Attachment 3

APEX

Site Characterization Work Plan
Salem-Willamette Valley Airport
Salem, Oregon

Prepared for:
City of Salem

July 28, 2025
32-25007713

Site Characterization Work Plan
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Salem, Oregon

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Herb Clough, P.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
17,296
OREGON
JULY 19, 1994
MICHAEL W. STEVENS
EXPIRES JUNE 30, 2026

Michael Stevens, P.E.
Principal Engineer

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1.0 Introduction

This Site Characterization Work Plan (Work Plan) was prepared by Apex Companies, LLC (Apex) on behalf of the City of Salem (City) for the Salem-Willamette Valley airport facility. This Work Plan summarizes existing data and facility characteristics, identifies data gaps, and describes the investigation approach and field sampling activities to be completed.

1.1 Purpose

The purpose of this Work Plan is to describe the scope of work to be completed to assess the nature and on-site extent of per- and polyfluoroalkyl substances (PFAS) in soil and groundwater at the airport facility resulting from the historical use of aqueous film forming foam (AFFF) or other substances that contain PFAS, specifically focused on the identification of potential source areas. The proposed scope of work may be the first phase of site characterization work. Depending on the results of this initial investigation, subsequent phases of investigation and/or monitoring may be required to fully define the extent and magnitude of PFAS at the airport.

1.2 Site Description and Background

The Salem-Willamette Valley Airport facility is a 751-acre property owned by the City of Salem and is located at 2990 25th Street SE in Salem, Oregon (the Site; Figures 1 and 2), formerly known as the Salem Municipal Airport and McNary Field. The airport Site is located in Township 8S, Range 3W, Section 1 and Township 7S, Range 3W, Section 36, near the intersection of Interstate 5 and State Highway 22. The airport is a Fixed Base Operator providing general aviation (passenger and cargo) and private aviation support. Adjacent airport facilities also include an Army National Guard base, an on-site museum, an airfield view restaurant, more than 130 aircraft hangars, and a municipal fire station (Fire Station 6) that services the local response area as well as the airport facility.

The facilities associated with Fire Station 6 include the local firefighting and rescue apparatus and an on-site fire training facility. As part of the classification of the airport as an Index A facility (under the Aircraft Rescue and Firefighting [ARFF] classification system used by the United States Federal Aviation Administration [FAA]), the airport is required to maintain on-site fire-fighting equipment, including provisions for training on the proper use of AFFF. As a result of these FAA requirements, the mandatory training completed at the Fire Station 6 training facility included the use of PFAS-containing AFFF in personnel training and equipment testing until September 27, 2024, when the use of PFAS materials was discontinued and they were removed from the airport facility.

Historically, a separate fire training site was located on the south end of the airport property (see Figure 2). This historical fire training pit reportedly only used water for fire suppression (through the end of the use of this area when it was backfilled). It is still possible, however, that fire-fighting foams could have been used for part of this period.

The application of AFFF for fire suppression on an aircraft crash site is limited to one event in July 2015 when the crash of a private aircraft resulted in a fire near the north end of the main runway.

A portion of the south end of the Site was also historically used as a disposal site (the Salem Airport Disposal Site). As part of the administration of this historical site, a set of three groundwater monitoring wells were installed and are routinely monitored by the City of Salem (MW-2, MW-3R, and MW-5; shown on Figure 2). While it is not expected that PFAS-containing materials would have been disposed here, the monitoring wells are suitable for sampling of PFAS to verify this assumption and assess groundwater conditions upgradient of the other areas described above.

While not part of the airport Site, the Army Aviation Support Facility (AASF) Salem Army National Guard facility is located adjacent to the northeast corner of the Site. It is understood that several areas of the AASF have been associated with the use of AFFF or other PFAS-containing materials, and an investigation is being completed by the military department to assess the PFAS impacts originating from the facility. Releases from the AASF facility have a reasonable potential to have impacted the airport Site. An informal collaborative agreement between the City and the Oregon Military Department has been established to allow the mutual sharing of data from each investigative effort, which will be used to assess the larger extent of PFAS in the vicinity of the Site and inform potential future phases of investigation.

1.3 PFAS Discovery

A focused shallow soil sampling was completed at the hangar properties immediately south of Fire Station 6 in November 2022 (BB&A Environmental, 2022). Four soil samples were collected from shallow soil (6 to 12 inches below ground surface [bgs]) across the subject properties and analyzed for PFAS compounds by Environmental Protection Agency (EPA) Method 537 (modified). Multiple PFAS compounds were detected in each of the four samples, with most detected compounds at concentrations of less than 1 microgram per kilogram (µg/kg). In the report, these results were compared to the then-current EPA screening level of 1,600 µg/kg, and there were no exceedances. However, EPA regional screening levels (RSLs) have evolved since 2022, and the detected concentrations of perfluorooctanoic acid (PFOA) exceed the current industrial soil RSL of 0.078 µg/kg (with detections of between 0.17 µg/kg and 0.65 µg/kg).

