Groundwater Sampling & Analysis Plan

Pickles Butte Sanitary Landfill

Tetra Tech Project# 114-571040-2023
December 1, 2023

PRESENTED TO

Canyon County
15500 Missouri Avenue
Nampa, Idaho 83686

PRESENTED BY

Tetra Tech
2525 Palmer Street
Suite 2
Missoula, MT 59808

P +1-406-543-3045
F +1-406-543-3088
tetratech.com

Prepared/Modified by:

Ron Phillips, P.G.
Tetra Tech
Project Geologist

Date:
12/1/2023

Prepared by:

Natalie J. Morrow, LG, LHG
Tetra Tech
Environmental Geologist

Date:
11/29/2017

Reviewed by:

Maureen McGraw, PhD, PE
Tetra Tech
Project Manager

Date:
12/1/2023

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

ACRONYMS / ABBREVIATIONS

Acronyms/Abbreviations	Definition
%	Percent
%R	Percent recovery
°C	Degrees Celsius
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
DEQ	Department of Environmental Quality
DO	Dissolved oxygen
DQOs	Data quality objectives
EPA	Environmental Protection Agency
gpm	Gallons per minute
HASP	Health and safety plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDAPA	Idaho Administrative Procedures Act
LCS	Laboratory control sample
MCL	Maximum contaminant level
MDL	Method detection limit
mg/L	Milligrams per liter
mL	Milliliter
MS	Matrix spike
MSD	Matrix spike duplicate
NPA	Nitrate Priority Area
ORP	Oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PARCC	Precision, accuracy, representativeness, comparability, and completeness
PBSL	Pickles Butte Sanitary Landfill
PM	Project manager
PPE	Personal protective equipment
PQL	Practical quantitation limit
QA	Quality assurance
QC	Quality control
QA/QC	Quality assurance/quality control

Acronyms/Abbreviations	Definition
RPD	Relative percent difference
RSL	(EPA) Regional Screening Level
SAP	Sampling and Analysis Plan
SC	Specific conductivity
SOP	Standard operating procedure
US	United States

SAMPLING AND ANALYSIS PLAN UPDATE LOG

Revision Date	Update Description	Author	Reviewer
December 1, 2023	• Included PB-16 in the sampling program, removed PB-5 and PB-6 from the list of active wells • Updated text to reflect the use of electronic notes and sampling logs • Updated details for pump operation to reflect standard field practice • Updated Table 4.3 with the November 2023 EPA Regional Screening Levels (RSLs). • Updated tables and text to reflect latest groundwater measurements	Ron Phillips, PG	Maureen A. McGraw, PhD, PE
September 12, 2018	• Laboratory changed name from ESC Lab Science to Pace Analytical National Center for testing and Innovation • Included Table 8-3: Pump Bladder and Tubing Volumes • Added laboratory analysis for Total Kjeldahl and Ammonia Nitrogen, Organic Nitrogen (calculated), Chloride, and Total Dissolved Solids	Ron Phillips, PG	Maureen A. McGraw, PhD, PE
November 29, 2017	Original Plan	Natalie J. Morrow, LG, LHG	Maureen A. McGraw, PhD, PE

1.0 SITE LOCATION AND DESCRIPTION

Canyon County (the "County") contracted Tetra Tech to assist with Pickles Butte Sanitary Landfill (PBSL, or "the Landfill") activities beginning in 2015. PBSL is located at 15500 Missouri Avenue in Nampa, Canyon County, Idaho.

The landfill began accepting waste in 1983 under the original facility design, which was revised in 1994 as part of licensing the facility with the Idaho DEQ under the Federal Subtitle D rules. The cut and fill configuration approved in a letter from Southwest District Health (SWDH) on March 14, 2017 is the currently approved design for the facility.

This sampling and analysis plan (SAP) was prepared to guide groundwater monitoring and sampling activities at PBSL. This SAP covers existing wells, and any wells installed in the future can be added to this plan. This plan should be reviewed and updated when wells are added or removed from the sampling program or when other modifications (e.g. constituents sampled) are made.

2.0 SITE BACKGROUND

Two previous studies researched and investigated the geology, stratigraphy, and groundwater flow characteristics near to and beneath the Landfill. Holladay Engineering Company (Holladay) conducted the first study beginning in 1992. The results are summarized in a report titled *Hydrogeologic Characterization, Ground Water Monitoring Plan, and Facility Design, Pickles Butte Sanitary Landfill* (Holladay 1994a). This report was the initial status report for the Landfill and was commissioned by Canyon County for the Landfill to comply with Title 39, Chapter 74 of the Idaho Solid Waste Facility Act.

Daniel B. Stephens & Associates, (DBS&A) conducted the second primary investigation to study subsurface conditions beginning in 2011. The results were summarized in two reports: *Hydrogeologic Characterization Report, Pickles Butte Sanitary Landfill* (DBS&A, 2014a), and *Monitor Well Installation, Pickles Butte Sanitary Landfill* (DBS&A, 2014b).

Tetra Tech reviewed these two studies and presented a summary of the findings in the Landfill Status Report Update (Tetra Tech 2015). The evaluation included a review of the geology, stratigraphy, groundwater flow characteristics, groundwater composition, and groundwater sampling program for PBSL. Groundwater beneath PBSL is greater than 400 feet below ground surface (bgs) and has a unique chemistry. The potential for impacts to groundwater from PBSL are low because of the depth to groundwater and the geologic stratigraphy.

Although exempt from groundwater sampling per 40 CFR 258.50, Canyon County has maintained a biannual groundwater-sampling program at PBSL. **Figure 1** (**Appendix A**) shows the location of wells relative to the 2023 footprint of the Landfill. PBSL sampled wells PB-3 through PB-15 on a biannual basis from 1995 until Tetra Tech began the sampling in December 2017. Samples were not always collected from PB-5, PB-6, and PB-7 due to low flow or because the wells were dry.

Initial well purging and sampling efforts were conducted using stainless steel bailers, with a bailer dedicated to each well. At some point in the past (approximately October 2003), the well sampling procedure was field modified to collect the groundwater sample from the first bailer placed in the well, rather than purging water and obtaining new formation water prior to sampling. This modification was made because the repeated action of lowering and raising the bailer in the water column was causing the water to become turbid.

This sampling procedure is not considered to be standard practice for sampling monitoring wells to reflect aquifer conditions, and Tetra Tech recommended modifying the groundwater sampling method by installing dedicated, low-flow submersible pumps in each well and using U.S. Environmental Protection Agency's (EPA's) low-flow purging and sampling method. This method would provide consistent samples, and improves sample accuracy, reduces sample variability, and increases the well life by reduced pumping stress. The pumps were installed in December 2017, and the first groundwater monitoring event using the low-flow technique was conducted that month. The pumps were installed in monitoring wells PB-4 and PB-7 through PB-15. Monitoring well PB-3 had been closed in June 2017 to allow for the construction of the current landfill cell. Quarterly groundwater monitoring using the pumps was conducted 8 times (through September 2019). Semi-annual sampling has been conducted since September 2019.

EPA regulations (40 CFR, Chapter I, Part 258.53) include general groundwater monitoring requirements for municipal solid waste landfills. Groundwater samples have been analyzed for constituents listed in Appendix I of 40 CFR 258. The testing has included measuring various geochemical parameters in the field, laboratory analysis for volatile organic compounds (VOCs) by EPA method 8260B, and for metals using EPA methods 200.7/200.8. EPA Method 200.11 is used for the metals digestion.

The construction method of monitoring well PB-4 was suspected of allowing landfill gas to migrate downward between the walls of the boring and the well casing and causing contaminants of potential concern (COPCs) to be transferred to the water. Monitoring well PB-16 was installed in March – April 2020 to provide a properly constructed monitoring well that would accurately define groundwater conditions at this location. PB-4 was closed in September 2020.

Background levels of metals or organic contaminants in groundwater have not been established for PBSL because the groundwater monitoring program is conducted voluntarily. However, a review of the data indicates that samples from some of the wells have concentrations above detection limits for arsenic, barium, cadmium, copper, chromium, nickel, and zinc. Acetone was observed in groundwater from well PB-4 in October 2014 and again in PB-3, PB-4, and PB-13 during the April 2015 sampling event. The source of the acetone is likely not related to the landfill due to the stratigraphy, depth to groundwater, and thickness of the confining layer present beneath the PBSL. The acetone is likely a result of cross contamination in the field or laboratory, because it is a common laboratory contaminant. Acetone does not currently have an EPA or Idaho Department of Environmental Quality (DEQ) groundwater standard.

Benzene is routinely detected in monitoring well PB-12 at consistent concentrations of near 0.0015 micrograms per liter. The source of the benzene is likely not related to the landfill due because of the depth to groundwater, distance to the landfill from this location, and lack of benzene in other wells. The source is suspected of being cross contamination from either the well installation or initial sampling. The concentrations have never exceeded the EPA for DEQ standards.

While Canyon County has been granted a waiver for conducting groundwater monitoring, the County has elected to conduct groundwater monitoring on a semi-annual basis.

3.0 SCOPE OF WORK

This SAP was prepared to guide well sampling activities to ensure consistency in sample purging and collection methods, quality assurance (QA)/quality control (QC), sample handling and shipping, field documentation, decontamination, and reporting.

