PIONEER TECHNICAL SERVICES

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March 25, 2026

Mr. Christopher Herman
Environmental Project Officer
Petroleum Tank Cleanup Section
Montana Department of Environmental Quality
P.O. Box 200901
Helena MT 59620-0901

RE: Rev 1: Groundwater Monitoring Work Plan for the Former Bob's Tire Service
501 South Ellery Avenue, Fairview, Richland County, Montana
Facility ID #42-04828 (TID #27229), Petroleum Release #3053, Work Plan #35143

Owner/ Responsible Party:	Richland County Public Works 2140 West Holly Street Sidney, MT 59270	**Consultant/ Work Plan Preparer:**	Pioneer Technical Services, Inc. Taylor Bienvenue, GIT 2310 Broadwater Ave, Suite 1 Billings, MT 59102 tbienvenue@pioneer-technical.com

Dear Mr. Herman:

On behalf of Richland County Public Works, Pioneer Technical Services, Inc. prepared the following Groundwater Monitoring Work Plan and cost estimate for performing groundwater monitoring at the former Bob's Tire Service in Fairview, Montana. As requested in correspondence dated January 5, 2026, from Montana Department of Environmental Quality, our scope of work and associated proposed costs are outlined below.

If you have any questions concerning this project or the proposed scope of work, please contact me at (406) 723-1931 or tbienvenue@pioneer-technical.com.

Sincerely,

Pioneer Technical Services, Inc.

Taylor Bienvenue

Taylor Bienvenue, GIT
Project Scientist

Attachment 1: Figures
Attachment 2: Cost Estimate

cc: Mr. Joshua Johnson, Richland County Public Works
Charlie Peterson, PG, Pioneer Technical Services, Inc.

EXECUTIVE SUMMARY

The purpose of this document is to provide a Groundwater Monitoring Work Plan (work plan) for the former Bob's Tire Service (Facility ID #42-04828) facility (Site), located at 501 South Ellery Avenue, Fairview, Richland County, Montana, as requested in electronic correspondence from Montana Department of Environmental Quality (DEQ) dated January 30, 2026. The purpose of the proposed work activities is to monitor the natural attenuation of Release #3053 and propose additional work, if necessary, to resolve the release.

Montana DEQ requested Work Plan #35143 be developed to perform groundwater monitoring at the Site. The groundwater monitoring results will be used to evaluate the cleanup and to propose additional work needed to resolve Release #3053. This work plan provides the details for 2 years of semi-annual groundwater monitoring at the Site. Following completion of the first two monitoring events, Pioneer Technical Services, Inc. (Pioneer) will submit an Interim Data Submittal (IDS) presenting the 2026 groundwater monitoring results. Following the 2027 events, Pioneer will develop and submit a Groundwater Monitoring Report appended with an updated Release Closure Plan (RCP).

1 FACILITY SUMMARY AND CURRENT CONDITIONS

1.1 Physical Location

The former Bob's Tire Service facility is located at 501 South Ellery Avenue in Fairview, Montana. The Site is in a predominantly commercial area. The Site is on a level, rectangular-shaped parcel with an elevation of approximately 1,912 feet above mean sea level. The Site is bordered by West Fifth Street to the north, across from which is a bar/restaurant, South Ellery Avenue to the east, across from which is a casino and liquor store, a retail store to the south, and a storage area to the west. This area of Fairview is served by public utility city services (e.g., potable water and sanitary and storm sewer systems). There are currently no aboveground structures on Site, and the Site is covered with gravel. The location of the Site is shown on the Location and Vicinity Map (Figure 1) and Site Map (Figure 2) in Attachment 1.

The stratigraphic composition of the Site, underlying any fill material, is silt to approximately 6 feet below ground surface (bgs), silty clay to 12 feet bgs, and sand with varying amounts of silt and gravel to the bottom of the boring. Based on the most recent groundwater monitoring events, groundwater was present at an average depth of 17.56 feet bgs in May 2025 and at an average depth of 14.04 feet bgs in October 2025. Groundwater flows to the east.

1.2 Facility History and Release Background

During tank removal at the Site on November 4, 1996, potential petroleum impacts were identified near the hoists and underground storage tanks (USTs) and associated piping. The probable cause of the release was listed as tank overfill at the gasoline USTs and waste oil disposal tank. Prior to tank removal, the Site contained one 2,000-gallon gasoline UST, one 1,200-gallon gasoline UST, one 300-gallon waste oil aboveground storage tank (AST), and two hydraulic lifts with an estimated hydraulic oil capacity of 150 gallons each. The age of the USTs and hydraulic lifts at the time of removal was 19 years (DEQ, 1996a). On November 8, 1999, three monitoring wells (BMW-1, BMW-2, and BMW-3) were advanced as part of a remedial investigation at the Site. Monitoring well BMW-1 and BMW-3 soil samples, taken at or near the water table, had benzene values of 0.39 milligrams per kilogram (mg/kg) and 0.33 mg/kg, respectively, both of which exceed the current Montana DEQ risk-based screening level (RBSL) of 0.07 mg/kg. Monitoring well BMW-1 also had several other volatile petroleum hydrocarbon (VPH) constituents exceed current soil RBSLs. Groundwater samples from BMW-1 and BMW-3 had several VPH constituents exceeding modern DEQ RBSLs. The upgradient monitoring well, BMW-2, did not return any VPH constituents above DEQ RBSLs (Richland and McCone County Health Department, 2000).

Based on available information, approximately 23 groundwater monitoring events have occurred at the Site since 1998. The most recent monitoring events occurred in May 2025 and

October 2025 under Work Plan #34882. Under Work Plan #34822, to further define the extent and magnitude of remaining petroleum impacts on the Site, Pioneer advanced three soil borings (BMW25-06, BMW25-07, and BMW25-08) on April 29, 2025. All soil samples collected under Work Plan #34882 were below VPH and extractable petroleum hydrocarbon (EPH) RBSLs. Groundwater monitoring results indicated VPH constituents persist in the groundwater near BMW-01 and intermittently in monitoring wells BMW-03 and BMW25-07 (Pioneer, 2026).

2 OBJECTIVES OF GROUNDWATER MONITORING WORK PLAN

The primary objective of this work plan is to monitor the petroleum-contaminated groundwater and to evaluate the need for additional work to resolve the release.

In summary, this work plan involves conducting four semi-annual groundwater monitoring events, preparing an IDS after the first two groundwater monitoring events, and preparing a Groundwater Monitoring Report appended with a RCP upon completion of all activities. Specifically, this work plan proposes the following actions to achieve these goals:

- Perform four semi-annual groundwater monitoring events.
- Validate all laboratory analytical data using DEQ's Data Validation Summary Form.
- Discuss work plan tasks and results with DEQ's project manager; any modifications required to complete the work plan objectives will be submitted and agreed upon.
- Prepare and submit an IDS after the first two groundwater monitoring events.
- Prepare and submit a groundwater monitoring report appended with an updated RCP at the conclusion of all fieldwork activities.
- Update the RCP and discuss the results with DEQ's project manager.
- Submit work plan and reports electronically following the Petroleum Tank Cleanup Section submittal requirements.

Pioneer will provide the following services to monitor the current groundwater conditions at the Site:

- Task 1: Project Management Planning.
- Task 2: Semi-Annual Groundwater Monitoring.
- Task 3: Reporting.

The following sections describe each task for the proposed work along with Pioneer's cost estimate and proposed schedule.

2.1 Task 1 – Project Management and Planning

Task 1 Project Management and Planning work will include:

- Work plan and cost estimate preparation.
- Project scheduling.
- Health and Safety Plan preparation.
- Coordination with subcontractors, owners, and regulators.
- Site work preparation.

2.2 Task 2 – Semi-Annual Groundwater Monitoring

This work plan proposes performing four semi-annual groundwater monitoring events. During each semi-annual event, Pioneer will gauge all six existing Site monitoring wells (BMW-01, BMW-02, BMW-03, BMW25-06, BMW25-07, and BMW25-08) and will collect groundwater samples from the following monitoring wells: BMW-1, BMW-3, and BMW25-07. For each event, the Pioneer team will purge the wells and collect groundwater samples from the three previously mentioned monitoring wells. Our team will attempt to complete the sampling events in conjunction with the typically high and low groundwater conditions.

Prior to groundwater sample collection, the team will gauge each of the six monitoring wells for the presence of light non-aqueous phase liquid (LNAPL) as outlined in SOP-GW-03 Depth to Water Level Measurements (Pioneer, 2022a) provided in Attachment 3. Each well will be gauged using an electronic interface probe capable of detecting water or LNAPL hydrocarbons to within 0.01 foot. Groundwater samples will be collected in wells that do not contain LNAPL. If LNAPL is detected, the team will not collect any samples, will note the conditions in a logbook, and notify the DEQ project manager.