In January 2025, during preparations for the construction of a new hangar area on the south side of the airport Site, the developer completed four subsurface borings for the purpose of evaluating PFAS in soil potentially associated with a former fire training area located in the vicinity of the hangar project (Partner Engineering and Science, Inc, 2025). During this work, PFAS compounds were detected in 11 out of 12 soil samples at depths ranging from 2 feet to 8 feet bgs. PFOA was detected at concentrations up to 0.77 µg/kg, exceeding the EPA RSL of 0.078 µg/kg for industrial soil.

1.4 Regional Geology and Hydrogeology

The Site is located within the central Willamette Valley, a tectonic depression within the physiographic province of the Puget-Willamette Lowland that separates the Cascade Range from the Coast Range and extends from the Puget Sound, Washington to Eugene, Oregon (Yeats et al., 1996). The Puget-Willamette Lowland is situated along the Cascadia Subduction Zone where oceanic rocks of the Juan de Fuca Plate are subducting beneath the North American Plate, resulting in deformation and uplift of the Coast Range and volcanism in the Cascade Range. Extensive valley infilling and catastrophic flooding related to the Missoula Floods during the Late Pleistocene have subsequently buried older Oligocene and Eocene sedimentary and volcanic basement rocks, concealing many of the structural features throughout the valley. The Willamette River forms a broad alluvial basin with the Willamette River Valley draining northward along the central axis of the valley. Tributaries exiting the Coast Range and Cascade Range have contributed to terrace formations and alluvial fans protruding from range fronts.

Lithology at the Site generally consists of Holocene age alluvial sedimentary deposits comprised of unconsolidated silt, sand, and gravel (Tolan et al., 2000). According to soil surveys of the Site and east-Salem area, the predominant lithological units are categorized as Clackamas Gravelly Loam and Courtney Gravelly Silty Clay Loam (United States Department of Agriculture [USDA], 2019). Sediment size present in each unit ranges from fine clays to coarse grained gravels. Based on borings advanced during a subsurface investigation conducted on January 2, 2025, by Partner Engineering and Science, Inc, the underlying subsurface at the Site consists predominantly of brown clayey sand, gravelly sand, and fine gravel from the ground surface to approximately 10 feet bgs (Partner Engineering and Science, Inc, 2025). A review of Oregon Department of Water Resources (OWRD) well logs in the vicinity of the Site suggests that deeper geology grades into increasing percentages of gravels and cobbles to depths of more than 50 feet bgs.

Salem is situated near the western margin of the Columbia River Basalt Group and is an area of low to moderate relief, ranging from about 150 to almost 1,100 feet elevation. It is assumed also that an ancestral Willamette River flowed northward through this low-lying area so that water was present as streams and ponds along the flood plain (Tolan et al., 2000). Mill Creek flows northward along the west adjacent boundary of the Site before discharging into the Willamette River, while Mission Lake and Wirth Lake are also present east of the Site. Review of the United States Geological Survey, Salem West, Oregon Quadrangle topographic map (United States Geological Survey, 2000) indicates the subject property is situated approximately 215 feet above sea level, and the local topography is sloping gently to the north-northwest.

According to records of drinking water and groundwater monitoring wells installed at the Site and in the vicinity, static water levels have been recorded between approximately 5 to 90 bgs, with shallower water levels on the lower-elevation, east side of the Site, towards Mill Creek. During a subsurface investigation conducted in 2025, groundwater was encountered between 9 and 10 feet bgs (Partner Engineering and Science, Inc, 2025). Based on topography and local surface hydrology, it is likely that groundwater in the region flows to the east-northeast, toward Mill Creek. The Site averages approximately 40.08 inches of rain, annually, with most of the precipitation occurring from fall to early spring (National Oceanic and Atmospheric Administration, 2024). Lithology at the site is classified as somewhat poorly to poorly drained (USDA, 2019). Perched groundwater may be present above interbedded confining clay zones, recharged by infiltrating surface water. It is assumed that surface water flows into designated Site stormwater drainage ditches and catch basins to be directed offsite.

2.0 Preliminary Conceptual Site Model

This preliminary conceptual site model (CSM) was developed to guide the planning for site characterization sampling. The CSM will be updated as data are collected, and the updated model will guide future activities. In general, the CSM identifies potential PFAS sources/releases, transport pathways, and receptors. These are discussed below.

Sources. Based on information provided by the City of Salem, the following potential on-site source areas were identified: Fire Training Area, Historical Fire Training Area, and one aircraft accident site that resulted in the application of AFFF. In addition, multiple potential sources have been identified at the Army National Guard site. These potential source areas are briefly described as follows:

- **Fire Training Area.** Located in the northwest quarter of the Site adjacent to 25th Street SE, the current Fire Training Area is an approximately 50,000-square-foot area affiliated with the City's Fire Station 6 (see Figure 2). Until September 2024, the training activities included FAA-required application and testing of PFAS-containing AFFF (focused primarily in the north half of the training area, dominated by a multi-story concrete training structure). Training activities continue using foams that do not contain PFAS.
- **Historical Fire Training Area.** Located on the south end of the airport Site (in the southwest corner of the property), the historical fire training area was comprised of a shallow pit that was reportedly used for training on the suppression of fuel fires by applying water sprays to ignited fuels floating on water. The specific location of the training area is not evident (following the abandonment of the training area in preference of the newer facility discussed above), but the general location is shown on Figure 2.
- **Accident Site.** In July 2015, private aircraft N5608W crashed off of the north end of the main runway (at the location shown on Figure 2). During the response to the crash, AFFF was deployed for fire suppression.
- **Army National Guard.** AASF Salem is an approximately 81.5-acre facility located along the northeast end of Runway 16/34. Between the 1940s and 2017, PFAS was reportedly released to soil at several locations within the boundary of AASF Salem (including several fire training areas and several additional areas not associated with fire training). The military department is currently investigating the AASF Salem site.