- Measure depth to water in 10 wells at the Site.
- Sample groundwater in 10 wells at the Site.
- Collect quality control samples.
- Submit the samples to Pace Analytical National Center for Testing and Innovation (Pace) for analysis of metals, volatile organic compounds (VOCs), total Kjeldahl nitrogen, ammonia nitrogen, chloride, and total dissolved solids (TDS), and calculation of organic nitrogen.
- Prepare a groundwater monitoring report.

The following sections detail the work to be performed. The work described is designed to meet project quality objectives (**Section 7**) and will be collected following the procedures and methods defined in **Sections 9** through **18** of this document.

4.0 QUALITY OBJECTIVES AND CRITERIA

Data quality objectives (DQOs) for this project were developed to help define the requirements to support the qualitative and quantitative design of the data collection effort. DQOs are also used to assess the adequacy of the data in relation to their intended use. The DQO process allows Tetra Tech to evaluate the level of data quality required for specific data collection activities.

The objective of QA/QC is to ensure that analytical results obtained by sample analyses are representative of actual chemical and physical composition of the groundwater. Field QA/QC will consist of following a standard protocol for field documentation; equipment maintenance and calibration; sample collection and handling of natural and QC samples (**Sections 9** through **17**).

4.1 PROBLEM STATEMENT

The County is interested in continuing the evaluation of groundwater beneath and adjoining the PBSL. Groundwater sampling includes the 10 existing wells (PB-5 through PB-16.

Media affected that will be investigated during this project includes groundwater. This investigation will provide background metals and VOC data to continue to evaluate groundwater chemistry over time and help identify potential future landfill impacts to groundwater.

4.2 DECISION STATEMENT

This investigation will involve collecting environmental data to support evaluation of groundwater chemistry related to potential contaminants of concern related to the operation of the landfill. Tetra Tech will evaluate the data collected and make decisions based on the following decision statements.

- What are the background groundwater conditions at PBSL?
- Based on background monitoring, are there wells that exhibit concentrations of contaminants of potential concern (COPCs) or other chemical parameters above primary or secondary numerical water quality standards?
- Do concentrations of COPCs indicate leachate from PBSL is migrating to groundwater?
- Do concentrations of COPCs indicate that landfill gas may be affecting groundwater?
- Based on the analytical results, are additional wells needed for long-term monitoring?

4.3 SITE CONCEPTUAL MODEL

Tetra Tech (2015) provides additional landfill, geologic and groundwater information. A summary is provided below.

4.3.1 Geology

The PBSL is located in the western portion of the Snake River Plain. The Snake River Plain is a broad structural depression that extends across southern Idaho in a northwesterly/southeasterly direction. The center of the plain dropped several thousand feet relative to the margins due to faults (Swirydczuk, et. al. 1982). The basin created by the faulting has been filled over the past several million years by igneous rocks, lacustrine (lake deposited) and fluvial (river deposited) sediments to depth potentially greater than 20,000 feet (Mabey 1982).

A relatively thin layer of basalt belonging to the Bruneau Formation is present on the top of Pickles Butte and the adjacent ridge. Well PB-13 encountered the basalt but available information does not indicate that this material is present within the boundaries of the Landfill. The basalt overlies the Tuana Gravel formation, which consists mainly of sand and gravel. The Tuana Gravel is present at PBSL area only on the upper part of Pickles Butte and in the northeastern rim of Deadhorse Canyon. It was encountered while drilling wells PB-13, PB-14, and PB-15, located near the southern edge of the active landfill (DBS&A 2014).

The majority of the geologic materials exposed at PBSL is the Upper Glenns Ferry Formation, a primarily sand and silt unit that generally becomes finer grained and more consolidated or indurated with increasing depth. The formation ranges from poorly to well sorted, from very fine grained to coarse grained, and from having little or no consolidated structure to a well-lithified sandstone. The lower depth of the formation consists primarily of siltstone or claystone (Tetra Tech 2015).

A laterally extensive confining layer in the Glenns Ferry Formation is present beneath PBSL. Depths of the confining layer range from 150 to 500 feet deep. It is hundreds of feet thick and extends across the entire landfill area. The transition between the confining layer and the sediments above it has been described as “abrupt.” Its presence across the area is well-defined and generally described as a siltstone or claystone on lithologic logs. Contained within the layer is a boundary at which sediments below were deposited in an anoxic state and characterized by blue green or blue grey coloring.

Methane was monitored in a study by Holladay (1994a) but the results were believed to be characteristic of naturally occurring methane due to natural organics contained within the lithology present and depth of wells in which the methane was detected; rather than from PBSL wastes.

4.3.2 Groundwater

Groundwater conditions across the PBSL area are somewhat variable. There are three water bearing zones referred to as Upper Aquifer (UA), Middle Aquifer (MA), and Bottom Aquifer (BA) by Holladay (1994a). DBS&A (2014a) referenced these as uppermost-unconfined aquifer or unconfined aquifer, middle confined aquifer or confined aquifer, and bottom aquifer. While the names correspond to subsurface intervals that produce water, they are not necessarily considered aquifers due to low production rates or quality concerns.

The unconfined aquifer is not present across the entire landfill area and is limited to the area at the northeast corner of the active landfill and certification area. The saturated thickness of the unconfined aquifer is tens of feet with depth to groundwater between 500 and 550 feet bgs. Wells PB-5, PB-6, PB-7, PB-9, and PB-10 were completed in the uppermost aquifer/unconfined aquifer with total well depths ranging from 490 to 535 feet bgs. Groundwater flow in the unconfined aquifer is to the northeast with a gradient similar to the slope of the confining layer (DBS&A 2014a). The level of groundwater in the unconfined unit has steadily decreased by 0.3 to 0.4 feet per year over the time period in which groundwater monitoring has been conducted. Monitoring wells PB-5 and PB-6 were closed in August 2021 because they no longer contained groundwater.

The confined aquifer lies within the blue clay unit that underlies the entire landfill. Wells PB-3, PB-4, PB-8, and PB-11 through and PB-16 were completed in the confined aquifer. Monitoring well PB-3, located in the Phase 3 area of the site, was decommissioned on May 30, 2017. Depth to the confined aquifer varies between 300 to almost 900 feet bgs. Water in the confined aquifer appear to be within deeper fractures within the clay with the shallower portions of the unit more plastic and unable to support fractures (DBS&A 2014a). The overall flow direction on the in the confined aquifer is to the southwest, with a gradient ranging from 0.05 ft/ft in the northwest portion of the site to 0.02 ft/ft in the southwest portion of the site.

The unconfined aquifer only exists in the northeastern corner of the site. Yield for the unconfined aquifer is less than 1 gallon per minute (gpm) and is not considered to be a viable aquifer. Recharge to the unconfined aquifer may be related to percolation of irrigation water from agricultural activities to the east and north of PBSL, but this theory has not been confirmed. Recharge to the confined aquifer appears to be related to a regional system of geothermal origin (Holladay 1994a). There is likely no connection between the site’s surface and the confined aquifer based on available information and infiltration modeling using HYDRUS and HELP models (Tetra Tech 2015).

Table 4-1. Summary of Monitoring Well Information

Well Number	Groundwater Source	Screened Interval(s)	Depth to Top of Confining Layer	Total Depth Drilled	Depth First Water Encountered	Depth to Potentiometric Surface* (September 2023)
PB-7	Tuana Gravel	535 - 555	540	610	535	551.22
PB-8	Glenns Ferry Fm - Confining Layer	377 - 407	240	420	380	285.87
PB-9	Tuana Gravel	508 - 543	510**	544	Unknown	530.57
PB-10	Tuana Gravel	504 - 534	515**	560	Unknown	526.38
PB-11	Glenns Ferry Fm - Confining Layer	340 - 400	200	420	350 - 400	293.18
PB-12	Glenns Ferry Fm - Confining Layer	480 - 540	140	555	500 - 560	304.75
PB-13	Glenns Ferry Fm - Confining Layer	840 - 900	545	923	850 - 900	728.79
PB-14	Glenns Ferry Fm - Confining Layer	845 - 905	522	923	800 - 840	712.88
PB-15	Glenns Ferry Fm - Confining Layer	790 - 850	565	870	800 - 860	653.05
PB-16	Glenns Ferry Fm - Confining Layer	572 - 592	445	597	580 - 590	550.99

Measurements are in feet and referenced to ground surface except as noted

*Referenced to top of casing, typically 2 to 3 feet higher than ground surface

**Based on interpretation from driller's log

4.3.3 Groundwater Geochemistry

Groundwater characterized for this project is present within the Glenns Ferry Formation. The formation is primarily sedimentary by nature, but several ash layers have been identified within the formation in other areas (Swirydczuk, et. al, 1981). Parent rock for the formation may have been older igneous rock. Therefore, many elements associated with igneous rock may be present in the formation, including metals. It is also not uncommon for groundwater in southern Idaho sedimentary aquifers to contain concentrations of metals (non-anthropogenic), and in some cases concentrations are above EPA drinking water standards. Geothermal waters also often contain high metal concentrations, including arsenic, because of their interaction with igneous rock. The presence of metals in groundwater samples collected from monitoring wells at PBSL are naturally occurring, rather than representative of impacts from PBSL.

