waste (IDW) Disposal or Storage

IDW Type	Action
Well Water	☒ On Site, pending analysis and further action
	☐ Secured (list method):
	☐ Other (describe destination, responsible parties):
PPE	☐ On Site, pending analysis and further action
	☐ Secured (list method):
	☒ Other (describe destination, responsible parties): placed in black contractor bags and disposed in trash receptacle

7.6. Spill Containment Plans

WILL SPILL CONTAINMENT CONTINGENCIES BE NEEDED ON THIS PROJECT? YES ☐ OR NO ☒

7.7. Sampling, Managing and Handling Drums and Containers

THERE WILL BE DRUMS OR SEALED CONTAINERS ON SITE DURING THIS PROJECT? YES ☒ OR NO ☐

Drums and containers used during the investigation and/or cleanup activities shall meet the appropriate Department of Transportation (DOT), Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (EPA) and applicable state regulations for the waste that they contain. Site operations shall be organized to minimize the amount of drum or container on-Site temporary storage and movement. When practicable, drums and containers shall be inspected, and their integrity shall be ensured before they are moved. Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled. Before drums or containers are moved, employees involved in the transfer operation shall be warned of the potential hazards associated with the contents. Personnel involved with the coordination of the drum or container's off-Site disposal shall ensure that the off-site disposal facility is approved by the GeoEngineers' PM and the Client.

Drums or containers and suitable quantities of proper absorbent shall be kept available and used where spills, leaks or rupturing may occur. Where major spills may occur, a spill containment program shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

Fire extinguishing equipment shall be on hand and ready for use to control incipient fires.

7.8. Sanitation

Field staff and subcontractors must go off Site to access sanitation facilities.

7.9. Lighting

Work is anticipated to be performed during daylight hours.

8.0 EMERGENCY RESPONSE

For each potential site emergency indicate what site-specific procedures you will implement to address the occurrence.

Emergency Event	Response Plan
Medical	Get injured personnel to the hospital. If life-threatening, call 911.

8.1. General Response Guidance

- If any member of the field crew experiences any adverse exposure symptoms while on Site or an injury, the entire field crew should immediately halt work and act according to the instructions provided by the SSO.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should result in the evacuation of the field team, contact of the PM, and reevaluation of the hazard and the level of protection required.
- As soon as feasible, notify GeoEngineers' PM and follow the GeoEngineers' Incident Reporting and Investigation Program, and Health and Safety Injury Management Procedures Flowchart (see copy attached to this HASP).
- If an accident occurs, the SSO and the injured person are to complete, within 24 hours, an Incident Report (Form 4) for submittal to the PM, the HSPM, and Human Resources (HR). The PM should ensure that follow-up action is taken to correct the situation that caused the accident or exposure.

Hospital Name and Address: **Sacred Heart Medical Center**
101 West 8th Avenue

Phone Numbers (Hospital ER): 509.474.3131

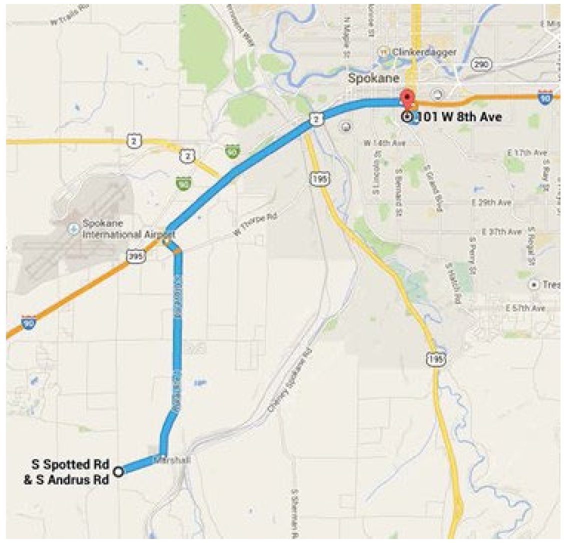
Distance: 10 miles

Route to Hospital:

1. Head east on W Andrus Rd towards S Grove Rd
2. Turn left onto S Grove Rd
3. Turn right to merge onto I-90E
4. Take exit 281 for Division St toward US-2 E / US-395 N/Newport/Colville
5. Keep right at the fork, follow signs for Division St S.
6. Turn right onto South Division Street

Turn right onto W 8th Avenue

Map to Hospital:



Ambulance: 9-1-1

Poison Control: 800.732.6985

Police: 9-1-1

Fire: 9-1-1

Location of Nearest Telephone: Cell phones are carried by field personnel. Check connectivity at work site location.

Nearest Fire Extinguisher: Located in the GeoEngineers vehicle on site.

Nearest First-Aid Kit: Located in the GeoEngineers vehicle on site.

Standard Emergency Procedures

Get help

- Send another worker to phone 9-1-1 (if necessary)
- As soon as feasible, notify the GeoEngineers' PM and/or GeoEngineers HSM and follow the GeoEngineers' Incident Reporting and Investigation Program, and Health and Safety Injury Management Procedures Flowchart (see copy attached to this HASP).