Preliminary information provided by the Oregon Military Department suggests that another PFAS source may exist upgradient of the AASF facility, but the nature of that source has not yet been determined.

Transport Pathways. In the immediate vicinity of areas where AFFF was used for training or fire suppression (and adjacent in the downwind direction) or where other PFAS-containing materials were used or stored, PFAS compounds would be present in shallow soil. Once released, PFAS compounds can infiltrate through surface soils and migrate vertically through the unsaturated zone, often facilitated by rainfall or surface water runoff, potentially transporting PFAS into the saturated zone and resulting in contamination of groundwater. Lateral migration through groundwater can then lead to offsite transport, posing potential risks to downgradient wells and aquatic receptors.

Additionally, PFAS can be transported by surface water runoff to downstream conveyance systems, ditches, and surface water bodies.

Receptors. Except for several publicly accessible parking lots and the terminal area (which are located on the west side of the Site along 25th Street SE), the airport is a controlled facility with access limited to employees and contractors with security badges. Many parts of the secured area experience very infrequent direct human contact. Based on information provided by the City, there are no water wells in use at the airport property, but a review of the OWRD well logs identified 43 wells located in the Township, Range, and Sections that include the airport and the immediately downgradient direction (north or west) that were flagged as being used for domestic, irrigation, or industrial purposes (copies of these well logs are included in Appendix A; the current status of these wells has not been determined). Therefore, the relevant potential exposure pathways/receptors for the Site include the following:

- On-Site:
  - Direct contact with soil by a commercial/industrial worker; and
  - Direct contact with soil and/or groundwater by a construction worker;
- Off-Site:
  - Potential for direct contact with groundwater by resident or commercial/industrial worker (if vicinity water wells are in use); and
  - Potential ecological impacts via stormwater runoff or erosion.

3.0 Scope of Work

The initial scope of work will target source areas and primary potential transport pathways. Soil sampling will be conducted at each potential source area. Groundwater sampling will be conducted near potential source areas and in the likely downgradient direction to assess impacts to groundwater and the potential migration with groundwater. Sampling in the upgradient direction will be conducted to assess if there are off-site source areas for groundwater contamination. Sediment samples from stormwater conveyance systems will be collected to assess potential transport via stormwater. The goal is to characterize the nature and extent of PFAS originating at the airport; that effort may require multiple phases of sampling.

Monitoring Well Installation. New monitoring wells will be installed at selected locations across the airport property. The initial focus will be the first encountered groundwater. One well will be installed into deeper groundwater to assess potential vertical migration of PFAS. These wells will be used in conjunction with existing wells and other available data (such as may be available from the adjacent Army National Guard facility) to delineate the extent and magnitude of PFAS compounds across the airport. The locations will primarily focus on the fire training center, the historical crash site, the PFAS discovery near the hangar construction, the on-site area upgradient of the Army National Guard site, and downgradient locations of these potential sources (initially excepting the immediately downgradient area of the Army National Guard as ongoing investigation of this area is being planned by the Military Department). During drilling, two soil samples will be collected from the cores of each monitoring well (one near-surface sample and one from unsaturated soil within the zone of seasonal water table fluctuation).

Surface Soil and Sediment Sampling. Surface soil samples will be collected and analyzed to assess the potential for source areas and surficial migration of PFAS compounds. Soil samples will be composited from three discrete subsample locations at each of the identified potential source areas (fire training center, historical crash site, and hangar construction area) at depths of 6 inches and 2 feet. Sediment samples will be collected from within the stormwater drainages downstream of selected stormwater system outfalls to characterize the potential for PFAS-impacted sediment movement in the stormwater collection system.

Groundwater Monitoring. Groundwater samples will be collected from both existing and newly installed monitoring wells.

4.0 Investigation Activities

The scope of work includes monitoring well installation, soil sampling, and groundwater monitoring. Detailed field and sampling procedures are described in the Sampling and Analysis Plan (SAP) provided in Appendix B. Proposed well and sampling locations are shown on Figures 3 through 7.

4.1 Preparatory Activities

Property Access. Apex will coordinate access to each drilling site with airport management (who will coordinate with the FAA as needed for access to work areas). Depending on the location of work, a badged escort may be necessary (such as within the fence line of the controlled airfield perimeter). It is also anticipated that restrictions will be in place for the timing of airfield work (limiting access to certain days or times of day).

Coordination for access will also include discussion of equipment being used, height restrictions, and flagging of elevated equipment such as drilling masts.