The groundwater samples will be collected according to low flow sampling techniques as outlined in *SOP-GW-10.2 Purging and Sampling Using the Low Flow Purge Method* (Pioneer, 2022b) provided in Attachment 3. To ensure representative groundwater samples are collected, the team will monitor the water quality parameters for the following intrinsic bioremediation indicators and allow them to stabilize during the purging process prior to sample collection: temperature (plus or minus 3%), pH (plus or minus 0.1), dissolved oxygen (plus or minus 10%), specific conductance (plus or minus 3%), oxidation-reduction potential (plus or minus 10 millivolts), and turbidity (plus or minus 10%). To complete groundwater sampling according to DEQ's low-flow sampling guidance (DEQ, 2018), the wells will be gauged at each field parameter monitoring interval with a water level meter to ensure that excessive drawdown (plus or minus 0.3 feet) does not occur prior to sampling.

Pioneer's team will collect the groundwater samples with a peristaltic pump and disposable tubing and transfer the samples to the appropriate laboratory containers. The laboratory will supply new, decontaminated containers prior to sample collection. Groundwater samples from

all six monitoring wells will be submitted for laboratory analysis of VPH, EPH screen, and Intrinsic Bioremediation Indicators, including methane, alkalinity (carbonate [CO_3], calcium carbonate [$CaCO_3$], and bicarbonate [HCO_3]), dissolved metals iron and manganese, pH, dissolved inorganic carbon, sulfate (SO_4), and nutrients (nitrite, nitrate, nitrite plus nitrate). Based on their absence during the historical sampling at the Site, lead scavengers have been excluded. Samples that exceed the EPH screening level (1,000 micrograms per liter) will undergo fractionation without polycyclic aromatic hydrocarbons (PAHs). For the purpose of this work plan, it is assumed that two of the samples will require fractionation without PAHs.

Analysis of groundwater samples will be in accordance with DEQ's *Risk-Based Corrective Action Guidance for Petroleum Releases* (DEQ, 2024). Pioneer's team will collect one field duplicate during each sampling event. Each sample container will be preserved as directed by the laboratory, labeled, and packaged on ice. The samples will be delivered to Energy Laboratories, Inc. Chain of custody documentation will accompany the samples.

Purge water generated during the sampling activities will be infiltrated into the grassy areas available at the Site in accordance with Montana DEQ standards.

2.3 Task 3 – Reporting

Pioneer will prepare one IDS following the 2026 groundwater sampling events and a Groundwater Monitoring Report with an appended, updated RCP following the completion of all groundwater monitoring events.

Following the second round of groundwater sampling, Pioneer will prepare and submit an IDS, prepared according to DEQ's *Montana Groundwater Monitoring Work Plan and Report Guidance for Petroleum Releases* (DEQ, 2021) that will include the following:

- Updated Site maps, illustrating the locations of existing monitoring wells, underground utilities, and surface features.
- Tables summarizing cumulative laboratory analytical data for the release and comparison of concentrations of petroleum compounds in soil and groundwater to their respective RBSLs listed in DEQ's Risk-Based Corrective Action Guidance (DEQ, 2024).
- Laboratory analytical reports for groundwater samples.
- Logs, field data sheets, and related field data.
- Laboratory data validation.

Following the final round of groundwater sampling, Pioneer will analyze the results and compile and submit a Groundwater Monitoring Report, prepared according to DEQ's *Montana Groundwater Monitoring Work Plan and Report Guidance for Petroleum Releases* (DEQ, 2021) that will include the following:

- Updated Site maps, illustrating the locations of the new and existing monitoring wells, underground utilities, and surface features.
- Tables summarizing cumulative laboratory analytical data for the release and comparison of concentrations of petroleum compounds in soil and groundwater to their respective RBSLs listed in DEQ's Risk-Based Corrective Action Guidance (DEQ, 2024).
- Laboratory analytical reports for groundwater samples.
- Logs, field data sheets, and related field data.
- Laboratory data validation.
- Recommendations relevant for further investigation or remedial action.
- An updated RCP.

3 COST ESTIMATE

A detailed cost estimate to perform this scope of work is presented on the worksheet in Attachment 2.

4 SCHEDULES

Pioneer proposes to perform the first groundwater sampling event (Task 2) during spring of 2026. The following groundwater monitoring events will be performed in the fall of 2026, spring of 2027, and fall of 2027. The IDS will be completed and submitted within 45 days of receipt of all laboratory analytical reports for groundwater samples for the fall 2026 event. The groundwater monitoring report will be completed and submitted within 45 days of receipt of all laboratory analytical reports for groundwater samples for the fall 2027 event. The full duration of the project is approximately 21 months, and the final report will be issued sometime in the late winter of 2027.

5 REFERENCES

DEQ, 1996a. 24-Hour Initial Release Response Report. Underground Storage Tank Program Department of Environmental Quality. November 4, 1996.

DEQ, 2018. Groundwater Sampling Guidance. Montana Department of Environmental Quality Contaminated Site Cleanup Bureau. DEQ-WMRD-GWM-1. March 6, 2018. Helena, Montana 59601.

DEQ, 2021. Montana Groundwater Monitoring Work Plan and Report Guidance for Petroleum Releases. Montana Department of Environmental Quality, Waste Management and Remediation Division, Petroleum Tank Cleanup Section. March 2021.

DEQ, 2024. Montana Risk-Based Corrective Action Guidance for Petroleum Releases. Montana Department of Environmental Quality. February 2024. Available at

https://deq.mt.gov/files/Land/StateSuperFund/Documents/rbca/Update/Final%20RBCA%202024%20Update_Compiled%20PDF.pdf.

Pioneer, 2026. Remedial Investigation Report for the Former Bob's Tire Service Facility; 501 South Ellery Avenue, Fairview, Richland County, Montana; Facility ID #42-04828, TID #27229, Release #3053, Work Plan ID #34882. Prepared by Pioneer Technical Services, Inc. January 14, 2026.

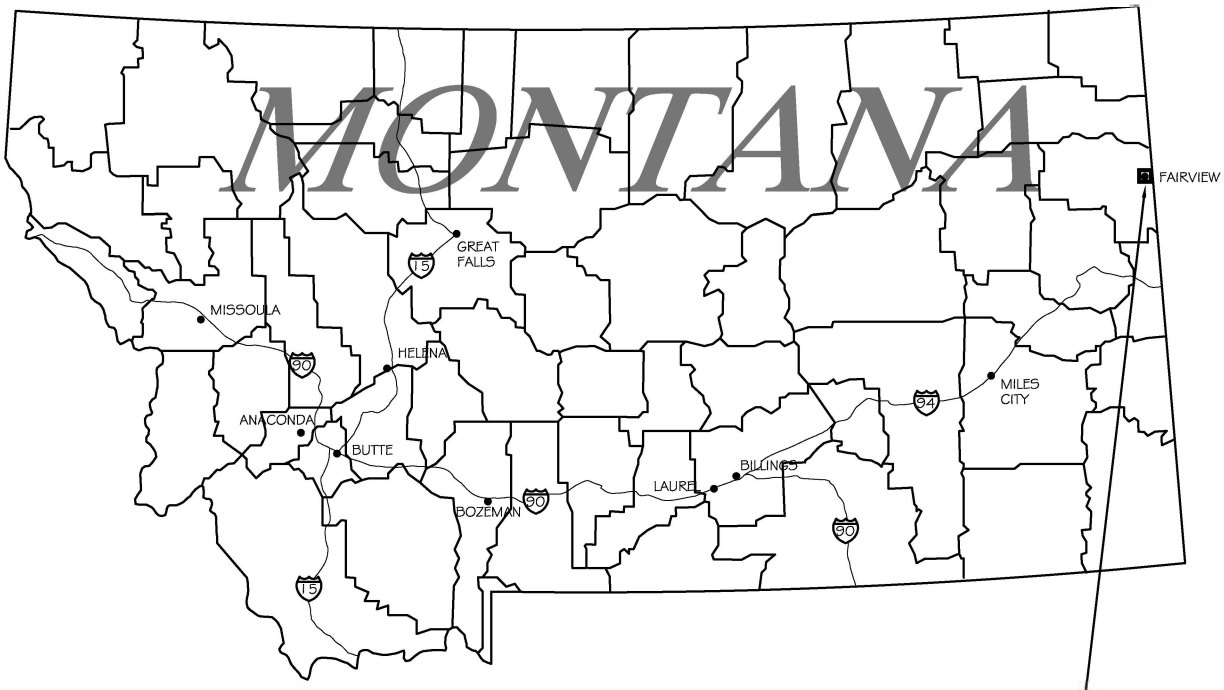
Pioneer, 2022a. SOP-GW-03 Depth to Water Level Measurements. Pioneer Technical Services, Inc. January 18, 2022.