Reduce risk to injured person

- Turn off equipment.
- Move person from injury location to safer area (if in life-threatening situation only).
- Keep person warm.
- Perform CPR (if necessary).

Transport injured person to medical treatment facility (if necessary)

- By ambulance (if necessary) or GeoEngineers' vehicle.
- Stay with person at medical facility.
- Keep GeoEngineers' PM apprised of situation and notify HR Manager of situation.
- Accidents involving injuries requiring professional medical attention must be reported within 1 hour of occurrence to the Safety Officer.
- First aid cases not involving professional medical attention must be reported within 24 hours after occurrence.
- Incidents involving property damage must be reported within 24 hours of occurrence.
- After hours illnesses must be reported within 24 hours (i.e., flu, rashes).

9.0 DOCUMENTATION TO BE COMPLETED FOR HAZWOPER PROJECTS

- PM Checklist
- Daily Field Log
- FORM 1—Health and Safety Pre-Entry Briefing and Acknowledgment of Site Health and Safety Plan for use by employees, subcontractors and visitors
- FORM 2—Safety Meeting Record
- FORM 3—Elevated Risk Job Hazard Analyses (ERA-JHA) Form (as needed)
- FORM 4—Near Miss Form (as needed)
- FORM 4—Incident Report Form (as needed)
- FORM 5—Direct Reading Instrument Monitoring Log (as needed)

10.0 APPROVALS - HASP for Marshall Landfill Groundwater Monitoring

For HASPs with elevated risk tasks including but not limited to confined spaces, working over water, hazardous atmospheres, chemical hazards, extreme weather conditions, fall protection/rope access, or respirator usage the Health and Safety Team must review and sign lines 3 and 4. The Health and Safety Team may review other JHAs/HASPs as they have time upon request and will sign lines 3 and/or 4.

1. Plan Prepared by		
	Signature	Date
2. Project Manager Plan Approval		
	PM Signature	Date
3. Health and Safety Specialist or Consultant		
	HSS or HSC Signature	Date
4. Health and Safety Manager		
	HSM Signature	Date
5. GeoEngineers Laboratory Manager		
	GLM Signature	Date

Attachments:

Form 1: HEALTH AND SAFETY PRE-ENTRY BRIEFING AND ACKNOWLEDGEMENT
Form 2: SITE SAFETY MEETING RECORD (Daily or weekly)
Form 3: ELEVATED RISK ACTIVITY JHA FORM
Form 4: NEAR MISS OR INCIDENT REPORT FORM

FORM 1
HEALTH AND SAFETY PRE-ENTRY BRIEFING AND ACKNOWLEDGEMENT

FOR GEOENGINEERS' EMPLOYEES, SUBCONTRACTORS AND VISITORS
Marshall Landfill Groundwater Monitoring, Spokane County, WA
File No. 0504-104-01

Inform GeoEngineers employees, contractors and subcontractors or their representatives about:

- The nature, level and degree of exposure to hazardous substances and other hazards they are likely to encounter;
- All site-related emergency response procedures; and
- Any identified potential fire, explosion, health, safety or other hazards.

Conduct safety pre-entry briefing meeting with GeoEngineers on-Site employees, contractors and subcontractors, or their representatives as follows:

- A pre-entry briefing before any Site activity is started.
- Additional briefings, as needed, to make sure that the Site-specific HASP is followed, especially prior starting new activities and/or when new on-Site personnel is planning to work at the Site.
- Make sure all employees (GeoEngineers, contractors, subcontractors and equipment/material delivery companies) working on the Site are informed of any risks identified and trained on how to protect themselves and other workers against the Site hazards and risks.
- Update all information to reflect current Site activities and hazards.
- All personnel participating in this project must receive "initial" health and safety orientation. Thereafter, brief daily or weekly tailgate safety meetings will be held as deemed necessary by the Site Safety Officer.
- The orientation and the tailgate safety meetings shall include a discussion of emergency response, Site communications and site hazards associated with the planned activities and activities performed concurrently by others at the Site in the vicinity of the working areas.
- Have all personnel attending the pre-entry briefing meeting sign Form 2 of the HASP.

(All of GeoEngineers' Site workers shall complete this Form 1, which should remain attached to the HASP and be filed with other project documentation). Please be advised that this Site-specific HASP is intended for use by GeoEngineers employees only. Nothing herein shall be construed as granting rights to GeoEngineers' subcontractors or any other contractors working on this Site to use or legally rely on this HASP. GeoEngineers specifically disclaims any responsibility for the health and safety of any person not employed by the company.

I hereby verify that a copy of the current HASP has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge an understanding of the safety procedures and protocol for my responsibilities on Site. I agree to comply with all required, specified safety regulations and procedures.