4.4 DECISION INPUTS

Data required to address the decision statements may include physical and chemical characteristics of groundwater at the Site. All data collected and evaluated during this assessment will be compared to applicable state and federal screening levels and standards (**Section 7.6**). **Table 4-2** presents the specific decision inputs for this investigation.

The testing includes measuring various geochemical parameters in the field, laboratory analysis for metals using EPA methods 200.7/200.8 and laboratory analysis for volatile organic compounds by EPA method 8260B. Metals will be digested using EPA Method 200.11.

Table 4-2. Decision Inputs

Source Material	Data Parameters	Data Uses
Groundwater	Metals, Volatile organic compounds (VOCs), Total Kjeldahl and Ammonia Nitrogen, Organic Nitrogen (calculated), Chloride, Total Dissolved Solids	Evaluate metal and VOC concentrations in groundwater to provide background data, and evaluate whether leachate or vapor phase migration from PBSL impacts groundwater. Data will be compared to applicable state and/or federal groundwater standards. Nitrogen, chloride, and TDS samples would be used as indicators that leachate is affecting groundwater.
	Water table elevation	Evaluate groundwater flow direction and migration pathways.

4.5 STUDY BOUNDARY

The lateral study area boundary for this Site consists of the PBSL property. The vertical boundary is the base of each groundwater monitoring well (up to 905 feet bgs).

4.6 DECISION RULE

The Subtitle D (40 CFR part 258) constituents for groundwater monitoring will be compared to regulatory groundwater standards to evaluate data collected during the assessment as follows:

- An initial comparison of groundwater concentrations will be made to evaluate which analytical parameters, if any, exceed established regulatory standards.
- Based on the initial data, decisions will be made as to whether additional on-site and/or off-site investigation is needed.

Tetra Tech will compare the analytical results to the groundwater standards listed in **Table 4-3**.

Table 4-3. Regulatory Standards

Constituents for Monitoring per 40 CFR Appendix I to Part 258	IDAPA 58.01.11 Primary Numerical Ground Water Quality Standard (mg/L)	IDAPA 58.01.11 Secondary Numerical Ground Water Quality Standard (mg/L)	Maximum Contaminant Level (MCL) (mg/L)	EPA Tap Water RSL (mg/L)
METALS				
Antimony	0.006		0.006	0.00078
Arsenic	0.05		0.01	0.000052
Barium	2		2	0.38
Beryllium	0.004		0.004	0.0025
Cadmium	0.005		0.005	0.00018
Chromium	0.1		0.1 (Total Cr)	0.000035 (CrVI) 2.2 (CrIII)
Cobalt				0.0006
Copper	1.3		1.3	0.08
Lead	0.015		0.015	0.015
Nickel				0.02 (nickel oxide)
Selenium	0.05		0.05	0.01
Silver		0.1		0.0094
Thallium	0.002		0.002	0.00002
Vanadium				0.0086
Zinc		5		0.6
VOLATILE ORGANIC COMPOUNDS				
Acetone				1.8
Acrylonitrile				0.000052
Benzene	0.005		0.005	0.00046
Bromochloromethane				0.0083
Bromodichloromethane	0.1			0.00013
Bromoform	0.1		0.08	0.0033
Carbon disulfide				0.081
Carbon tetrachloride	0.005		0.005	0.00046
Chlorobenzene			0.1	0.0078
Chloroethane *(Ethyl chloride)*				0.83
Chloroform	0.002		0.08	0.00022
Dibromochloromethane *(Chlorodibromomethane)*	0.1		0.08	0.00087
1,2-Dibromo-3-chloropropane *(Dibromochloropropane)*	0.0002		0.0002	0.00000033
1,2-Dibromoethane (EDB) *(Ethylene dibromide)*	0.00005		0.00005	0.0000075

Table 4-3. Regulatory Standards

Constituents for Monitoring per 40 CFR Appendix I to Part 258	IDAPA 58.01.11 Primary Numerical Ground Water Quality Standard (mg/L)	IDAPA 58.01.11 Secondary Numerical Ground Water Quality Standard (mg/L)	Maximum Contaminant Level (MCL) (mg/L)	EPA Tap Water RSL (mg/L)
1,2-Dichlorobenzene *(o-Dichlorobenzene)*	0.6		0.6	0.03
1,4-Dichlorobenzene *(p-Dichlorobenzene)*	0.075		0.075	0.00048
trans-1,4-Dichloro-2-Butene				0.0000013
1,1-Dichloroethane				0.0028
1,2-Dichloroethane	0.005		0.005	0.00017
1,1-Dichloroethene *(1,1,-Dichloroethylene)*	0.007		0.007	0.028
cis-1,2-Dichloroethene *(cis-1,2-Dichloroethylene)*	0.07		0.07	0.0025
trans-1,2-Dichloroethene *(trans-1,2-Dichloroethylene)*	0.1		0.1	0.0068
1,2-Dichloropropane	0.005		0.005	0.00082
cis-1,3-Dichloropropene *(1,3-Dichlorpropene)*				0.00047
trans-1,3-Dichloropropene *(1,3-Dichlorpropene)*				0.00047
Ethylbenzene	0.7		0.7	0.0015
2-Hexanone *(MBK; Methyl butyl ketone)*				0.0038
Bromomethane				0.00075
Chloromethane				0.019
Dibromomethane *(Methylene bromide)*				0.00083
Methylene chloride			0.005	0.011
Methyl ethyl ketone *(2-Butanone)*				0.56
Methyl Iodide				
4-Methyl-2-pentanone *(MIBK; Methyl isobutyl ketone)*				0.63
Styrene	0.1		0.1	0.12
1,1,1,2-Tetrachloroethane				0.00057
1,1,2,2-Tetrachloroethane				0.000076
Tetrachloroethene *(Tetrachloroethylene)*	0.005		0.005	0.0041
Toluene	1		1.0	0.11
1,1,1-Trichloroethane	0.2		0.2	0.8
1,1,2-Trichloroethane	0.005		0.005	0.000041

Table 4-3. Regulatory Standards

Constituents for Monitoring per 40 CFR Appendix I to Part 258	IDAPA 58.01.11 Primary Numerical Ground Water Quality Standard (mg/L)	IDAPA 58.01.11 Secondary Numerical Ground Water Quality Standard (mg/L)	Maximum Contaminant Level (MCL) (mg/L)	EPA Tap Water RSL (mg/L)
Trichloroethene *(Trichlorethylene)*	0.005		0.005	0.00028
Trichlorofluoromethane				0.52
1,2,3-Trichloropropane				0.00000075
Vinyl acetate				0.041
Vinyl chloride	0.002		0.002	0.000019
Xylenes	10		10	0.019

Blank = no standard
IDAPA – Idaho Administrative Procedures Act, 580.01.11 – Groundwater Quality Rule (2011)
EPA Tap Water – From November 2023 Regional Screening Level (RSL) Summary Table

4.7 TOLERABLE LIMITS OF DECISION ERRORS

Decision errors are incorrect conclusions about a site caused by using data that are not representative of site conditions due to sampling or analytical error. Limits on decision error are typically established to control the effect of sampling and measurement errors on decisions regarding a site, thereby reducing the likelihood that an incorrect decision is made. Decision errors fall into three categories; null hypothesis, false positive, and false negative.

For example, a null hypothesis for the Site would be that groundwater is impacted by nitrates above the MCL of 10 mg/L. A false positive decision would be made that states the Site is contaminated and requires treatment when in actuality it is not. A false negative decision error would be one that decides that the Site does not require cleanup when, in actuality, it does require treatment.

This SAP identifies specific field and laboratory methods that reduce sampling error. The total study error will be reduced by collecting an appropriate number of environmental samples deemed necessary by the assessment team that are intended to represent the range of concentrations present at the Site. The sampling program is designed to reduce sampling error by specifying an adequate number and distribution of samples to meet project objectives. The following sections discuss data accuracy, precision and measurement ranges. This information will be used during the data review and data validation process to evaluate precision, accuracy, representativeness, comparability, and completeness (PARCC). PARCC will be considered during data verification and validation (**Sections 23** and **24**).

For evaluation purposes, the lowest practical quantitative limit (PQL) will be reported to the maximum extent practical. The PQL is the lowest standard on the calibration curve and the lowest level that the laboratory can reliably achieve within the established limits of precision and accuracy. The method detection limit (MDL) is the minimum concentration of a substance that can be analyzed with 99% confidence that the analyte concentration is greater than zero. Laboratory test results reported between the MDL and PQL will be identified by Pace Analytical. The data will be considered as acceptable quality for the above compounds given the limitations of current analytical methods for this chemical.

QA/QC limits will be based on the method detection limit (MDL) and the laboratory's practical quantitation limits. The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the true value is greater than zero. The PQL is the lowest level that can be reliably achieved within the specified limits of precision and accuracy during routine laboratory operating conditions. The analytical laboratory selected for this project can provide a list of the PQLs, and precision and accuracy limits along with the MDLs. These values will be used to assess precision and accuracy of the data during data evaluation efforts.