Underground Utility Location. Apex's project manager or designee will mobilize to the Site to mark out the proposed sampling locations with marking paint to enable identification of nearby underground utilities by Oregon Utilities Notification Center (Oregon 811). Because Oregon 811 does not mark out underground utilities on private property and because the drilling activities will be performed inside the boundaries of the Site, it is anticipated that airport personnel will conduct an underground utility locate to mark out underground utilities located within the proximity of each proposed sampling location prior to performing the subsurface work.

If any underground utilities are identified within 5 feet of a proposed sampling location, Apex will adjust the proposed sampling location before drilling commences. Apex will also adjust the proposed drilling location to provide a safety buffer for buildings, heavy traffic areas, overhead utilities, and similar Site features so that sampling can be performed safely and with minimal disruption to existing businesses.

As an additional safety measure, all borings will be hand-cleared using a hand auger, air-knife, or post hole digger to approximately 5 feet bgs.

Site Health and Safety Plan. A Site-specific health and safety plan (HASP) has been prepared for the proposed activities (Appendix C). The HASP was prepared in general accordance with the Occupational Safety and Health Administration (OSHA) and the Oregon Administrative Rules (OAR). A copy of the HASP will be maintained on-site during the field activities.

4.2 Field Activities

4.2.1 Groundwater Monitoring Well Installation

Nine groundwater monitoring wells will be installed to delineate the lateral and vertical extent of contamination that may be originating from the Site, including eight shallow aquifer monitoring wells and one deeper zone well. Given the expected lithology, push-probe equipment will be used for the completion of the shallow monitoring wells (to depths of 20 feet bgs). Based on the expected presence of gravels and cobbles at depth, the deeper zone well installation will require sonic drilling methods to reach the target depths. To avoid the potential for damaging undiscovered underground utilities, the upper 5 feet of each location will be cleared by soft clearing methods (such as with a hand auger or air knife). A drilling subcontractor will perform the explorations. An Apex representative will observe and document the drilling activities and subsurface conditions encountered. Detailed discussions of these activities and methodologies are discussed in the SAP (Appendix B).

Locations. Figure 3 shows the proposed locations of the eight shallow aquifer monitoring wells. These locations have been selected to characterize the extent and magnitude of PFAS at and downgradient of the identified potential source areas (initially excluding installations near the runways, such as near the crash site), upgradient of the potential source areas, and in other areas as needed to provide a broad coverage of the airport property. The location of the deeper-zone monitoring well will be determined following the completion of the shallow aquifer wells, located in the vicinity of the downgradient perimeter well with the relatively highest PFAS concentrations. The locations are approximate and may be moved based on field conditions.

Exploration Depth. The eight shallow aquifer monitoring wells will be completed to an approximate depth of 20 feet bgs, and the deeper zone well will be completed to a depth of about 50 feet to assess vertical extent of the contamination. The deeper zone monitoring well will be installed using dual-tube drilling equipment (to prevent potential communication between the shallower impacted groundwater and the deeper aquifer). The actual depth of the explorations may vary based on field conditions.

Lithologic Logging. Continuous soil samples will be collected during the advancement of the explorations. The field geologist or engineer will describe each soil core, noting any indications of contamination based on visual inspection, and will describe the lithologic characteristics using the Unified Soil Classification System (USCS) in general accordance with ASTM 2487/2488. Other features such as sorting, sedimentary features, mineralogy, degree of weathering, and contacts with other soil types will be noted, if relevant.

Field Screening. Field screening is conducted as a standard practice during soil sampling. Screening methods are available for common contaminants such as petroleum hydrocarbons and volatile organic compounds (VOCs). There are no reliable methods to field screen for PFAS. Apex will conduct field screening as defined within Apex Standard Operating Procedure (SOP) No. 2.1 – Standard Field Screening Procedures (see Appendix B) and will use a calibrated photoionization detector (PID) and headspace method to provide a qualitative indication of the presence of VOCs. Other field screening methodology will include inspecting each soil and sediment sample for petroleum-like odors, discoloration, and sheens using a sheen test.

Soil Sampling. Based on the results of the field screening, soil samples may be collected for possible chemical analysis from each exploration core (if evidence of contamination is encountered in vadose-zone soil). Detailed soil sampling procedures are discussed in the SAP (Appendix B). The analytical program is discussed in Section 5.0.

Monitoring Well Completions. Each of the monitoring wells will be screened with 10 to 15 feet of slotted PVC screen placed at a depth of 20 feet. For the shallow aquifer monitoring wells, the screen will be set such that the top of the screen is above the estimated seasonal high water level, potentially requiring a longer screen section. The monitoring wells will be installed in accordance with State of Oregon requirements. The wells installed in paved areas will be finished at the ground surface with flush monuments, and wells installed in unimproved areas will be finished with stick-up monuments surrounded by protective bollards. The wells will be surged during installation and will be allowed to set for at least 24 hours prior to initiating well development. The wells will be developed by bailing and/or over-pumping to remove excess turbidity and improve hydraulic communication with the adjacent water-bearing zone.