Pioneer, 2022b. SOP-GW-10.2 Purging and Sampling Using the Low Flow Purge Method. Pioneer Technical Services, Inc. July 6, 2022.

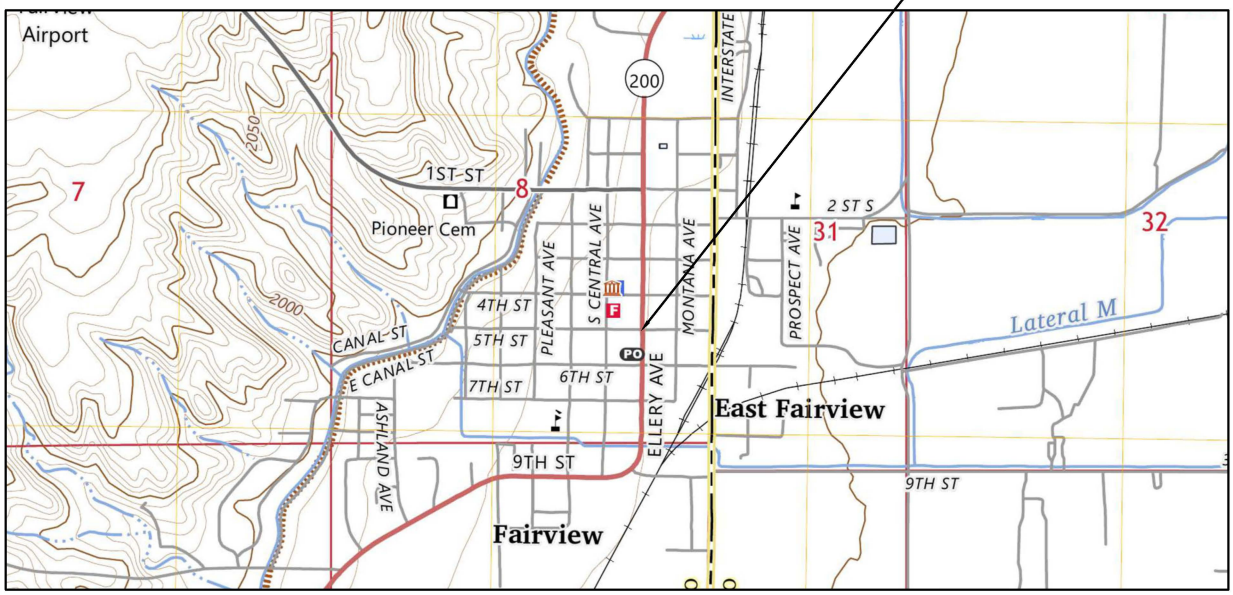
Richland and McCone County Health Department, 2000. Memorandum: Bob's Tire, Fairview – Facility ID # 42-04828, District Sanitarian Richland and McCone County Health Department. February 4, 2000.

Attachment 1
Figures

Figure 1. Location and Vicinity Map
Figure 2. Site Map



PROJECT LOCATION



SITE VICINITY MAP

DEQ FACILITY ID: 42-04828
RELEASE NUMBER: 3053
WORK PLAN NUMBER: 35143

FORMER BOB'S TIRE SERVICE FACILITY
501 SOUTH ELLERY AVENUE
FAIRVIEW, MONTANA 59221

DISPLAYED AS:
COORD SYS/ZONE: NAD83, NAVD88
DATUM: MSP
UNITS: INT. FEET
SOURCE: USGS

SCALE IN FEET
0 1000 2000

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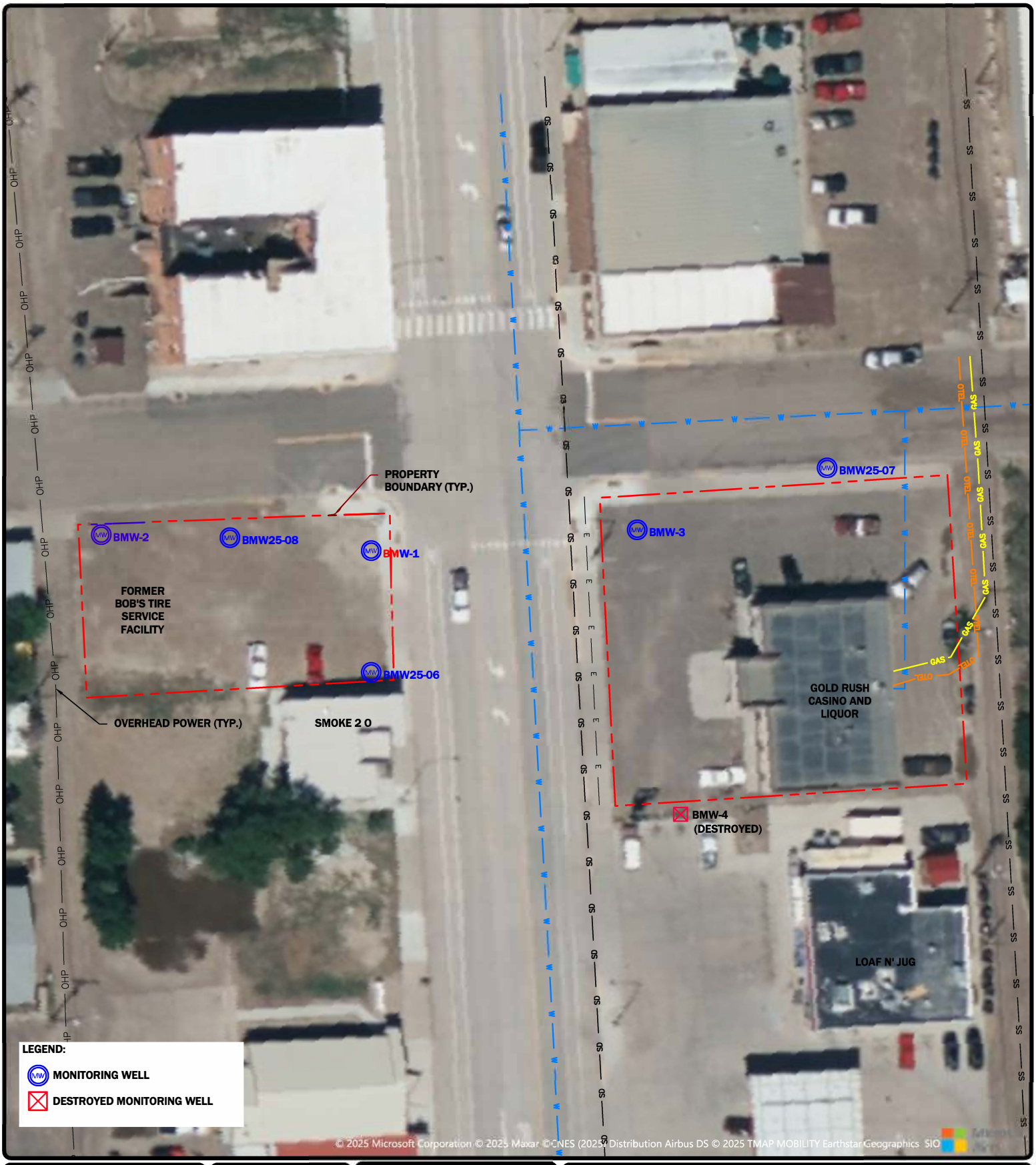
FIGURE 1

SITE VICINITY AND LOCATION MAP
FORMER BOB'S TIRE SERVICE FACILITY

DATE: MARCH 2026

10/2/2025 4:55:15 PM Z:\SHARED\ACTIVE PROJECTS\BILLINGSREGIONLUSTPROJECTS\BOBSTIRE\CADD\SHEETSETS\BOBS-FIG-001-25.DWG



DEQ FACILITY ID: 42-04828
RELEASE NUMBER: 3053
WORK PLAN NUMBER: 35143

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COORD SYS/ZONE: NAD83, NAVD88
DATUM: MSP
UNITS: INT. FEET
SOURCE: ----

SCALE IN FEET
0 25 50

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FIGURE 2

SITE MAP
FORMER BOB'S TIRE SERVICE FACILITY

DATE: MARCH 2026

10/3/2025 9:57:32 AM Z:\SHARED\ACTIVE PROJECTS\BILLINGSREGIONLUSTPROJECTS\BOBSTIRE\CADD\SHEETSETS\BOBS-FIG-002-25.DWG

Attachment 3
Standard Operating Procedure

PURPOSE	To provide standard instructions for conducting depth to water level measurements.
SCOPE	Pioneer Technical Services, Inc. (Pioneer) prepared this practice for the workforce and this Standard Operating Procedure (SOP) applies to all work performed by and on behalf of Pioneer. All members of the Pioneer workforce who conduct the work shall be trained and competent (as defined by OSHA) in the risk-assessed work described below before performing the work.