4.7.1 Accuracy

Accuracy is a measure of the agreement between a "true" or reference value and the associated measured value. A sampling campaign may include spiked samples with a known matrix submitted blind to the laboratory or may rely on reported recoveries for laboratory control samples (LCS). The recoveries of LCS, matrix spikes, and surrogate spikes will be used to evaluate the accuracy of the measurements. These recoveries are typically calculated as "percent recovery" (%R) represented by **Equation1** and **Equation 2**.

Equation 1. Spiked Sample or LCS Percent Recovery

$$\%R = \frac{C_M}{C_T} \times 100$$

Where: C_M = measured spike/LCS concentration
C_T = true spike/LCS concentration

Equation 2. Matrix Spike and Surrogate Recoveries

$$\%R = \frac{(C_S - C_{US})}{C_T} \times 100$$

Where: C_S = measured concentration of spiked sample
C_{US} = measured concentration of unspiked sample
C_T = true concentration of spike added

Laboratory accuracy for each analysis is determined through statistical analysis of the laboratory equipment by the laboratory; the acceptable accuracy range for the laboratory equipment will be indicated in the laboratory sheets. Any outliers from the acceptable range in percent recovery, as determined by the laboratory, will be flagged by the laboratory. **Accuracy requirements for this project are ±25%.**

4.7.2 Precision

Precision is a measure of agreement between two measurements of the same property under prescribed conditions. Sampling campaigns may include duplicate samples (field replicates or split samples; see **Section 14**) or may rely on LCS split sample results. The relative percent difference (RPD) of duplicate samples will be used to assess data precision. For laboratory duplicates, field duplicates, and matrix spike duplicates, **Equation 3** will be used to calculate RPD:

Equation 3. Relative Percent Difference (RPD)

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

Where: C_1 = concentration in first sample
C_2 = concentration in the second/duplicate sample
Where both C_1 and C_2 > 5 times the laboratory method detection limit (MDL)
Where one or both C_1 and C_2 are < 5 times the MDL, the results will be considered within control limits where C_1 and C_2 are ± MDL.

Precision will be based on field, LCS, and, if used, matrix spike duplicates, with an RPD goal of ±20%. The maximum RPD allowed for this project is ±50%.

Appropriate measurement range is determined by reviewing results with comparison to the laboratory reporting levels or MDLs. Reporting requirements are determined prior to sampling through review of historical data for the analytes and region of interest and reflected in choice of analytical laboratories, analysis methods, and requested reporting levels or MDLs.

4.7.3 Representativeness

Representativeness is the degree to which the sample data accurately and precisely represent site conditions. The representativeness criterion is best satisfied by confirming that sampling locations are properly selected, sample collection procedures are appropriate and consistently followed, a sufficient number of samples are collected, and analytical results meet data quality objectives. Representativeness is evaluated during data review, verification, validation, and reconciliation efforts by comparing the combination of data accuracy, precision, measurement range, and methods and assessing other potential sources of bias, including sample holding times, reported results of blank samples, and laboratory QA review.

4.7.4 Comparability

Comparability is the confidence with which one data set can be compared to another data set. Using standard sampling and analytical procedures will maximize comparability. To ensure data comparability, sample collection procedures will be consistently followed, the same analytical procedures will be used, and the same laboratory will be used to analyze the samples throughout each sampling event.

4.7.5 Completeness

Completeness is the percentage of valid data relative to the total possible data points. For data to be considered valid, it must meet all of the acceptance criteria, including accuracy and precision, and any other criteria specified by the analytical method used. **The overall data quality objective for completeness for the sampling events conducted under this SAP is 80%.** If the sampling event does not meet the quality assurance goal of 80%, the data will be discussed with the program manager and a course of action agreed upon. Any required departure from this goal will be justified and explained in the project records in accordance with the QMP.

4.8 SAMPLING DESIGN

Sections 9 through **24** of this SAP specify sampling related protocols, analytical methods, data management, and review. The assessment design is based information and results of the Landfill Status Report Update (Tetra Tech 2015) and the need to develop a consistent sampling protocol for monitoring wells being sampled at PBSL.

Field screening data [e.g., field measurements of pH, water temperature, specific conductivity, oxidation-reduction potential (ORP), and dissolved oxygen] are at data quality Level 1 (field parameter/screening level data). Groundwater samples collected during the field effort will be analyzed as per analytical data support Level III. Level III refers to Standard EPA-approved methods of analysis. Level III will allow for Stage 2A and 2B data validation procedures. Stage 2A data validation will be performed for this project, which includes a review of sample-related QC results as per EPA's Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA 2009). The data verification and validation will include a usability evaluation based on PARCC. Once collected, data review and data validation procedures will be implemented to evaluate whether the data achieves the DQOs.

5.0 SPECIAL TRAINING / CERTIFICATION

Staff assigned to conduct sampling under this SAP should receive initial 40-hour and annual 8-hour refresher training in Occupational Health and Safety Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) as per 40 Code of Federal Regulations (CFR) 1910.120. Additional HAZWOPER Supervisor Training and First Aid/CPR training are also recommended. Personnel receive additional training, as needed, based on PBSL requirements or the specific type of work to be performed. Personnel assigned to the project to conduct field activities will have the necessary education, on-the-job training, and field experience to conduct the work.

Participation in a medical surveillance program may also be required and will be based on OSHA and other applicable state or federal requirements. Subcontractors must also be enrolled in their company or agency's medical monitoring program.

6.0 DOCUMENTATION AND REPORTING

6.1 FIELD DOCUMENTATION

Field personnel will document all field activities in as they occur, either on paper field forms or in electronic format using a laptop or tablet computer. Tetra Tech's Standard operating procedure (SOP) 10 (**Appendix B**) will be used to guide documentation of field activities, including well purging and sampling. Field notebook entries will be written in ink and corrections or revisions made by lining through the original entry with a single line and initialing the changes. Field personnel will document the following in the field notebook or sampling forms, as applicable, for the sampling event:

- Date and time of starting work;
- Weather conditions;
- Names of field crew leader and team members;
- Project name and type;
- Description of site conditions and any unusual circumstances;
- Location of sample site, including map reference, if relevant;
- Equipment brand and model numbers;
- Calibration date, time and parameters;
- Details of actual work effort, particularly any deviations from the field work plan or standard;
- Field observations;
- Calculations;
- Names, date, and times of samples collected;
- Name, date, and time of duplicate samples collected with reference to corresponding natural sample name;
- Name, date, and time of field blanks collected;
- Problems encountered, or concerns identified;
- Project-related communications with site personnel, visitors, and other field personnel.

Field personnel will document additional groundwater monitoring and sampling activities by completing groundwater sampling field forms. SOP-10 (**Appendix B**) includes the form. Tetra Tech will maintain original field records in hard copy and by scanning the records and storing them electronically in the project folders.

6.2 LABORATORY DOCUMENTATION

Laboratory reports will document the following:

- Sample identification;
- Laboratory batch or report number;
- Sampling date and time;
- Date/time received;

- Extraction date (if required);
- Analytical parameter;
- Analytical results with appropriate units of measure;
- Minimum Detection Limit and Practical Quantitative Limit;
- Analytical method;
- Sample non-conformance form (if necessary);
- Completed chain-of-custody;
- Laboratory QA/QC documentation; and
- Other documentation necessary to adhere to Stage 1 and Stage 2A criteria outlined in **Sections 22** and **23**.

6.3 RECORDS

All documents, including this SAP, the health and safety plan (HASP), analytical reports, field notebooks and forms, project reports, memoranda, and communications will be stored electronically in the project folder on a server that receives frequent backup. Tetra Tech's server is backed up daily. Documents will be maintained for at least 3 years.

7.0 SAMPLING PROCESS DESIGN

7.1 RATIONALE FOR SELECTING SAMPLE SITES

Monitoring well locations are based on existing well locations. Monitoring wells are located such that PBSL can monitor for migration of possible landfill leachate. **Figure 1 (Appendix A)** Site Map shows the location of existing groundwater monitoring wells.

7.2 SAMPLE DESIGN LOGISTICS

7.2.1 Pre-Field Logistics

Field personnel will coordinate with Pace National to obtain proper sample containers and associated preservatives (as required), and chain-of-custody forms. The request for sample containers will be made at least 1 week in advance of the sampling event. Field personnel will notify the landfill director at least one week in advance so that the spent nitrogen tanks can be replenished prior to the sampling.

Field personnel will also conduct an inspection of sampling equipment that will be used in the field. This includes:

- Pump controller, nitrogen gas cylinder(s), electrical generator, and tubing;
- Electronic water level probe;
- Multi-parameter meter and flow-through cell, including the date and condition of all calibration standards;
- Other required supplies or equipment such as decontamination supplies, personal protective equipment (PPE), and sample coolers (if not provided by the laboratory). These will be obtained as needed prior to the field work.

Field personnel will ensure the equipment is clean, check for proper calibration, assembly, and operation prior to use. Equipment will be transported in such a manner as to maintain cleanliness to and from the Site as well as between sample locations.