Locating. Following completion of the monitoring well installations, a licensed surveyor will be subcontracted to complete a survey of the wells. The survey will include determination of the horizontal location and elevation of the wells (State Plane Coordinate System for horizontal control and NAVD88 or other approved datum for vertical control). As the datum used for the existing monitoring wells around the historical disposal site is not recorded in the recent sampling documentation, the casing elevations of these wells will be included in the survey to verify that elevation data from these wells are consistent with the newly installed monitoring wells.

4.2.2 Surface Soil and Sediment Sampling

Apex will conduct surface soil and sediment sampling at selected areas across the airport property. These samples will include shallow soil near the identified potential source areas (a total of 17 locations) and sediment in stormwater drainages near representative downstream stormwater system outfalls for representative drainage subbasins defined for the airport (a total of 12 outfall locations). See Figures 4 through 6 for the proposed shallow soil sample locations and Figure 7 for outfall sediment sample locations.

Each sample will include collecting three discrete subsamples for compositing into the sample for laboratory analysis. The discrete soil subsamples will be composited within large decontaminated stainless-steel bowls. Once composited, a portion of the soil will be placed in new laboratory-provided sample containers. All samples will be stored in a chilled container for transport to an accredited laboratory for analysis.

Hand tooling will be used to collect each subsample at depths of 6 inches, and the source-area soil samples will also be sampled at a depth of 2 feet bgs. At each location, Apex will conduct field screening (described in the SAP; Appendix B) and soil logging in accordance with the USCS to record soil texture, grain size, etc.

Each exploration location will be backfilled with excess soil removed from the exploration, and the surface will be patched to match the surrounding area.

4.2.3 Groundwater Monitoring Well Sampling

Groundwater Levels. Groundwater levels will be measured from monitoring wells prior to collecting groundwater samples. The wells will be opened to allow water levels to equilibrate before the measurements are recorded. The depth to groundwater will be measured in each well to the nearest 0.01 foot using an electronic probe. The probe is equipped to detect petroleum products separately from water in the event that liquid oil products are present on groundwater.

Groundwater Sample Collection. Wells will be sampled using low-flow methods with a peristaltic pump and dedicated PFAS-free tubing. Prior to the collection of groundwater samples, pH, conductivity, temperature, dissolved oxygen, and oxidation-reduction potential will be measured using a water parameter meter with flow cell connected to the discharge tubing of the sample pump for samples collected from the monitoring wells. Turbidity of the water will be monitored visually, and the color and clarity of the water will be recorded on the sampling data sheet. Purging will be considered complete when the water quality parameters have stabilized to within 10 percent and the water is visually clear for three consecutive three-minute intervals.

Additional groundwater sampling procedures, sample handling, and quality assurance/quality control (QA/QC) procedures are detailed in the SAP (Appendix B).

4.2.4 Investigation-Derived Waste Management

Investigation-derived waste (IDW) will consist of purge water, soil, and decontamination water. IDW will be placed in properly labeled Oregon Department of Transportation-approved drums. A sample of the containerized soil and water will be collected for disposal profiling. The drums will be stored at an area designated by airport management pending receipt of chemical data. Sampling materials and personal protective equipment will be disposed of as solid waste. Upon receipt of analytical data, the waste will be properly designated and disposed of in accordance with the waste designation.

5.0 Analytical Program

Soil and groundwater samples will be analyzed for PFAS by EPA Method 1663 (which includes 40 compounds). Samples will be analyzed on a standard turnaround time (approximately 28 days for PFAS). The SAP in Appendix B discusses the analytical program in detail.

QA/QC procedures will be used throughout this project. The SAP in Appendix B describes the QA plan for this project, including sampling and custody procedures, QA sampling analyses, detection limit goals, laboratory QC, and QA reporting.

6.0 Reporting and Schedule

After receipt of the analytical results, Apex will prepare a data report that summarizes the investigation activities and presents the groundwater and soil/sediment sampling results. The data evaluation will include a preliminary risk screening of the chemical data to assess whether PFAS concentrations may pose an unacceptable risk to human health or the environment, a discussion of the identified extent of PFAS contamination, and recommendations based on those results. The outcome may include recommendations for additional investigation.

The summary report will initially be prepared as a draft for review by the City of Salem. Upon receipt of the City's comments, Apex will issue the report in final form.

Schedule. Following approval of the work plan and budget for implementation, it is anticipated that scheduling subcontractors (utility location, drilling, waste disposal, and well surveying) and coordination with airport management for access to the work areas will require on the order of a month to finalize. The implementation of the initial phase of field activities (shallow well installations and soil/sediment sampling) would be completed within two weeks of starting work, and the second phase of drilling (the installation of the deeper zone monitoring well) would be scheduled to coincide with the receipt of the shallow well data (following the 28-day turnaround time for PFAS analyses). Initial presentation of the shallow well data (including data tables and figures) will be prepared and sent to the City for review and discussion within a week of receipt, and the draft summary report would be completed within two weeks of receipt of the final data from the deeper zone monitoring well installation and sampling (within six weeks of completing the second phase of field work). Based on this general schedule, we expect delivery of the draft report approximately four months after authorization of this scope of work.