WORK INSTRUCTIONS

The following instructions provide guidance to perform the task in a safe, accurate, and reliable manner. If these instructions present information that is inaccurate or unsafe, personnel must notify the Project Manager, Safety Manager, and the SOP Technical Author to initiate appropriate revisions. Personnel will perform all work under this SOP in a manner that is consistent with procedures and policies described in the appropriate Operation, Maintenance, and Monitoring (O&M) Plan (where applicable), appropriate Site-Specific Health and Safety Plan (SSHASP), and Pioneer Corporate Health and Safety Plan (HASP).

TASK	INSTRUCTIONS
Electric Depth to Water Indicator	
1. Inspect well casing.	Inspect well and casing for a marked measuring point (e.g., a line or arrow made with a permanent marker, or an indentation on the well's inner casing). If no measuring point is marked, locate the north side of the well and establish a marking point. Choose the point for ease in accurately reading the measuring tape. Mark the measuring point with a Sharpie© or paint pen.
2. Turn on and test the water level indicator.	Turn the depth to water meter on. Test that the water level indicator is on and working by pushing the test button on the body of the meter. Check the buzzer sound level and/or check that the indicator light flashes. Before using the meter, clean and decontaminate the meter per SOP-DE-02 Equipment Decontamination.
3. Lower the sensor.	Lower the sensor probe slowly into the well to minimize disturbance of water when it is encountered. As the sensor is lowered down the well, the buzzer and/or flashing light will indicate contact with water. Be aware that the sensor may indicate water prior to actual water level if the probe contacts condensation on the well; in this case the buzzer on the meter will buzz intermittently.
4. Align probe cable.	Once a solid tone is heard or the indicator light stays on, a depth to water reading can be taken. Align the marked probe cable with the designated marking point and gently raise and lower the probe until the exact mark on the probe cable, when water is encountered, is identified.
5. Record information.	Record this information in the project logbook as the depth to water (DTW) along with the time the reading was taken. Additionally, record where the marking point was located (e.g., top of casing [TOC], top of steel casing [TOSC], top of polyvinyl

	chloride (PVC) [TOPVC], inner PVC [IPVC], etc.) to help maintain continuity, if subsequent depth to water readings are needed from this well.
6. Reel in equipment.	Reel in sensor probe.
7. Decontaminate equipment.	Decontaminate all equipment prior to re-use per SOP-DE-02 Equipment Decontamination.
Chalked Measuring Tape Depth to Water Measurements	
1. Coat tape with chalk.	Make sure the equipment is clean and decontaminated per SOP-DE-02 Equipment Decontamination. Coat the lower 3 to 5 feet of tape with chalk and lower into the well. Listen for a slight splash when the weight contacts water or the cable may feel a slight drag or be lighter once it contacts the water, then lower tape an additional 0.5 foot.
2. Record information.	Record measure point and pull tape carefully from well. Read the wetted chalk mark and record. Subtract the wetted chalk mark from the measure point for true depth to water.
3. Decontaminate equipment.	Decontaminate all equipment prior to re-use per SOP-DE-02 Equipment Decontamination.

HEALTH SAFETY SECURITY ENVIRONMENT (HSSE) CONSIDERATIONS
This section to be completed with concurrence from the Safety and Health Manager.

SOURCE	*HAZARDS*	*WHERE*	*HOW, WHEN, RESULT*	*CONTROLS*
CHEMICAL	Potential contact with contaminated water.	Sites.	Inadvertent exposure to contaminated soil and water could lead to adverse health effects.	Personnel will practice proper personal hygiene – wash hands prior to eating/drinking and when leaving the site. Personnel will wear nitrile gloves and safety glasses when collecting and handling samples.
NOISE	Not applicable.			
ELECTRICAL	Not applicable.			
BODY MECHANICS	Bending, squatting, and kneeling.	During depth measurements.	Bending, squatting, and kneeling during depth measurements could result in muscle/back strains or other injuries.	Personnel should stretch prior to starting work and take breaks when necessary.
GRAVITY	Falls from slips and trips.	Uneven terrain, slick / muddy / wet surfaces and steep slopes.	Walking / working on slick / muddy / wet and uneven terrain could cause slips and trips resulting in falls and injuries.	Personnel will wear work boots with good traction and ankle support. Personnel will be aware of working/walking surfaces and choose a path to avoid hazards. Keep work areas as dry as possible. Wear muck boots, as necessary.
WEATHER	Cold/heat stress.	Sites.	Exposure to cold temperatures may result in cold burns, frostbite, and hypothermia. Exposure to high temperatures may result in heat cramps, heat exhaustion, or heat stroke.	Training on signs and symptoms of cold/heat stress is required. Personnel will wear appropriate clothing when working outdoors. Personnel will remain hydrated and will have sufficient caloric intakes during the day. Personnel will follow procedures outlined in applicable SSHASP and/or Pioneer corporate HASP.

HEALTH SAFETY SECURITY ENVIRONMENT (HSSE) CONSIDERATIONS
This section to be completed with concurrence from the Safety and Health Manager.

SOURCE	*HAZARDS*	*WHERE*	*HOW, WHEN, RESULT*	*CONTROLS*
	Lightning.	Outdoor sites.	Electrocution, injury, death, or equipment damage could be caused by lightning strike.	Personnel will follow the 30/30 rule during lightning storms.
RADIATION	Ultraviolet (UV) radiation.	Outdoors.	Personnel could be exposed to UV radiation during summer months causing sun burns, skin damage, and eye damage.	Personnel will wear safety glasses with tinted lenses, long-sleeve work shirts, and long pants. Personnel should wear sunscreen, if necessary.
BIOLOGICAL	Plants, insects, and animals.	Sites and well casings.	Exposure to plants, insects, and/or animals may cause rashes, blisters, redness, and swelling.	Training on the signs and symptoms of exposure to plants, insects, and animals is required. Avoid contact with plants, insects, and animals. First-aid kits will be available on site. Personnel with allergies will notify their supervisor.
MECHANICAL	Scrapes and cuts.	Well casing.	Scrapes and cuts could result when taking measurements, from sharp edges in metals or PVC casings.	Personnel will inspect well casing for sharp edges. If edges are very sharp, personnel will wear leather gloves.
PRESSURE	Not applicable.			
THERMAL	Not applicable.			

HEALTH SAFETY SECURITY ENVIRONMENT (HSSE) CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.				
SOURCE	***HAZARDS***	***WHERE***	***HOW, WHEN, RESULT***	***CONTROLS***
HUMAN FACTORS	Inexperienced and improperly trained personnel.	Sites.	Inexperienced personnel and improper training could cause incidents resulting in adverse health effects and/or property damage.	Personnel will be properly trained in this procedure and other applicable procedures. Personnel will implement stop work procedures, if necessary.
SIMOPS (Simultaneous Operations)	Struck by and/or caught in between heavy equipment or vehicles.	Sites.	Personnel could be injured if struck by and/or caught in between heavy equipment or vehicles while collecting samples.	Personnel will communicate with the contractors on site. Personnel will avoid working near heavy equipment/vehicles, when possible. Personnel will wear high visibility clothing. When possible, personnel will park field vehicles or use traffic cones to prevent third party vehicles from coming into the work area.

ADDITIONAL HSSE CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.	
REQUIRED PPE	**Personnel Protection Equipment** (PPE)**:** Hard hat, safety glasses, high-visibility work shirt or vest, long pants, work boots, and nitrile gloves.
APPLICABLE SDSs	**Safety Data Sheets** (SDSs) will be maintained based on site characterization and contaminants. Safety Data Sheets are available to Pioneer personnel on the internal website under Safety.
REQUIRED PERMITS/ FORMS	Per site/project requirements.
ADDITIONAL TRAINING	Per site/project requirements.

DRAWINGS, DOCUMENTS, AND TOOLS/EQUIPMENT The following documents should be referenced to assist in completing the associated task.	
DRAWINGS	Map with well locations.
RELATED SOPs/PROCEDURES /WORK PLANS	SOP-DE-02 Equipment Decontamination.
TOOLS/ EQUIPMENT	Depth to water meter or measuring tape and chalk and field logbook.
FORMS/ CHECKLIST	

APPROVALS/CONCURRENCE

By signing this document, all parties acknowledge the completeness and applicability of this SOP for its intended purpose. Also, by signing this document, it serves as acknowledgement that I have received training on the procedure and associated competency testing.