7.2.2 Field Logistics

The following provides basic field logistics that will be followed during this project related to sample logistics:

- Coordinate with PBSL for access 1 week prior to arrival at the Site and evaluate any potential access issues.
- Ensure proper PPE is worn at all times according to the site-specific HASP. Nitrile sample gloves will be donned when handling sampling equipment, sample bottles, and during decontamination procedures. Gloves will be replaced frequently, and especially prior to resuming sampling work if the gloves come into contact with sampling equipment that has not been decontaminated or if they become soiled. Gloves will be replaced after purging and prior to sample collection.
- Obtain ice for preservation of samples prior to site arrival. The ice will be placed in a cooler specifically designated for samples. Ice will be replenished as needed during temporary transport and storage, and prior to shipment to the laboratory.
- Collect and preserve samples as required by the laboratory and method requirements.
- Place the samples in the cooler containing the ice immediately following labeling and collection.
- Collect samples from the dedicated bladder pump tubing at the surface by directing the flow of water directly into laboratory-provided sample containers.
- Adhere waterproof labels to the sample container and write, in indelible ink, the well name, date and time of sample collection, the analyses requested, and project name or number.
- Complete chain-of-custody forms in the field at the time of the sampling. Field personnel will also maintain custody of the samples and ensure proper storage and handling until transfer to the analytical laboratory or overnight courier.

Section 11 provides additional sample methodology and sample handling requirements.

8.0 SAMPLING METHODS

This section describes the procedures and equipment used to obtain project samples and reporting.

8.1 GROUNDWATER MONITORING AND SAMPLING

This project includes monitoring and sampling of the on-site groundwater monitoring wells. The following sections define the work to be performed. Field personnel will document all field activities in a field notebook and/or on electronic field forms. **Section 9** discusses additional record keeping requirements.

8.1.1 Standard Operating Procedures

Tetra Tech will also follow the sampling methods described in this section and use the following Tetra Tech SOPs to guide field activities. **Appendix B** includes copies of the SOPs.

- SOP-05: Field Measurement of Electric or Specific Conductance;
- SOP-06: Field Measurement of pH;
- SOP-07: Field Measurement of Water Temperature;
- SOP-08: Field Measurement of Dissolved Oxygen;
- SOP-09: Sample Packaging and Shipping;
- SOP-10: Field Forms;
- SOP-11: Equipment Decontamination;
- SOP-12: Sample Documentation;
- SOP-13: Quality Control Samples;
- SOP-28: Field Measurement of Redox Potential;

- SOP-46: Low Flow Groundwater Sampling

8.1.2 Groundwater Monitoring Wells

Table 8-1 presents monitoring well details for the existing on-site monitoring wells that field personnel will monitor and sample during this field event.

Table 8-1. Monitoring Well Details

Well Number	Groundwater Source	Screened Interval(s)	Depth to Top of Confining Layer	Total Depth Drilled	Depth First Water Encountered	Depth to Potentiometric Surface* (September 2023)
PB-7	Tuana Gravel	535 - 555	540	610	535	551.22
PB-8	Glenns Ferry Fm - Confining Layer	377 - 407	240	420	380	285.87
PB-9	Tuana Gravel	508 - 543	510**	544	Unknown	530.57
PB-10	Tuana Gravel	504 - 534	515**	560	Unknown	526.38
PB-11	Glenns Ferry Fm - Confining Layer	340 - 400	200	420	350 - 400	293.18
PB-12	Glenns Ferry Fm - Confining Layer	480 - 540	140	555	500 - 560	304.75
PB-13	Glenns Ferry Fm - Confining Layer	840 - 900	545	923	850 - 900	728.79
PB-14	Glenns Ferry Fm - Confining Layer	845 - 905	522	923	800 - 840	712.88
PB-15	Glenns Ferry Fm - Confining Layer	790 - 850	565	870	800 - 860	653.05
PB-16	Glenns Ferry Fm - Confining Layer	572 - 592	445	597	580 - 590	550.99

Measurements are in feet and referenced to ground surface except as noted
*Referenced to top of casing, typically 2 to 3 feet higher than ground surface
**Based on interpretation from driller's log

Field personnel will don nitrile sample gloves and safety glasses during all site sampling activities. Sample gloves will be changed frequently and particularly when the gloves come into contact with equipment that has not been decontaminated or if they become soiled and following well purging before sample collection. The site-specific HASP provides additional health and safety requirements for this project.

Activities at each monitoring well will include measuring methane levels at the well head, depth to water in the well casing, and collecting groundwater samples for laboratory analysis. Field personnel will decontaminate all re-useable equipment prior to use at the Site and between wells. The dedicated systems used at PBSL limit the equipment that is used at multiple wells, therefore the only item to be decontaminated is the water level probe. **Appendix B** will be used as guidance for equipment decontamination.

Measuring methane concentration will be the first activity at each well head. The process will include inserting a hose through the measurement port on the well cap and extending it into the well casing. The other end of the hose will be connected to a meter that measures the concentration of methane and displays the percentage of the lower explosive limit (LEL) that is present. Field personnel will allow the pump on the meter to withdraw air from the well casing until a stable value is observed on the meter. The reading on the FID will be recorded in the daily notes and the well sampling form.

Field personnel will record the depth to water to 0.01-foot accuracy in each groundwater monitoring well prior to sampling using an electronic water level meter. Depth to water will be measured relative to the top of the casing. PBSL owns a motorized, 1000-foot water level meter that is typically used to obtain the measurements. A gasoline powered generator is used to provide electricity for the water level meter. The generator should be fueled before the sampling process begins to avoid carrying a gasoline container in the pickup during the sampling to avoid a potential source of VOCs. Several of the wells have depth to water that is less than 500 feet. Field personnel may use Tetra Tech's 500-foot water level probe for these wells. The water level meter probe(s) will be decontaminated before use and between measurements.

Field personnel will use the dedicated, stainless steel bladder pump installed in each well to purge and sample the well using EPA's low-flow sampling method. During well purging, the applied pressure, discharge time, and refill time on the pump controller will be set based on information collected during previous monitoring events. A copy of the sampling forms from the previous sampling event should be taken into the field to use as a reference.

SOP-46 in **Appendix B** presents generic practices for low flow purging and sampling. Additional procedures specific to the dedicated pumps used on this project are listed here.

- A check valve is present on top of each pump that is intended to keep the discharge tubing from draining back into the well between monitoring events. The amount of water in the discharge line above the pump affects the pressure that needs to be applied to the bladder to facilitate purging. Therefore, the initial pressure needed at the beginning of each monitoring event may be in the range of 150 to 250 psi. However, the bladder can be damaged if too much pressure is applied to the bladder without a corresponding amount of head in the discharge tubing above it. This could be an issue if the check valve does not seal properly and the water from the discharge tubing drains back into the well between monitoring events. The initial pressure applied at each well will therefore be limited to 50 psi. The pressure can be increased slowly until a small amount of air is noted to be discharged from the pump outlet tubing. This indicates that the pressure applied to the pump is slightly more than needed to overcome the weight of the water in the discharge line. This typically occurs within 50 psi of the standard applied pressure for a given well. The pressure can be the increased slowly until water is discharged from the pump outlet line. in approximately 50 psi intervals with each purge cycle until water is produced from the discharge tubing. If air is being evacuated from the line at the lower pressures, it is an indication that water has drained from the tubing through the check valve and care must be taken to avoid applying too much pressure too quickly. Several discharge and refill cycles may be needed in this case before water is brought to the surface.
- Groundwater should be purged from the outlet tubing throughout the entire discharge cycle to avoid damage to the bladder. Field personnel will observe that water is continually pumped until the time that the controller switches from the discharge to the refill cycle. The length of the discharge cycle will need to be shortened using the programming function on the controller if the water flow stops before the end of the discharge cycle.

During purging, field personnel will connect the pump tubing to a flow-through cell where field parameters will be monitored throughout purging using a calibrated multi-parameter meter. Field personnel will calibrate the meter prior to the sampling event using the manufacturer guidelines. The meter will require re-calibration sooner if, for example, readings begin to fluctuate, or readings are outside of the range of values from a specific well noted during prior sample events.

Wells will be purged until field parameters stabilize **AND** three volumes of the bladder and submerged tubing have been evacuated (**Tables 8-2 and 8-3**). If stabilization cannot be reached, purging will cease when a minimum of three well volumes have been purged from the well and 60 minutes of purging has occurred.

Field personnel will document field parameter readings at every 5-minute purge interval. Stabilization will be considered complete when parameters meet stabilization criteria in three consecutive 5-minute intervals. **Table 8-2** provides the list of field parameters that will be monitored and their corresponding stabilization criteria.

The outlet from the flow cell will be directed to a 5-gallon bucket to track the total purge volume for each well. A graduated cylinder or similar will be used to quantify the flow rate at least once per well per sampling event. This will involve recording the amount of water generated during one cycle of purging, and also recording the purging and refill times from the pump controller. Observations will also be made to determine if water is being drawn back into the well through the purging tube during bladder refill cycles. This may indicate failure of the check valve on top of the pump. Field personnel will quantify the amount of water being drawn back into the well if this is happening. This will include keeping the end of the tube submerged in water in a graduated cylinder and recording how much the water level drop during the bladder refill cycle. The measurements and observations will be recorded in the daily field notes and on the sampling log sheet.