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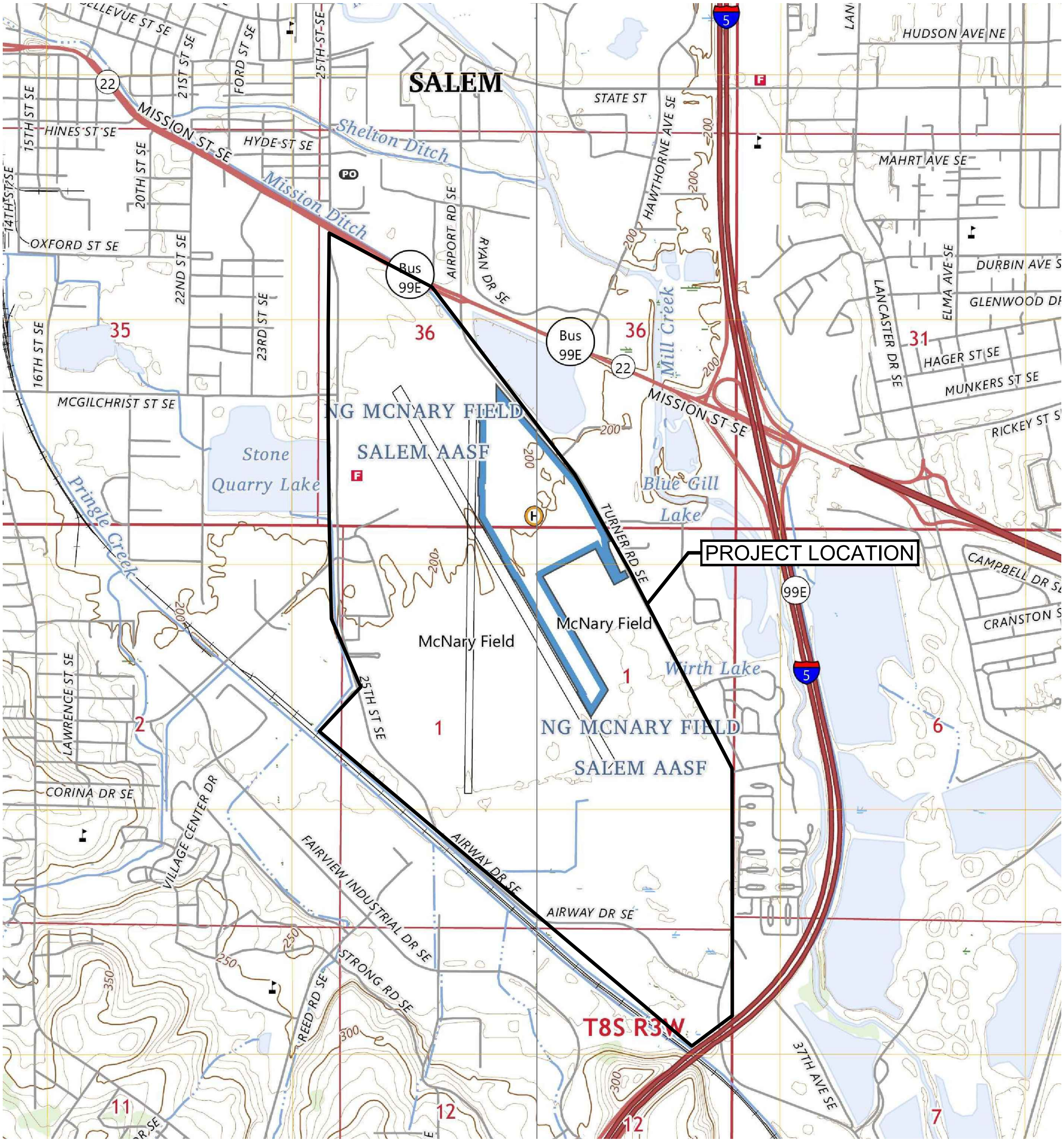
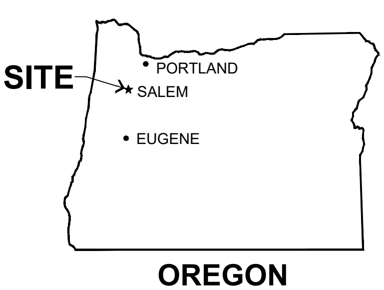


SOURCE: USGS SALEM WEST AND SALEM EAST, OR QUADRANGLE 2024.



SCALE: 1" = 2,000'

0 1,000' 2,000' 4,000'