SOP TECHNICAL AUTHOR	**DATE**
Patricia Olson **Patricia Olson**	**01/18/2022**
SAFETY AND HEALTH MANAGER	**DATE**
Tara Schleeman **Tara Schleeman**	**01/18/2022**

PURPOSE	To provide standard instructions for purging and sampling groundwater wells or piezometers using the low flow purge method. This procedure can be used with the following pumps: peristaltic and bladder pumps.
SCOPE	Pioneer Technical Services, Inc. (Pioneer) prepared this practice for the workforce and this Standard Operating Procedure (SOP) applies to all work performed by and on behalf of Pioneer. All members of the Pioneer workforce who conduct the work shall be trained and competent (as defined by OSHA) in the risk-assessed procedure described below before performing the work.

WORK INSTRUCTIONS

The following instructions provide guidance to perform the task in a safe, accurate, and reliable manner. If these instructions present information that is inaccurate or unsafe, personnel must notify the Project Manager, Safety Manager, and the SOP Technical Author to initiate appropriate revisions. Personnel will perform all work under this SOP in a manner that is consistent with procedures and policies described in the appropriate Operation, Maintenance, and Monitoring (O&M) Plan (where applicable), appropriate Site-Specific Health and Safety Plan (SSHASP), and Pioneer Corporate Health and Safety Plan (HASP).

TASK	INSTRUCTIONS
Note	Sampling wells in order of increasing chemical concentrations is always preferred but not required.
Pump Manuals	The pumps that Pioneer currently uses are listed below. If a pump is necessary for fieldwork and not listed below, please refer to the Sampling Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), Work Plan (WP), Field Sampling Plan (FSP), and/or other project documents (referred to collectively herein as the guidance document) for directions on pump selection and manuals. • Peristatic Pump: Geotech Geopump Peristaltic Pump Installation and Operation Manual (geotechenv.com) • Bladder Pump: Geotech Bladder Pumps Installation and Operation Manual (geotechenv.com)
1. Gather information for the sample event.	Review the guidance document for the following: • Sampling/purge method requested for sampling the required wells. • Purge water containment requirements. • Well installation information (e.g., total depth, screen interval, the last depth to water [DTW] level reading if available, etc.) to determine the appropriate pump and approximate purge volumes required. • Depth at which the pump should be installed; the mid-point of the saturated screen is used by convention as the location of the pump intake. Chemical concentrations or permeability considerations may require pump placement in a different zone. Refer to the guidance document to determine the project or analyte requirements.

- Sample container and preservation requirements; make sure the appropriate bottles and preservatives have been provided by the analytical laboratory.
- Whether samples must be filtered; if so, determine the number and type of filters needed.
- Sample storage requirements such as:
  - Do the samples need to be iced immediately upon their collection?
  - If highly contaminated samples are to be collected, do they need to be stored in a separate cooler/container from other samples?
- Analytes to be analyzed. If low-level analyte analysis is being requested (e.g., mercury or low-level volatile organic compounds [VOCs]), determine if additional precautions and equipment will be required.
- Type of water quality measurements required for either informational or stabilization parameters. Confirm that the appropriate meters or field tests are available.
- Refer to the project-specific requirements in the guidance document for purge volume requirements.

2. Select pump needed for sampling.

The table below summarizes the types of pumps Pioneer has available for groundwater sampling. Using the information compiled in Step 1, select the appropriate pump using the table below.

Table 1. Pumps Available for Groundwater Sampling

Pump/Development Type	Well Diameter (inches)	Max Well Depth (feet)	Anticipated Production
Peristaltic Pump	≥ 0.38	25	Up to 0.25 GPM
Bladder Pump (stainless steel) – 3/4" diameter[1]	=1 ½	<200	Low Flow Only
Bladder Pump (stainless steel) – 1 ¾" or 2" diameter	≥ 2	<290	Low Flow Only

[1] 3/4" bladder pump can only be used in 1 ½" wells.

GPM: gallons per minute.

Use stainless-steel pumps (bladder pump) when sampling for VOCs, semi-VOCs (SVOCs), pesticides, and polychlorinated biphenyl (PCBs). Peristaltic pumps and bailers are not recommended when volatile organic samples are to be collected as they may introduce air into the sample.

If the purging/sampling requirements from the guidance document cannot be met by the pumps Pioneer has available, talk to the project manager about renting an appropriate pump. This may be particularly necessary for deeper or wider diameter wells requiring large purge volumes.

3. Gather field equipment.	Based on the type of pump selected, ensure that the proper diameter tubing (inner and outer diameters) and the appropriate disposable or decontaminated tubing type is available for use. Teflon or Teflon-lined tubing is preferred when sampling for VOCs, SVOCs, pesticides, and PCBs. The polyvinyl chloride (PVC), polyethylene, and polypropylene tubing can be used when sampling for inorganics. For other analytes or low-level analysis, specialty tubing may be required. **Note**: All down hole and potentially wetted surfaces must also be made of non-contaminating/non-contributing materials. This includes power and suspension cables and compressed gas or sample tubing. Gather the remaining required field equipment based on the information Step 1, including containment supplies, decontamination equipment, field measurement devices, personnel protection equipment (PPE), well keys, pumps, tubing, sampling supplies, etc.
4. Calibrate all field measurement devices.	Following the directions in the specific meter user's manual or corresponding Pioneer SOP, calibrate all the field parameter measurement devices needed for the sample event. General devices used are listed below with the corresponding SOP. The specific guidance document or project may require other measurement devices. • Potential hydrogen (pH) probe/meter (SOP-WFM-01). • Oxidation Reduction Potential (ORP) probe/meter (SOP-WFM-02). • Specific Conductivity (SC) probe/meter (SOP-WFM-03). • Dissolved Oxygen (DO) probe/meter (SOP-WFM-07). • Turbidity meter (SOP-WFM-08). • Photoionization detector (PID) (SOP-FM-01). Record all calibration information and results in the field logbook. Water quality parameter meters must be calibrated DAILY.
5. Mobilize to site.	When arriving at the site, take notice of where you park the vehicle. If using the truck battery to power the pump, make sure that the truck is parked with the proper side facing the well. If unloading heavy pumps and generators is required, park the vehicle as close to the well as possible to limit the distance the equipment needs to be carried. When sampling for VOCs or extractable petroleum hydrocarbon (EPH), purging, sample collection, sample handling, and containerization should not take place near a running motor or any type of exhaust system. A 12-volt battery can be carried to the well site. If the truck battery needs to be used for sampling, do not have the truck running just before and during sampling. If the truck needs to run during sampling or a generator will be used, make sure that they are located as far downwind of the well as possible so that exhaust will blow away from the well. Note in the logbook and on the field data sheet the presence of a running vehicle or generator when sampling for volatile organics. If there are additional sources of exhaust in the vicinity (site is close to active road, etc.), this should also be noted in the logbook.

	When collecting water quality VOC samples, use a new pair of nitrile gloves to collect the samples. Do not allow the gloves to come into contact with the media being sampled and change them any time during sample collection when their cleanliness has been compromised. If possible, one member of the sampling team should take all the notes and fill out sample tags/identification, while the other member collects the groundwater samples. This will help prevent contamination to the sample being collected.
6. Open well cap and collect PID readings (if required).	If sampling for VOCs such as volatile petroleum hydrocarbon (VPH), methane, or EPH, the guidance document may require measuring organic vapors immediately upon opening the well casing, prior to determining DTW level or sampling. The procedures for calibrating and using a PID meter are discussed in SOP-FM-01. The section "*Screening organic vapors in a well casing"* in that SOP discusses measuring organic vapors in a groundwater well.
7. Determine the water level in the well.	Using clean, non-contaminating equipment, such as an electronic DTW level indicator, determine the water level in the well. Refer to SOP-GW-03 for instructions. If required, check for the presence of free or floating product with an interface probe. If an interface probe is not available, use a clean, clear bailer. To use a bailer to measure floating product depth: • Slowly and gently lower the bailer to just below the surface of the water; try not to agitate the water in any way. • Mark the string at the measuring point on the well head. • Pull the bailer up and measure the width of floating product present in the bailer above the water surface. The bailer may need to set for a few minutes to ensure that any product has risen to the surface. • Calculate the depth to top of product by measuring from the mark on the string to the top of the product in the bailer or by subtracting the width of the product layer in the bailer from the water level measured with the DTW level indicator. If there is no existing information available about the total depth of the well, determine the depth to the bottom of the well. • Once you have recorded the DTW level measurement in the field logbook and/or on the field data sheet, turn down the volume on the DTW meter. • Slowly lower the probe until it gently touches the bottom. The bottom is easier to identify in narrower wells with hard bottoms. If necessary, because of a "soft" bottom, gently lower and raise the probe to determine when the bottom is encountered. In larger-diameter wells, the probe cable will go slack as the probe hits the bottom and leans over. Be gentle when tapping the bottom as sediment in the bottom of the well will be stirred up each time the bottom is touched. This will make stabilizing water quality readings more difficult.