Table 8-2. Field Parameters & Stabilization Criteria

Field Parameter	Stabilization Criteria
Depth to water	0.2 feet
Temperature (°C)	10%
pH	0.1 unit
Dissolved oxygen (DO)	10%
Oxidation-reduction potential (ORP)	10 units
Specific Conductivity (SC)	3%
Turbidity	10% or 10 NTUs

% - percent
NTU – Nephelometric turbidity units

The volume of water in the pump bladder and submerged tubing varies at each location depending on the depth of the pump below the potentiometric surface. **Table 8-3** includes pump intake depths, typical depth to the potentiometric surface, the volume of a single combined volume of the bladder and tubing, and the minimum amount to be purged (three volumes).

Table 8-3. Pump Bladder and Tubing Volumes

Well Number	Typical Depth to Water (ft.)	Pump Intake Depth (ft.)	Submerged Tubing Length (ft.)	Submerged Tubing Volume (gal.)	Pump Bladder Volume (gal.)	One Purge Volume (gal.)	Three Purge Volumes (gal.)
PB-7	551	552	0	0.0	0.03	0.03	0.1
PB-8	286	385	96	0.55	0.1	0.65	2
PB-9	531	539	5	0.029	0.1	0.129	0.4
PB-10	526	531	2	0.01	0.1	0.10	0.3
PB-11	293	370	74	0.425	0.1	0.53	1.6
PB-12	305	510	202	1.16	0.1	1.26	3.8
PB-13	729	870	138	0.792	0.1	0.89	2.7
PB-14	713	875	159	0.912	0.1	1.01	3
PB-15	653	814	158	0.907	0.1	1.01	3
PB-16	551	572	18	0.103	0.1	0.203	0.6

Depths are relative to top of casing.

Field personnel will collect groundwater samples from the well after the purging is considered complete using the criteria described above. The dedicated hose that is placed between the quick-release fitting on the well cap and the flow through cell will be disconnected from the flow cell. Labeled, laboratory-provided sample containers will then be filled directly from the discharge end of this dedicated tubing. More than one discharge cycle will be needed to fill the required number of sample containers. **Section 14** discusses required project QA/QC and collection of duplicates and blanks. Samples will be labeled based on their individual well names (e.g., PB-7, PB-8, etc.).

Samples will be placed immediately in a cooler containing ice following collection. **Section 12** provides additional sample handling details. After sample collection, the dedicated tubing used at each well will be placed into a sealable plastic bag specific to that well for re-use during the next monitoring event. The tubing used to winterize the upper portion of the in-well discharge tubing is also dedicated for each well and will be replaced into the sealable plastic bag after use.

Field personnel will ship the samples to Pace National or deliver them to the Pace service center in Boise for final packing and shipping. **Table 8-4** provides the specific analytical method and number of samples that should be collected. **Section 13** provides additional analytical method, preservation, holding time and sample container details.

Table 8-4. Analytical Parameters & Designated Laboratory

Constituents for Monitoring per 40 CFR Appendix I to Part 258	EPA Analytical Method	# of Groundwater Samples	# of QC Samples	Analyzing Laboratory & Shipping Address
METALS	Metals Digestion 200.9-11			
Antimony	200.8 (low)	10 Monitoring Well Samples	1 Duplicate 1 Field Blank	Pace National 12065 Lebanon Rd., Mt. Juliet, TN 37122 (800) 767-5859
Arsenic	200.8 (low)			
Barium	200.7			
Beryllium	200.8 (low)			
Cadmium	200.8 (low)			
Chromium	200.8 (low)			
Cobalt	200.7			
Copper	200.7			
Lead	200.8 (low)			
Nickel	200.7			
Selenium	200.8 (low)			
Silver	200.8			
Thallium	200.8 (low)			
Vanadium	200.7			
Zinc	200.7			
VOLATILE ORGANIC COMPOUNDS				
Acetone	8260B	10 Monitoring Well Samples	1 Duplicate 1 Trip Blank 1 Field Blank	Pace National 12065 Lebanon Rd., Mt. Juliet, TN 37122 (800) 767-5859
Acrylonitrile				
Benzene				
Bromochloromethane				
Bromodichloromethane				

Table 8-4. Analytical Parameters & Designated Laboratory

Constituents for Monitoring per 40 CFR Appendix I to Part 258	EPA Analytical Method	# of Groundwater Samples	# of QC Samples	Analyzing Laboratory & Shipping Address
Bromoform				
Carbon disulfide				
Carbon tetrachloride				
Chlorobenzene				
Chloroethane *(Ethyl chloride)*				
Chloroform				
Dibromochloromethane *(Chlorodibromomethane)*				
1,2-Dibromo-3-chloropropane *(Dibromochloropropane)*				
1,2-Dibromoethane (EDB) *(Ethylene dibromide)*				
1,2-Dichlorobenzene *(o-Dichlorobenzene)*				
1,4-Dichlorobenzene *(p-Dichlorobenzene)*				
trans-1,4-Dichloro-2-Butene				
1,1-Dichloroethane				
1,2-Dichloroethane				
1,1-Dichloroethene *(1,1,-Dichloroethylene)*				
cis-1,2-Dichloroethene *(cis-1,2-Dichloroethylene)*				
trans-1,2-Dichloroethene *(trans-1,2-Dichloroethylene)*				
1,2-Dichloropropane				
cis-1,3-Dichloropropene *(1,3-Dichlorpropene)*				
trans-1,3-Dichloropropene *(1,3-Dichlorpropene)*				
Ethylbenzene				
2-Hexanone *(MBK; Methyl butyl ketone)*				
Bromomethane				
Chloromethane				
Dibromomethane *(Methylene bromide)*				
Methylene chloride				
Methyl ethyl ketone *(2-Butanone)*				
Methyl Iodide				

Table 8-4. Analytical Parameters & Designated Laboratory

Constituents for Monitoring per 40 CFR Appendix I to Part 258	EPA Analytical Method	# of Groundwater Samples	# of QC Samples	Analyzing Laboratory & Shipping Address
4-Methyl-2-pentanone *(MIBK; Methyl isobutyl ketone)*				
Styrene				
1,1,1,2-Tetrachloroethane				
1,1,2,2-Tetrachloroethane				
Tetrachloroethene *(Tetrachloroethylene)*				
Toluene				
1,1,1-Trichloroethane				
1,1,2-Trichloroethane				
Trichloroethene *(Trichlorethylene)*				
Trichlorofluoromethane				
1,2,3-Trichloropropane				
Vinyl acetate				
Vinyl chloride				
Xylenes				
OTHER ANALYTES AND GEOCHEMICAL TESTS				
Organic Nitrogen	450NOrg C-2011	10 Monitoring Well Samples	1 Duplicate 1 Field Blank	Pace National 12065 Lebanon Rd., Mt. Juliet, TN 37122 (800) 767-5859
Ammonia Nitrogen	350.1			
Total Kjeldahl Nitrogen	351.2			
Chloride	9056			
Total Dissolved Solids	2540 C-2011			

8.1.3 Reporting

A monitoring report will be prepared to document the groundwater monitoring and sampling activities, and laboratory analytical results. The report will include comparison of the results to the Idaho Ground Water Quality Standards. Also included in the report will be a summary of the purpose, scope of work, field and analytical methods, tables of analytical results, figures, and tables. Depth to water and well table elevation data will be used to prepare a potentiometric surface map and estimate groundwater flow direction. The report will also include results of the data validation, verification, and usability; present the findings of the effort; and make recommendations, as needed. The report will also discuss any deviations from this SAP.

Tetra Tech will submit an electronic draft report to PBSL for review and incorporate PBSL comments into a final report. The final report will be submitted in both electronic .pdf and hard copy formats.

9.0 SAMPLE HANDLING AND CUSTODY

Field personnel will collect groundwater samples in laboratory-provided containers and preserve the samples as required by the laboratory and analytical method. Field personnel will follow all sample collection and preparation instructions provided by the laboratory. Following collection, samples will be stored in coolers containing ice for preservation. Ice will be replenished as needed during the investigation and prior to shipment to the laboratory. Samples kept overnight may be kept in the sample refrigerator inside of Tetra Tech's locked storage room for safe keeping until the end of the sampling event.

Field personnel will document all samples on laboratory chain-of-custody documents (SOP-12; **Appendix B**). The chain-of-custody will remain with the samples throughout storage and transportation.

Field personnel will use SOP-9 (**Appendix B**) as guidance for sample packing and shipping. Field personnel will ship the samples under priority delivery via overnight courier to the laboratory. Field personnel will review the chain-of-custody then sign, date, and document the time on the chain-of-custody upon transfer of the samples to the sealing the sample cooler.

10.0 ANALYTICAL METHODS

Table 10-1 lists the analytical method, container type, preservative and holding time applicable to the samples collected during this project. Field personnel will order all sample containers directly from the laboratory for this project. Tetra Tech's project manager for field personnel will notify the laboratory prior to shipment of the samples to ensure holding times will not be exceeded.