PREPARED FOR: CITY OF SALEM

APEX

VICINITY MAP

SALEM-WILLAMETTE VALLEY AIRPORT SITE INVESTIGATION
2990 25TH STREET SE
SALEM, OREGON

JUNE 2025
25007713

FIGURE 1

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GENERAL NOTES

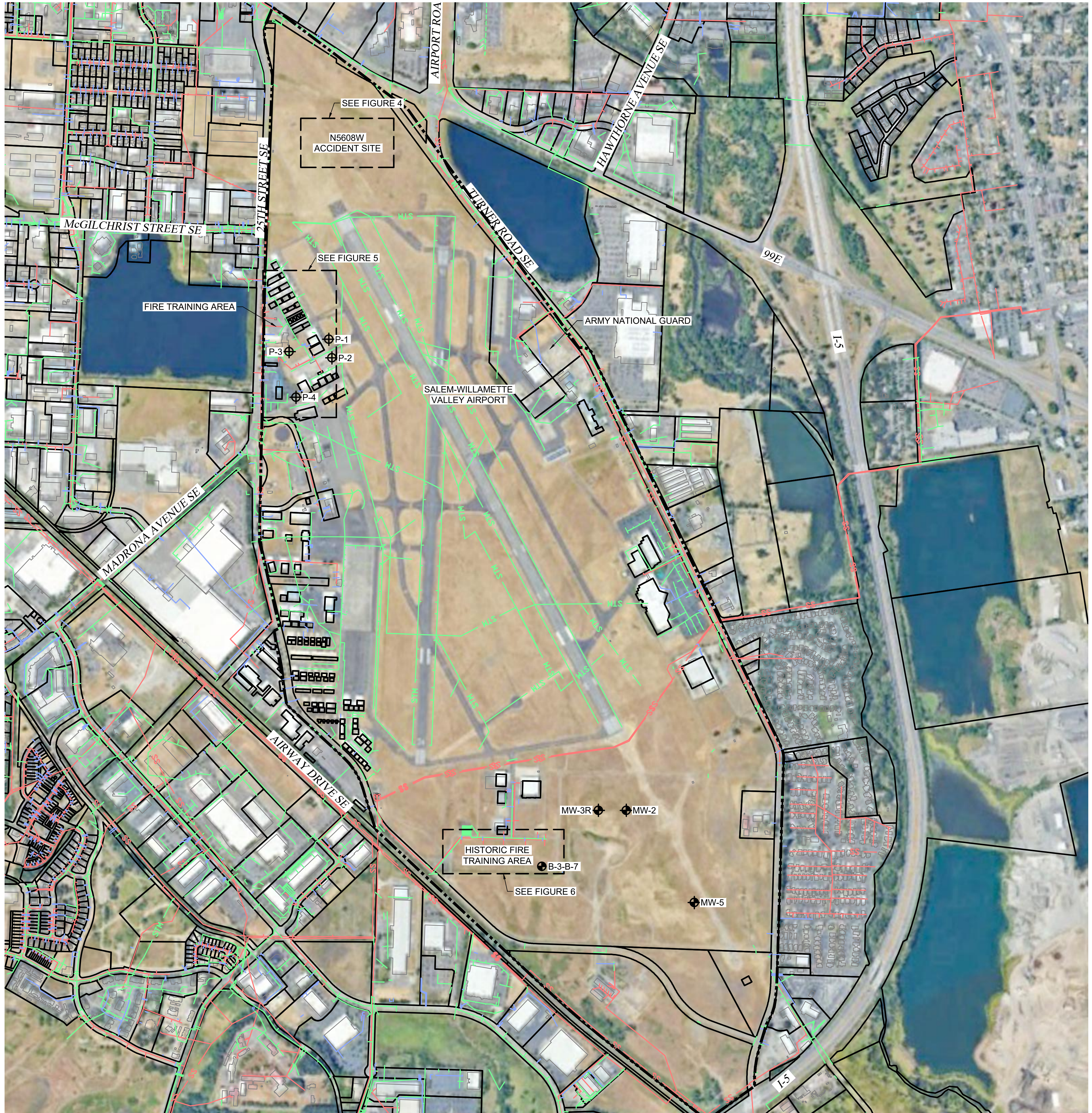
1. THIS DRAWING IS DIAGRAMMATIC. IT IS FOR GENERAL INFORMATION ONLY.

LEGEND

— · · —	PROJECT SITE BOUNDARY
——	PARCELS
P-#	HISTORICAL SOIL SAMPLE
B-#	HISTORICAL SOIL SAMPLE
MW-#	EXISTING MONITORING WELL

UTILITIES

— W —	WATER
— SS —	SEWER
— STM —	STORM



SOURCE: © 2025 GOOGLE EARTH PRO.

N

SCALE: 1" = 500'

0 250' 500' 1,000'

PREPARED FOR: CITY OF SALEM

apex companies, LLC
4412 SW Corbett Avenue
Portland, OR 97239
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apexcos.com