	Record the total depth of the well from the same measuring point used for the DTW level measurement.
8. Calculate purge volumes.	Using the Multi-Purge Volume Method (SOP-GW-10.1), purging a monitoring well of 3 well volumes is considered sufficient to obtain a valid sample. A well volume is the amount of water contained initially inside the well casing. The 3 well volumes are part of the stabilization parameter requirements for the Multi-Purge Volume Method. However, the Low Flow Purge Method parameter stabilization does not include well volume requirements. The Low Flow Purge Method is used to reduce stress to the well, meaning having slower purge rates (typically less than 0.5 Liters per minute [L/min]) with minimal drawdown to water level in the well. In general, groundwater samples can be collected after pH, SC, ORP, DO, and turbidity have stabilized (refer to SOP-GW-14 or Step 14 of this SOP for additional information on stabilization parameters), only for the Low Flow Purge Method. Project-specific sampling requirements may require different well volumes for sufficient sampling. For all purge methods, if you have purged 5 or more well volumes, you can proceed with sampling. Record all information regarding purging, problems with purging, and decision-making processes in the field logbook and/or on the field data sheet. Although purge volumes are not part of the stabilization requirements (unless stated otherwise), the calculation of the fluid volume in the well casing ("casing volume") must be recorded in the logbook and/or on the field data sheet. Refer to Table 2 for constants that may help in calculating gallons required for purging. **It may be necessary to follow purge volume requirements. If so, follow the guidance in Table 2 and the procedures following the table. If purge volumes are not required as part of the stabilization parameters, skip to Step 9 of this SOP.** Refer to the guidance document to determine total purge volume. Contact the project manager or quality assurance officer, if necessary.

Table 2. Purge Volumes Per Foot of Water Column for Various Well Diameters

Well Diameter (inches)	Gallons per foot Constant for purging 1 casing volume	Gallons per foot Constant for purging 3 casing volumes
0.5	0.01	0.03
0.75	0.02	0.07
1	0.04	0.12
1.5	0.09	0.28
2	0.16	0.49
3	0.37	1.10
4	0.65	1.96
6	1.47	4.41
7	2.00	6.00
8	2.61	7.83
10	4.08	12.24
12	5.87	17.62
16	10.44	31.33
18	13.22	39.65
24	23.50	70.50

To determine the gallons required for a 3 well volume purge:

a. Subtract the DTW level from the total depth of the well (water column).
b. Multiply the water column (Step a) by the constant for purging 3 well volumes (Table 2, above) associated with the well diameter. This result is the number of gallons to purge for 3 well volumes.

For example, DTW level on a 2-inch monitoring well was measured at the marking point as 10.5 feet. The total depth of the well is 20 feet to that same marking point. The calculation is then:

(20 – 10.5) * 0.49 = 4.7 gallons.

The resultant 4.7 gallons is the amount that would need to be purged to achieve 3 casing volumes.

Use the constant for purging 1 well volume in Table 2 to determine the number of casing volumes purged if trying to determine how many casings have been purged or to calculate the volume for 5 well casings.

9. Attach tubing to the pump outlet.	Based on the information collected in Step 1, determine the depth the pump will be set in the well. The mid-point of the saturated screen is used by convention as the location of the pump intake. Chemical concentrations, permeability considerations, or the physical limitations of the pump (pumping depth or tubing length) may require pump placement in a different zone; this should be indicated in the guidance document or recorded in the logbook as a deviation to this SOP. Measure and cut the appropriate length of tubing if using disposable tubing. Remember to add enough tubing to reach from the measuring point to the flow cell or the containment system when cutting tubing. If using decontaminated or dedicated tubing, depth intervals may already be marked on the tubing, which makes installation at the appropriate depth easier. Make sure that the tubing is marked with the depth the pump needs to be set at from the marking point. Refer to the individual pump operating manual to determine the location of tubing attachments; this is particularly important when installing air and sample tubing on the bladder pumps.
10. Attach pump shroud if needed.	In larger bore wells (greater than or equal to 4 inches), the stainless-steel electric submersible pumps may need a shroud installed over the pump to force water to flow around the pump and keep it cool. Check the pump user's manual to determine if a shroud is needed. If the water in the well is fairly warm and the pump will run for an extended time a shroud is recommended. Pioneer owns several PVC shrouds that can be used. **To install a shroud:** a. Loosen the hose clamp on the top of the shroud. b. Remove the two top sections. c. Slide the pump into the base, then replace the two top sections. d. Slide the hose clamp into place and tighten the screw.
11. Lower pump and tubing into well.	Lower the pump and tubing gently into the well to the predetermined sampling zone. If possible, keep the pump at least 2 feet from the bottom of the well to avoid mobilization of particulates in the bottom of the well. The placement of the pump in the well should be such that the well cannot be pumped dry. If, when lowering the pump into the well, the pump touches bottom before the mid-screen depth is reached, the project manager should be contacted about potentially redeveloping the well. Using the clamp on the pump reel, large binder clips, or clamps, secure the pump/tubing in the sampling zone. If using clips or clamps make sure that the tubing is not constricted as to reduce flow rates. Reinsert the DTW meter probe into the well to monitor drawdown while purging.

12. Prepare the work area for purging and sample collection.	Attach the flow cell to the discharge tubing or valve associated with the water parameter meters being used. Refer to the individual SOPs (listed previously under Step 4) for information on using the water parameter meters and the flow cells. If necessary, collect/contain purge water. There are several methods to collect/contain purge water if directed to do so in the project guidance document. • If a pickup truck with a tank is available, run the discharge hose directly from the well into the tank for containment. Use this tank to transport for disposal. Pioneer has several large plastic tanks available. If hydrocarbon contamination in a well is known or suspected, make sure to use a tank marked for hydrocarbons (hydrocarbon-marked tanks must not be used for non-hydrocarbon purge water containment). • In some cases, tanks may not be available. Consult with the project manager or quality assurance officer for containment and disposal. Use a bucket or discharge storage container to collect the discharge water from the flow cell. Place the discharge tubing from the flow cell into the bucket or storage container. At this time, the valve to the flow cell should be in the OFF position. The valve to the discharge hose should be open all the way.
13. Start the pump and adjust the pump's speed.	Place the outlet end of the tubing in a bucket for containment or connect it to a discharge hose prior to starting the pump. Using the pump's controller or by attaching the leads of the pump to a 12-volt battery, start the pump. Refer to the individual pump user's manual for specific requirements for each pump. Adjust the flow using the controllers or the valve until an appropriate discharge rate is achieved (refer to the paragraph below). Try and set a purge rate that allows the water level to stay above the screened interval to avoid exposing sediments adjacent to the well to oxidize and possibly affect incoming groundwater chemistry. **To determine the discharge rate** use a stopwatch and a container of an appropriate size marked with gallons/quarts or liters to measure the flow. Refer to SOP-WFM-09 for methods on calculating flow rates. Record this information in the logbook or on the field data sheet. You will use this information along with time elapsed to determine the volume of water purged from the well. Once you establish a flow rate, turn the valve so water flows through the flow cell. **Caution**: Be aware that as a well is pumped, the water level is frequently drawn down causing the efficiency of the pump to decrease. Pump efficiency is decreased because the water has to be lifted higher above the decreasing water level in the well. This causes the flow rate to decrease. Check the discharge rate during the purging process if needed. If you notice a decrease in flow rate, the flow rate or the purging time may need to be adjusted to compensate.