Table 10-1. Analytical Method, Bottle, Preservative and Holding Time Requirements

Analytical Parameter	Analytical Method	Container Type	Minimum Sample Size (mL)	Preservative	Maximum Holding Time
VOCs	EPA Method 8260B	40 mL glass vial	3 x 40 mL	HCl, 6°C pH <2	14 days
Metals	EPA Method 200.7 / 200.8	Plastic	500 mL	HNO_3, 6°C pH <2	6 months
Ammonia Nitrogen	350.1	Plastic	125 mL	H_2SO_4, 6°C	28 days
Total Kjeldahl Nitrogen	351.2	Plastic	250 mL	H_2SO_4, 6°C	28 days
Chloride	9056	Plastic	125 mL	None	28 days
Total Dissolved Solids	2540 C-2011	Plastic	250 mL	None	7 days

mL – milliliter, HCl – hydrochloric acid, HNO_3 – nitric acid, H_2SO_4 – Sulfuric Acid
Note: Organic Nitrogen value is a calculation based on Total Kjeldahl and Ammonia Nitrogen values. It does not require additional material to be submitted to the laboratory, so it is not included in the table above.
At the discretion of the laboratory, the nitrogen samples may be combined into one container, and the chloride and TDS samples may be combined into one container.

11.0 QUALITY CONTROL

11.1 FIELD QUALITY CONTROL

The project manager and field team lead will coordinate the field effort and be responsible for QA/QC for the project. The project manager will manage all data for the project once it has been collected. The data will be maintained in the electronic project file on a server that is backed up frequently. The project manager and field team leader will be responsible for coordinating the project and ensure equipment is ready for use and jars/bottles have been ordered from the laboratory. The field team leader will be responsible for inspection of field equipment prior to use and periodically over the course of the project. Field personnel will collect QA/QC samples to evaluate PARCC. Field personnel will use SOP-13 (**Appendix B**) for guidance.

Two QC samples will be collected for this project. **Table 11-1** presents the number and type of QC samples. Analytical parameters will be consistent with the parameters listed for groundwater. In addition to the field QC listed in **Table 11-1**, the analytical laboratory will analyze laboratory control samples, method blanks, matrix spike/matrix spike duplicates, and other QA/QC analyses as per method requirements to ensure data quality.

Table 11-1. Field QC Sample Objectives

Field QC Sample	Purpose	Frequency	Number of QC Samples	QA Objective
Duplicate **MW-D**	Measure analytical precision	1 per event	1	30% RPD for water
Field Blank	Measure of accuracy and representativeness. Quantify artifacts introduced during sampling, decontamination, transport from ambient air, and in decontamination water supply, or analysis of sample.	1 per event	1	Target analytes not detected

RPD – Relative percent difference

Duplicates

Duplicate sampling involves collecting two samples, one "natural" sample, and one "duplicate" sample. The samples are collected during the same sample event and at the same sample location. There are two types of duplicate samples, a "replicate," and a "split." Replicate samples are collected one immediately after the other, separated only by the actual time required to fill the sample container. Split samples are those that are collected from the same initial volume of matrix.

Duplicates collected for this project will be collected as replicates. The same number and type of bottles and preservatives will be used for the duplicate sample as its associated natural sample and will be analyzed for the same analytical parameters. Field personnel will document which natural sample the duplicate is associated with on the field form and in the field notebook. **The duplicate sample will be submitted blind to the laboratory and labeled as MW-D.**

Field Blank

A field blank is a sample of blank matrix. The field blank will be collected using deionized water that is supplied by the laboratory. Field personnel will collect the field blank in the field by pouring the deionized water directly from its original container and into laboratory-provided sample containers while at one of the monitoring well locations. **The sample will be labeled as Field Blank.**

11.2 LABORATORY QUALITY CONTROL

Pace National will perform laboratory QC as per the analytical method and their individual laboratory requirements. **Appendix D** provides the laboratory QC manuals. The frequency and type of QC performed by the laboratory is often driven by the analytical method being performed. The laboratory will report the result of their QC efforts in a

QC summary with each analytical laboratory report. Typical laboratory QC checks include internal check for sample analysis activities, duplicate samples, and blanks. Common laboratory QC are described below.

Laboratory Blanks

A laboratory blank is a sample of known matrix and where the presence or absence of concentrations are known to be less than the laboratory minimum limit of detection (practical quantitation limit). The laboratory analyzes the blank to evaluate the accuracy of the analysis.

Laboratory Control Samples (LCSs)

LCSs are samples that contain a known concentration of analytes. The laboratory analyzes the samples to evaluate the overall method performance and accuracy. The LCSs are prepared in the same manner and undergo the same procedures as the project samples. LCSs are an indicator of laboratory performance and are used to evaluate accuracy and the duplicate of the LCS is used to measure precision by calculating the RPD.

Laboratory Duplicate Sample

A laboratory duplicate is a split collected by the laboratory from one of the project samples being analyzed. The laboratory analyzes the two samples and compares the results using the RPD. The duplicate samples are used to evaluate precision.

Matrix Spikes and Matrix Spike Duplicate

For a matrix spike (MS), the laboratory selects a sample from the batch and adds a known amount of target analyte to the sample before analysis to assess possible matrix interferences on the analysis. The laboratory will analyze a matrix spike duplicate (MSD) to evaluate precision.

11.3 DATA ANALYSIS QUALITY CONTROL

Tetra Tech's field personnel, project manager, and/or QA/QC manager(s) will review the field notes and data collected during this project. Problems that arise and their corresponding corrective actions will be documented. All data will be reviewed, and analytical data evaluated through the data verification/validation process. Data qualifiers will be assigned to the data, as needed.

12.0 INSTRUMENT / EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

Field personnel will check the condition and operation of equipment that will be used in the field. The equipment will be maintained, as needed, and decontaminated prior to arrival at the Site. This includes all portions of the instrument or equipment including, but not limited to, cables, probes, housing, switches, buttons, batteries, etc.

The dedicated pumps do not require scheduled maintenance. If there are problems with the pumps in the field, the QED service department should be called immediately to troubleshoot the problem. The pumps are designed to last 10+ years maintenance free. The operation manual for the pumps is included in **Appendix E**.

The micropurge controller requires batteries that should be checked before each sampling event. Maintenance includes replacing the batteries (3 x AA alkaline) as needed and wiping dust from the interior of the storage box with a soft, clean cloth after each use. The operations manual for the controller is included in **Appendix E**.

Dedicated tubing for each well is stored in separate plastic bags to avoid cross contamination. The bags will be replaced as needed in their integrity is compromised. The tubing may be replaced with new stock if the existing tubing for a given well is suspected of being contaminated from an outside source.

Laboratory instrument/equipment testing, inspection and maintenance will be performed and documented by the laboratory according to the laboratory's quality assurance manual, any method-specific requirements, and if/as required by the State of Idaho laboratory certification process.

13.0 INSTRUMENT / EQUIPMENT CALIBRATION AND FREQUENCY

Field personnel will check equipment calibration of the multi-parameter instrument in the office prior to the field effort and again if drift in the readings is noticed or if the readings are otherwise suspect. The calibration standards will be replaced prior to expiration and/or if the calibration standards become compromised. Field personnel will document calibration details in the field notes. Calibration will be as per manufacturer guidelines.

14.0 INSPECTION / ACCEPTANCE OF SUPPLIES AND CONSUMABLES

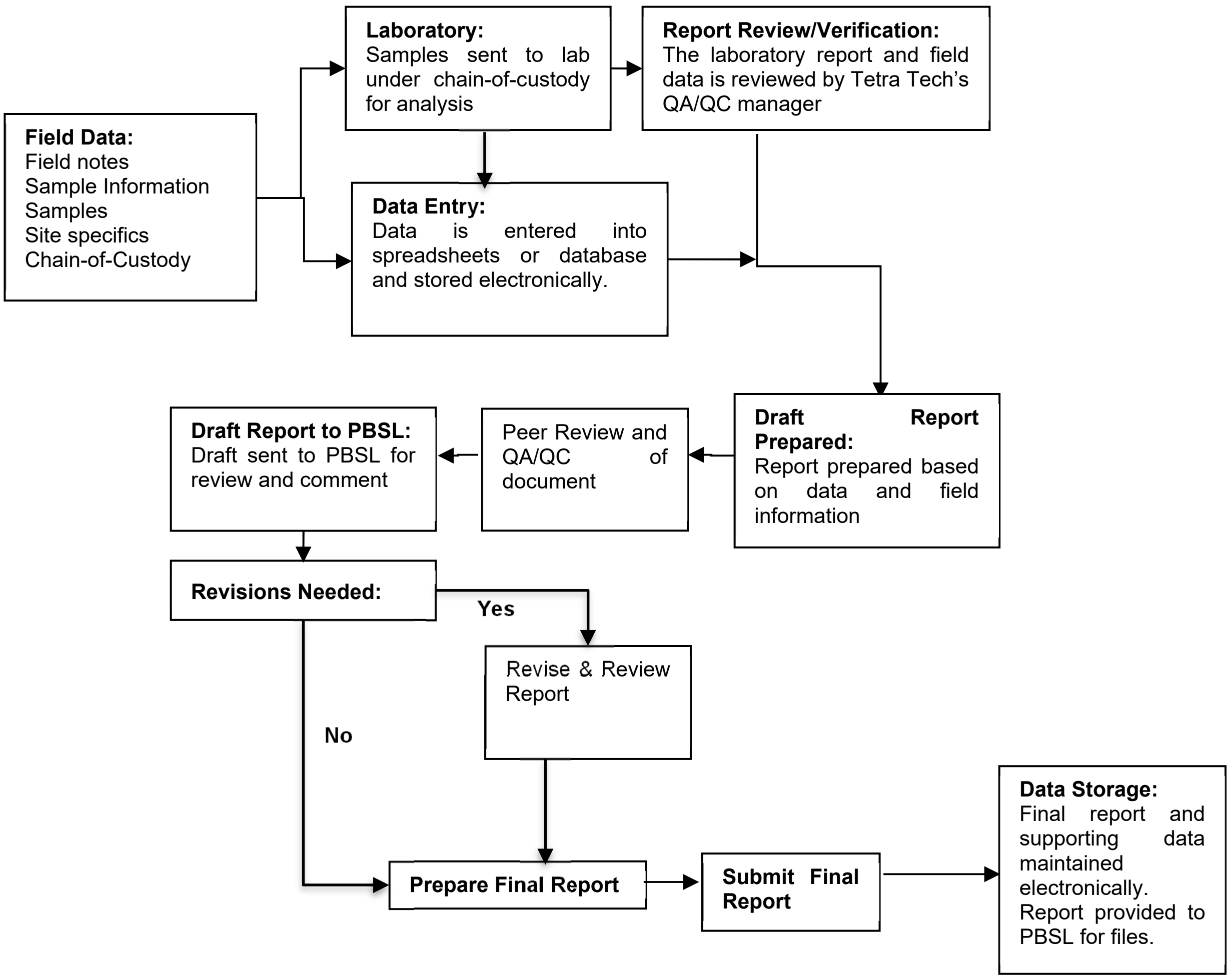
Supplies and consumable items required for the groundwater monitoring effort will be based on the work described in **Section 11**. Supplies and consumables will be purchased new and inspected prior to the field effort. Field personnel will obtain all sample bottles from the analytical laboratory. The bottles will be ordered at least 1 week prior to the field effort and the order checked for accuracy upon arrival.