Print Name	Company	Signature	Date

FORM 1 (CON'T)
HEALTH AND SAFETY PRE-ENTRY BRIEFING AND ACKNOWLEDGEMENT

Marshall Landfill Groundwater Monitoring, Spokane County, WA
File No. 0504-104-01

Print Name	Company	Signature	Date

FORM 2
SITE SAFETY MEETING RECORD (Daily or weekly)

Marshall Landfill Groundwater Monitoring, Spokane County, WA
File No. 0504-104-01

Site Safety meetings should include a discussion of emergency response, Site communications and Site hazards associated with the planned activities. Site safety meetings should be completed prior to implementing Site activities at a minimum in the beginning of each day and/or at a minimum weekly for similar activities performed few consecutive days.

- Use in conjunction with the HASP Hazard Review and ERA Job Hazard Analyses (JHA) Form 3 to help identify hazards with the planned activities and activities performed concurrently by others at the Site in the vicinity of the working areas.

Date: ______________________________ **Site Safety Officer (SSO):** ____________________________________

Topics: ____

____

Attendees:

Print Name	Company	Signature

FORM 3
ELEVATED RISK ACTIVITY JHA FORM

Marshall Landfill Groundwater Monitoring, Spokane County, WA

This ERA JHA Form is to be used when the project's Principal Field Tasks (Section 4.1) include elevated risk activities. Complete a separate ERA JHA for each identified elevated risk activity. Add activities manually if not included in drop down. Activity Phases may include staging/set-up/initiation/operations/shutdown/clean-up or others specific to this project. If all phases of this activity have the same controls, indicate this by including all applicable phase names in single row.

<table>
<tr><td>Elevated Risk Activity:</td><td colspan="3">Choose an item.</td></tr>
<tr><td>Written by:</td><td>Position/Title:</td><td>Reviewed by:</td><td>Position/Title:</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">Required Planning Actions <u>Prior</u> to Arriving on Site:</td></tr>
<tr><td colspan="2">1.</td><td colspan="2">2.</td></tr>
<tr><td colspan="2">3.</td><td colspan="2">4.</td></tr>
<tr><td colspan="2">5.</td><td colspan="2">6.</td></tr>
</table>

<table>
<tr><th>Activity Phase</th><th>How Risk May Occur</th><th>Phase Based Hazard Mitigations</th></tr>
<tr><td rowspan="8">Set-up</td><td rowspan="8">Unfamiliar locations, congestion, unpaved roads, Mechanical Failure, Flat Tires Vehicle Fire, Exhaust Leaks, Vehicle Collision, Internal Projectiles</td><td>Actions</td></tr>
<tr><td>• Test equipment
• Reset starter
• Clear road of fallen trees</td></tr>
<tr><td>PPE</td></tr>
<tr><td>•</td></tr>
<tr><td>Equipment</td></tr>
<tr><td>•</td></tr>
<tr><td>Tools</td></tr>
<tr><td>•</td></tr>
<tr><td rowspan="8">Operations - Shut-down - Cleanup</td><td rowspan="8">Slipping into waste water pond from shore</td><td>Actions</td></tr>
<tr><td>•</td></tr>
<tr><td>PPE</td></tr>
<tr><td>•</td></tr>
<tr><td>Equipment</td></tr>
<tr><td>•</td></tr>
<tr><td>Tools</td></tr>
<tr><td>•</td></tr>
</table>

Communication Plan

Activity Phase	Mode Communication During Task Phase	Frequency of Communication	Related Reference Material or Plan
Set-up	Cellular Phone	Continuous	Action Level Table
Operations		Every 4 hours	River Map

FORM 4
NEAR MISS OR INCIDENT REPORT FORM

Marshall Landfill Groundwater Monitoring, Spokane County, WA
File No. 0504-104-01

Electronic Version Available at: https://safety.geoengineers.com/nearmisses/new or https://safety.geoengineers.com/incidents/new

NEAR MISS

Near Miss Date	
Reported By	
Location	
Location Type	
Incident Details	
How did the incident happen?	
What led to the Near Miss occurring? (Contributing factors, constraints, the setting, behaviors, etc.)	
What is the most important thing you learned from this Near Miss that others could learn from?	

INCIDENT REPORT

Basic Information	
Incident Date	
Reported By	
Location	
Location Type	
Business Unit	
Office Information	
Project Manager	
Group Leader	

Office Manager	
Other Emails	
Incident Type (more than one OK)	
	Injury
	Vehicle
	Utility Strike
	Damaged Property
	Stolen Equipment
Incident Details What happened? Describe how the incident occurred. Where the employee was located at the time of the incident.	
Project Number (if project related)	
Date & Time employee started working	
Date & Time supervisor notified	
Supervisor Name	
Notified Project Manager/PA	___ Yes ___ No
Client Notified	___ Yes ___ No
Supervisor Comments (Optional. These are usually filled out later.)	
Supervisor Comments Date	
Project Manager Comments (Optional. These are usually filled out later.)	
Project Manager Comments Date	
Health and Safety Comments (Optional. These are usually filled out later.)	
Health & Safety Rep Name	
Health & Safety Comments Date	
Corrective Action (Optional. These are usually filled out later.)	