	If the recharge rate of the well appears to be slower than a reasonable extraction rate for the pump used, the well may have become essentially dewatered (e.g., water level falls below the pump intake level). In this case, shut off the pump and allow the well to recover sufficiently to continue sampling and fill all the sample containers. If possible, do not move the pump intake during this process. Once the well recovers, continue to collect samples even though parameters have not stabilized. Record and document sampling procedures in the field logbook. **Never allow a well to be pumped dry.** Oxidation of sediments at the bottom of the well can alter the incoming water chemistry and provide misleading results. If needed, allow the monitoring well to sit for up to 24 hours after purging before sampling to ensure enough water will be available to fill sample containers. Remember that when determining the amount of water in the well after recovery, use the constant for 1 well casing for calculations. Record any deviations to the standard sampling protocol in the field logbook and/or on a field data sheet.
14. Monitor and record field parameters and depth to water level measurements.	During well purging, monitor field parameters including DTW, pH, ORP, SC, temperature, DO, and turbidity (refer to SOP-GW-03, SOP-WFM-01, SOP-WFM-02, SOP-WFM-03, SOP-WFM-04, SOP-WFM-07, and SOP-WFM-08). Depth to water measurements should be less than 0.1 meter (m) (0.3 feet) of drawdown from the time of purge to the time of sampling. If drawdown is greater than 0.1 m (0.3 feet), consult with the project manager and quality assurance officer prior to sample collection. Refer to the guidance document for other field parameters that may need to be monitored. As outlined in the *"Groundwater Sampling Guidance"* from the Montana Department of Environmental Quality – Contaminated Site Cleanup Bureau (available at https://deq.mt.gov/files/Land/LUST/Documents/downloadables/GWSamplingGuidance-FINAL.pdf), water quality parameters are considered stable when 3 consecutive readings (generally 2-5 minutes apart) are as follows: a. Temperature range is no more than plus or minus 1 degree Celsius (°C). b. pH varies by no more than 0.1 pH units. c. SC readings are within 3% of the average. d. ORP varies by no more than 10 millivolt (mV) units. e. DO readings are within 10% of the average. f. Turbidity readings are within 10% of the average. It should also be noted that natural turbidity levels in groundwater may exceed 10 nephelometric turbidity units (NTU); therefore, turbidity can be considered stable when 3 consecutive readings are within 10% for values greater than 5 NTU and if 3

	turbidity values are less than 5 NTU (Montana Department of Environmental Quality *"Groundwater Sampling Guidance"* – available at https://deq.mt.gov/files/Land/LUST/Documents/downloadables/GWSamplingGuidance-FINAL.pdf). For DO, if 3 consecutive values are less than 0.5 milligrams per Liter (mg/L), consider the values as stabilized. Record field parameters in the logbook or on field data sheets. As researched and determined in Step 1, the guidance document may require different stabilization ranges. Because groundwater temperature can be subject to rapid changes during stabilization, you may need to cover the discharge tubing and flow cell with a blanket or something similar if the ambient temperature is too cold, too hot, or the tubing/well/flow cell is in sunlight (thermal heating). Record the DTW level readings each time water parameters are read to make sure that the well is not becoming dewatered.
15. Label and preserve sample bottles.	Label the sample bottles with the appropriate label and/or tag. Ensure that the sample bottle is appropriately labeled with field sample identification number, sample date, start time of sample collection, preservative, filtered or non-filtered, and sampler initials. Place clear tape over the completed label to ensure that the information is not smeared during sampling or transport. Record the sample information in the field logbook and/or on a field data sheet. If the sample bottles were not received pre-preserved from the laboratory and need to be preserved, add the appropriate preservatives to the sample bottles as directed by the analytical laboratory. For VOC vials, add the acid prior to collecting the sample and immediately cap the vial making sure that a Teflon liner is present in the cap.
16. Collect samples.	The guidance document (or project manager) may indicate that sampling can occur if water quality parameters have stabilized. If purge volume requirements are necessary, water quality parameters and purge volume requirements must be met prior to sample collection. Once these conditions occur, begin sampling. If VOC analysis is required, collect them first (see VOC analysis below). If the discharge tubing from the pump is connected to anything, such as a hose or flow cell, remove the tubing from the connection. If necessary, make sure to **cut the discharge tubing** above the connection or hose to prevent any contamination of the sample from this connection. Always sample from the tubing connected directly to the pump. When filling sample containers prevent dust from blowing into the bottle by blocking any wind with your body while filling the containers or put the lid back on the container

momentarily if you see dust approaching. If you suspect that dust has gotten into the container, discard the container and fill another sample container.

Collect VOC samples: Collect VOC samples first directly into pre-preserved sample containers:

1. If necessary, reduce flow from the discharge tubing to avoid overflowing the vials.
2. Hold each vial at an angle and underneath the discharge.
3. Fill the sample vials by allowing pump discharge to flow gently down the side of the vial with minimal entry turbulence.
4. Cap each bottle as filled. The goal is to have little agitation and avoid introducing air bubbles while filling.
5. When the vial is nearly full, tilt the vial to the vertical position and fill completely. Avoid overfilling as this can "wash" out the preservative.
6. Completely fill the vial and form a meniscus (the curved upper surface of a liquid formed by surface tension) at the top of the vial. If needed, collect a small amount of water in the cap and pour it over the top of the vial to form the meniscus.
7. Screw the cap onto the vial and check for air bubbles.
   a. Turn the VOC bottle upside down, tap it lightly, turn it right side up, and see if any bubbles float to the top. If there is a small bubble, open the lid, fill the cap and pour the water from the lid to form a new meniscus and recap. Check again for bubbles.
   b. If there is still a bubble, or many bubbles were present in the original sample, discard the sample and collect a new sample using a new preserved vial.

   If a sample cannot be obtained without air bubbles due to off-gassing, then note the presence of air bubbles in the field logbook or field data sheet. Also, air bubbles may form during shipment to the laboratory. These bubbles do not necessarily invalidate the sample but may result in qualification of the sample during data validation.

Collect other samples: Once you have collected the VOC samples, fill other organic sample bottles, the total metal bottles, the containers for general chemistry analytes, the dissolved metals bottles, and then any other analyte bottles that require filtration.

Collect filtered sample: Filtered samples should be collected after all other sample containers are filled as you may need to adjust the flow from the discharge hose to keep appropriate pressure through the filter.

If a filtered sample is required, insert the filter specified in the guidance document, generally an in-line high capacity (0.45 micrometers [µm]), into the discharge hose. There may be a small amount of water dripping from the filter/tubing connection; MAKE SURE that no drops of this unfiltered water get into the filtered samples. If

	dust or unfiltered water drops get into the sample container, discard the sample bottle, and fill another bottle with the filtered water. If discharge from the pump is not of an adequate flow for the sample collection (for example, no water is discharged from the filter), purge water from discharge hose into an unpreserved container. Then, use a peristaltic pump to filter the sample. Refer to SOP-SW-02. As you fill each sample bottle, immediately cap the bottle to prevent dust or debris from getting into the bottle. If the sample vial/bottle overflows and preservative is lost, empty the container, replace the acid or use a new pre-preserved bottle, and collect the sample again.
17. Transport sample bottles.	Place organic sample containers into a cooler with ice immediately upon collection. Keep samples at 4 °C plus or minus 2 °C or less and under chain of custody protocols until they can be transported to the laboratory for analysis as described in SOP-SA-01. Properly preserved metals and general chemistry samples may need to be stored and shipped on ice. Refer to the guidance document or the analytical laboratory submittal requirements to determine storage and transportation requirements.
18. Dispose of purged water and measure purge volume.	Collect and dispose of purged water according to the requirements in the guidance document or with SOP-DE-03. Empty the bucket or storage container associated with the flow cell appropriately. When finished purging, measure and record the total purge volume in the field logbook and/or on the field data sheet.
19. Decontaminate the pump.	After each use, thoroughly decontaminate any pump immersed in a well according to SOP-DE-02A. Discard disposable tubing used in peristaltic pumps and the bladder in the bladder pumps after sampling each well. If required by the guidance document, empty any fluids used for decontamination into the purge water container.

HEALTH SAFETY SECURITY ENVIRONMENT (HSSE) CONSIDERATIONS

This section to be completed with concurrence from the Safety and Health Manager.

SOURCE	HAZARDS	WHERE	HOW, WHEN, RESULT	CONTROLS
CHEMICAL	Potential contact with contaminated water.	Sites.	Inadvertent exposure to contaminated water could lead to adverse health effects.	Personnel will practice proper personal hygiene – wash hands prior to eating/drinking and when leaving the site. Personnel will wear nitrile gloves and safety glasses when collecting and handling samples. Pour water from bucket into disposal area slowly to prevent splashes and skin contact. Keep control of high-flow discharge hoses to prevent water spraying and skin contact.
	Preservatives: hydrochloric acid (HCL), nitric acid (HNO_3), sulfuric acid (H_2SO_4), zinc, acetate, and sodium hydroxide (NaOH).	In bottles or added to bottles through sampling process.	Inadvertent exposure to preservatives could lead to adverse health effects.	Personnel will practice proper personal hygiene – wash hands prior to eating and after handling preservatives and sampling bottles. Personnel will wear nitrile gloves and safety glasses when handling preservatives and sampling bottles.
	Carbon monoxide (CO).	Generator.	Potential exposure to CO when working around the generator could result in irritated eyes, headache, nausea, weakness, and dizziness.	Personnel will stay upwind when working around the generator. The generator will not be operated indoors or near openings to any buildings that might be occupied.