15.0 NON-DIRECT MEASUREMENTS AND DATA ACQUISITION

Project personnel may rely upon secondary data not directly measured or generated in this scope of work. This data may include existing data collected during past groundwater monitoring events, on-line regulatory data, interviews with persons knowledgeable about the Site, and other historical data. Specific non-direct measurements are not included in this SAP.

16.0 DATA MANAGEMENT

If field notebooks and physical field forms are used, they will be maintained in a project folder. Any field notebooks and paper forms will also be scanned and electronically kept in the project's electronic folder on the server along with electronic forms generated in the field and the electronic analytical data files and reports obtained from the laboratory. Other data that may be used during this project include historic groundwater data and reports. The existing data will also be stored electronically in the project folder.



17.0 ASSESSMENT AND RESPONSE ACTIONS

The project manager will be responsible for assessment and oversight of project activities. PBSL will be kept informed of project activities and progress throughout the duration of this project. Tetra Tech may conduct an internal audit of field procedures. If completed, the internal audit may include a review of procedures selected for the sampling program, a review of QA/QC samples required, and a review of training requirements. The laboratory is required to have written procedures addressing internal QA/QC as specified in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Contract Laboratory Program (CLP) protocol.

Corrective actions will be taken promptly upon identification of potential problems with data acquisition or measurement. Field equipment malfunctions will be identified promptly and corrected by the field team leaders. Problems and their associated corrective actions will be document in the field notes. Laboratory equipment malfunctions are handled according to EPA analytical method specifications. Laboratory QC samples (calibration samples, method blanks, matrix spike samples, laboratory control samples, and laboratory duplicates) will be handled according to EPA analytical method specifications. Laboratory corrective actions will be included on analytical laboratory reports.

18.0 REPORTS TO MANAGEMENT

Project and sample results for this project will be presented in a groundwater monitoring report. The report will document the groundwater monitoring and sampling activities, and laboratory analytical results and include a comparison of the results to the Idaho Ground Water Quality Standards. The report will summarize the purpose, scope of work, field, and analytical methods, and present tables of analytical results, and figures. The report will also include results of the data validation and verification, and data usability assessment, as well as findings and recommendations for additional work, as needed. The report will also discuss any deviations from this SAP.

Tetra Tech will submit an electronic draft report to PBSL for review and incorporate PBSL comments into a final report. The final report will be submitted in both electronic .pdf and hard copy formats.

19.0 DATA REVIEW, VERIFICATION, AND VALIDATION

Data review, verification, and validation will be conducted on the field and laboratory data collected during this project.

19.1 DATA REVIEW

Data review will be conducted to ensure project data has been recorded, transmitted, and processed correctly. Data review will be performed by the project manager.

19.2 DATA VERIFICATION

Data verification will be performed after the data review to evaluate whether the data complies with the scope of work, investigation methods, DQOs and other requirements specified in the SAP. The goal is to evaluate project performance against the requirements in the SAP. The project manager will perform the verification.

19.3 DATA VALIDATION

An experienced data validator or subject matter expert will conduct the data validation on project analytical data. Data validation will be conducted to evaluate the quality of the project data relative to the end use. Validation is related to analyte- and sample-specific process that focuses on the project-specific data needs and documents any potentially unacceptable variances from the SAP. Qualifiers will be assigned to project data during the validation process.

20.0 REVIEW, VERIFICATION, AND VALIDATION METHODS

This section describes the methods that will be used to review, verify, and validate the data. Data review, verification, and validation efforts are based on the analytical support determined to be necessary in the planning stages of the project. Tetra Tech personnel performing data verification and validation will use the following documents, as needed, for guidance during the effort:

- *EPA QA/G-8 Guidance on Environmental Data Verification and Data Validation* (EPA 2002b)
- *Appendix A of EPA's Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA 2009)
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004).
- *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review* (EPA 2008).

Deviations from the SAP will be noted during the data review, verification, and validation process. Deviations will be identified in the project report along with an assessment of how the data may be affected.

20.1 DATA REVIEW

Tetra Tech's project manager will perform a review of data and information collected under this SAP. The data review checklist in **Appendix C** will be used to guide the review. The goal of the review will be to identify errors; evaluate completeness of all data collected, and how it was collected and handled; ensure that all non-direct measurement data was received; check for completeness of the data obtained and identify any deficiencies; review analytical laboratory documentation; and evaluate any programming or software related errors.

20.2 DATA VERIFICATION

The data verification checklist in **Appendix C** will be used to guide the data verification effort. The review will generally consist of verifying that all data specified in the SAP was collected; that the samples collected, handled, and analyzed according to the methods and procedures specified; field and laboratory supporting document is present and complete; data calculations use correct mathematical formulas, and numerical and modeling methods. The verification process will identify any deficiencies and limitations on the use of the data.

20.3 DATA VALIDATION

The experienced data validator or subject matter expert will conduct the data validation using the data validation checklist in **Appendix C**. The goal of the validation effort is to evaluate whether the project data meets the needs of the user and associated decision makers. Validation will be completed on a minimum of 10% of all project data with a goal of 20%, except as noted below. Data validation will generally include:

- A 100% review of field QC sample results and assignment of data qualifiers, as needed.
- Review of analytical laboratory report and data, and assignment of data qualifiers, as needed.
- Evaluate data quality in relation to DQOs.
- Evaluate, where possible, reasons for any failure to meet methodical, procedural, or contractual requirements and the impact this may or may not have on the data.
- Assess adequacy of the data in relation to project DQOs and user requirements.
- As applicable, evaluate the extent of which any non-direct measurement data (existing data) and accompanying support information and documentation, meet the requirements of the data user.
- Evaluate limitations on the use of project data, as needed.

21.0 RECONCILIATION WITH USER REQUIREMENTS

The project manager and/or QA/QC manager will assess whether the data is adequate to meet the project DQOs. The project report will include a list of any deviations from the SAP and how the deviation may affect the data for use.

22.0 REFERENCES

DBS&A. 2014a. Hydrogeologic Characterization Report, Pickles Butte Sanitary Landfill, Volumes 1 and 2. Report to Pickles Butte Sanitary Landfill, April 25.

DBS&A. 2014b. Monitor Well Installation, Pickles Butte Sanitary Landfill. Report to Pickles Butte Sanitary Landfill, April 25.

Holladay (Holladay Engineering Company), 1994a. Hydrogeologic Characterization, Groundwater Monitoring Plan, & Facility Design, Pickles Butte Sanitary Landfill, Canyon County Idaho, July 1994.

Swirydczuk, K., Larson G.P., and Smith, G.R., 1982. Volcanic Ash Beds as Stratigraphic Markers in the Glenns Ferry and Chalk Hills Formations from Adrian, Oregon to Bruneau, Idaho. Cenozoic Geology of Idaho: Idaho Bureau of Mines and Geology Bulletin 26. Bill Bonnichsen and R.M. Breckenridge, editors. P. 543-558.

Tetra Tech, 2015. Landfill Status Report Update. Tetra Tech report number 4576RPT, submitted to Canyon County, December 8.

U.S. Environmental Protection Agency (EPA), 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. *Dated* January 13, 2009.

APPENDIX A – FIGURES

APPENDIX B – STANDARD OPERATING PROCEDURES

APPENDIX C – DATA REVIEW, VERIFICATION, AND VALIDATION CHECKLISTS

APPENDIX D – QUALITY MANUAL FOR ANALYTICAL LAB

Hard copy not provided due to size. Electronic version includes this appendix.

APPENDIX E – OPERATION MANUALS