HEALTH SAFETY SECURITY ENVIRONMENT (HSSE) CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.				
SOURCE	**HAZARDS**	**WHERE**	**HOW, WHEN, RESULT**	**CONTROLS**
	Contact with gasoline.	Fueling generator.	Inadvertent exposure via inhalation and/or skin contact can result in adverse health effects and skin irritation if contact with gasoline occurs.	Fuel generators in well-ventilated area, stand upwind while fueling, and minimize splash hazards so skin contact does not occur. Wear nitrile gloves when removing fuel cap and filter.
NOISE	Elevated noise levels.	Sites, when using a generator.	Exposure to elevated noise levels when using a generator can result in hearing damage.	Set up the generator away from the working area and use hearing protection (ear plugs) if necessary.
ELECTRICAL	Improper use of 12-volt battery.	Sites, when using battery to power pump.	Personal injuries could result from improper use and maintenance of a 12-volt battery. Examples include shocks, acid burns on skin or eyes, skin burns from electrical charge transfer through a tool and into a metal ring or watch, and battery explosions.	Personnel will remove all jewelry before working with a 12-volt battery. Personnel will disconnect the negative cable first and re-connect it last to prevent getting a shock from current overflow, use battery in well-ventilated areas, and inspect battery before and after each use. Personnel will wear leather gloves and safety glasses when handling battery.

HEALTH SAFETY SECURITY ENVIRONMENT (HSSE) CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.				
SOURCE	**HAZARDS**	**WHERE**	**HOW, WHEN, RESULT**	**CONTROLS**
	Improper use of generator.	Sites, when using the generator during wet conditions.	Electrocution, shock, death, or equipment damage could be caused when using a generator during wet conditions.	If personnel must use a generator when it is wet outside, the generator should be protected from moisture. The generator should be equipped with a Ground Fault Circuit Interrupter (GFCI). Keep extension cord (if used) and connections as dry as possible. Place generator on a surface where water cannot puddle or drain under it. Personnel should dry hands, if wet, before touching the generator. Items should be connected to the generator using heavy-duty extension cords that are specifically designed for outdoor use.
BODY MECHANICS	Bending, squatting, and kneeling.	During sampling collection.	Bending, squatting, and kneeling during sample collection could result in muscle/back strains or other injuries.	Personnel should stretch prior to starting work and take breaks when necessary.
	Improper lifting and carrying equipment.	Sites.	Back injuries and muscle/back strains could result when using improper techniques to lift and carry equipment, such as 12-volt batteries, generator, and pump.	Personnel will use a proper lifting technique – get a good grip, keep the load close to the body, lift with legs and not with back, and avoid lifting loads above shoulder height. Two workers will lift heavy items, if needed.

HEALTH SAFETY SECURITY ENVIRONMENT (HSSE) CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.				
SOURCE	**HAZARDS**	**WHERE**	**HOW, WHEN, RESULT**	**CONTROLS**
GRAVITY	Falls from slips and trips.	Uneven terrain, slick/ muddy/wet surfaces, and steep slopes.	Walking/working on slick/muddy/ wet and uneven terrain could cause slips and trips resulting in falls and injuries.	Personnel will wear work boots with good traction and ankle support. Personnel will be aware of working/walking surfaces and choose a path to avoid hazards. Keep work areas as dry as possible. Wear muck boots, as necessary.
WEATHER	Cold/heat stress.	Sites.	Exposure to cold temperatures may result in cold burns, frostbite, and hypothermia. Exposure to high temperatures may result in heat cramps, heat exhaustion, or heat stroke.	Training on signs and symptoms of cold/heat stress is required. Personnel will wear appropriate clothing when working outdoors, remain hydrated, and have sufficient caloric intakes during the day. Personnel will also follow procedures outlined in applicable SSHASP and/or Pioneer Corporate HASP.
	Hypothermia/ frostbite.	Sites where air temperature is 35.6 degrees Fahrenheit (°F) (2 °C) or less.	Personnel whose clothing becomes wet during decontamination procedures may be exposed to hypothermia and/or frostbite.	If it becomes wet, personnel will change clothing.
	Lightning.	Outdoor sites.	Electrocution, injury, death, or equipment damage could result from lightning strike.	Personnel will follow the 30/30 rule during lightning storms.

HEALTH SAFETY SECURITY ENVIRONMENT (HSSE) CONSIDERATIONS

This section to be completed with concurrence from the Safety and Health Manager.

SOURCE	HAZARDS	WHERE	HOW, WHEN, RESULT	CONTROLS
RADIATION	Ultraviolet (UV) radiation.	Outdoors.	Personnel could be exposed to UV radiation during summer months causing sun burns, skin damage, and eye damage.	Personnel will wear safety glasses with tinted lenses, long-sleeve work shirts, and long pants. Personnel should wear sunscreen, if necessary.
BIOLOGICAL	Plants, insects, and animals.	Sites.	Exposure to plants, insects, and/or animals may cause rashes, blisters, redness, and swelling.	Training on the signs and symptoms of exposure to plants, insects, and animals is required. Avoid contact with plants, insects, and animals. First-aid kits will be available on site. Personnel with allergies will notify their supervisor.
MECHANICAL	Pinch points.	Well caps.	Personal injury could result from fingers getting pinched in the well cap.	Personnel will wear leather gloves when removing well caps.
PRESSURE	Not applicable.			
THERMAL	Not applicable.			
HUMAN FACTORS	Inexperienced and improperly trained personnel.	Sites.	Inexperienced personnel and improper training could cause incidents resulting in adverse health effects and/or property damage.	Personnel will be properly trained in this procedure and other applicable procedures. Personnel will implement stop work procedures, if necessary.
	Interaction with public.	Sites.	Public can enter the work area and interfere with work activities.	Personnel will stop work if public enters the work area. Work will resume once public has left the area.

HEALTH SAFETY SECURITY ENVIRONMENT (HSSE) CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.				
SOURCE	**HAZARDS**	**WHERE**	**HOW, WHEN, RESULT**	**CONTROLS**
SIMOPS (Simultaneous Operations)	Not applicable.			

ADDITIONAL HSSE CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.	
REQUIRED PPE	**Personnel Protection Equipment** (PPE): Hard hat, safety glasses, high-visibility work shirt or vest, long pants, work boots, nitrile gloves, and leather gloves.
APPLICABLE SDSs	**Safety Data Sheets** (SDSs): HCL, HNO_3, H_2SO_4, zinc, acetate, and NaOH. Safety Data Sheets are available to Pioneer personnel on the internal website under Safety.
REQUIRED PERMITS/ FORMS	Per site/project requirements.
ADDITIONAL TRAINING	Per site/project requirements.

DRAWINGS, DOCUMENTS, AND TOOLS/EQUIPMENT The following documents should be referenced to assist in completing the associated task.	
DRAWINGS	Map with site location and sample locations.
RELATED SOPs/ PROCEDURES/ WORK PLANS	SOP-DE-02A Equipment Decontamination – Pumps for Well Sampling SOP-DE-03 Investigation Derived Waste Handling SOP-FM-01 Field Headspace Analysis and VOC Measurements with PID SOP-GW-03 Depth to Water Level Measurements SOP-GW-10.1 Purging and Sampling Using the Traditional Multi-Volume Purge Method SOP-GW-14 Field Water Quality Measurements Using the YSI Meter and Flow Cell SOP-SA-01 Soil and Water Sample Packaging and Shipping SOP-SW-02 Field Sample Filtration SOP-WFM-01 Field Measurement of pH in Water SOP-WFM-02 Field Measurement of Oxidation Reduction Potential in Water SOP-WFM-03 Field Measurement of Specific Conductance SOP-WFM-07 Field Measurement of Dissolved Oxygen SOP-WFM-08 Field Turbidity Measurement SOP-WFM-09 Bucket and Stopwatch Method for Measuring Flow

TOOLS/ EQUIPMENT	Well keys, sampling supplies, electronic DTW level indicator, required pump, tubing, 12-volt battery (if needed), generator (if needed), sampling bottles, water quality meters, buckets, containment supplies, decontamination equipment, cooler, field logbook, and field data sheets.
FORMS/ CHECKLIST	

APPROVALS/CONCURRENCE

By signing this document, all parties acknowledge the completeness and applicability of this SOP for its intended purpose. Also, by signing this document, it serves as acknowledgement that I have received training on the procedure and associated competency testing.

SOP TECHNICAL AUTHOR	**DATE**
Kendra Overley **Kendra Overley**	**07/06/2022**
SAFETY AND HEALTH MANAGER	**DATE**
Tara Schleeman **Tara Schleeman**	**07/06/2022**