APEX®

SITE PLAN

SALEM-WILLAMETTE VALLEY AIRPORT SITE INVESTIGATION

2990 25TH STREET SE, SALEM, OREGON

NO	REVISION	DATE	BY	APPD

DRAWN BY: JAB

CHECKED: MS

DATE: JUNE 2025

PROJECT NUMBER: 250007713

SHEET DRAWING NO: 2

SHEET 2 OF 7

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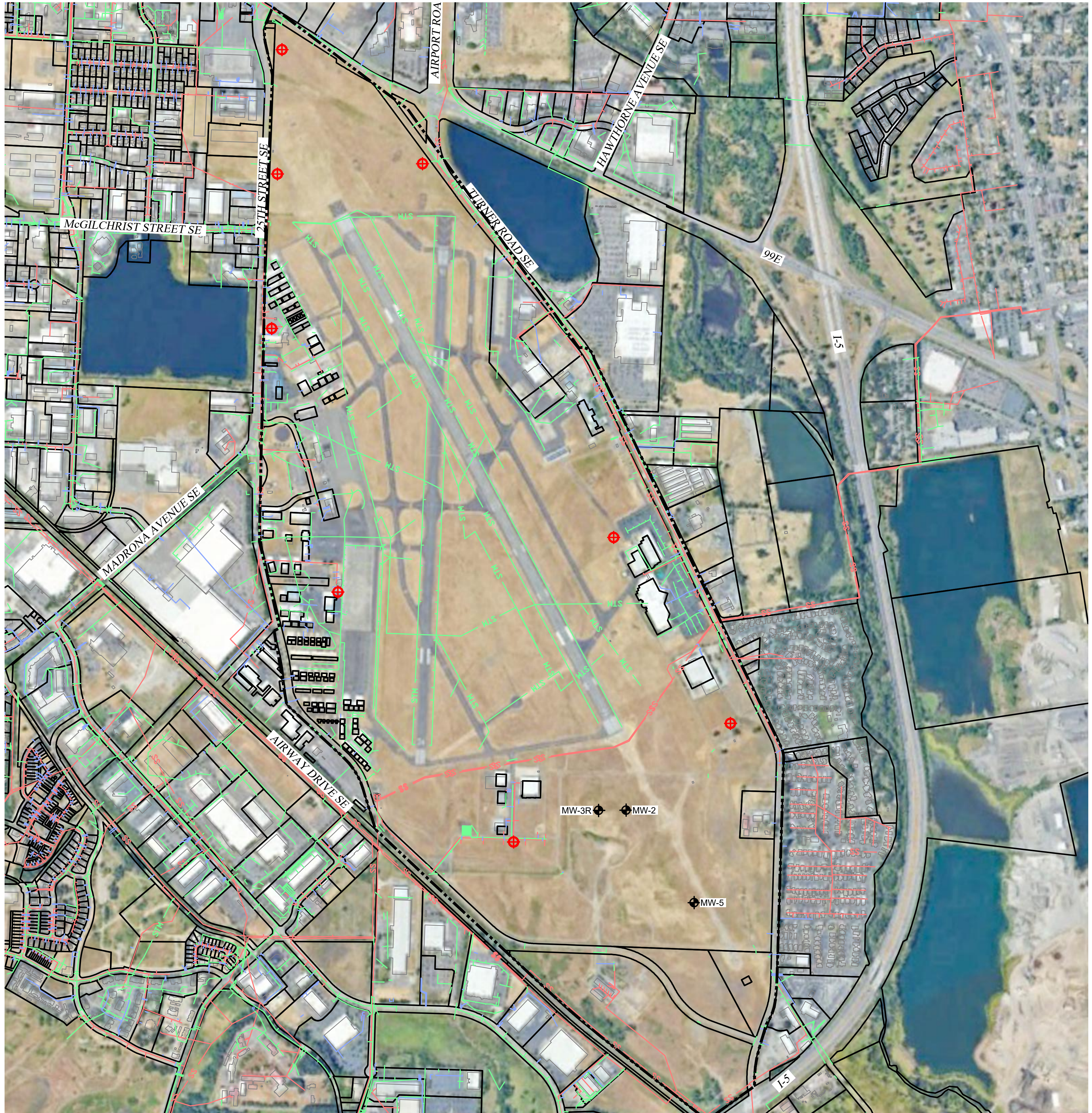
FULL SIZE SHEET FORMAT IS 24X36; IF PRINTED SIZE IS NOT 24X36, THEN THIS SHEET FORMAT HAS BEEN MODIFIED & INDICATED DRAWING SCALE IS NOT ACCURATE.

GENERAL NOTES

1. THIS DRAWING IS DIAGRAMMATIC. IT IS FOR GENERAL INFORMATION ONLY.

LEGEND

- PARCELS
- IMPERVIOUS
- WATER
- SEWER
- STORM
- PROJECT SITE BOUNDARY
- MW-# EXISTING MONITORING WELL NUMBER AND LOCATION
- PROPOSED MONITORING WELL



SOURCE: © 2025 GOOGLE EARTH PRO.

SCALE: 1" = 500'

0 250' 500' 1,000'

PREPARED FOR: CITY OF SALEM

FULL SIZE SHEET FORMAT IS 24X36; IF PRINTED SIZE IS NOT 24X36, THEN THIS SHEET FORMAT HAS BEEN MODIFIED & INDICATED DRAWING SCALE IS NOT ACCURATE.

Filename: L:\Projects_DVP\C\CIT236\25007713\GIS\25007713_0001_FIG-3.dwg Layout Tab: LAYOUT1 User: James Blanco CAD Plot Date/Time: 7/25/2025 11:34:19 AM

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PROPOSED GRONDWATER MONITORING WELLS

SALEM AIRPORT

2990 25TH STREET SE, SALEM, OREGON

NO	REVISION	DATE	BY	APPD
1	ADD TWO PROPOSED WELLS	07/25/2025	JAB	MS

DRAWN BY: JAB
CHECKED: MS
DATE: JUNE 2025
PROJECT NUMBER: 250007713

SHEET DRAWING NO: 3

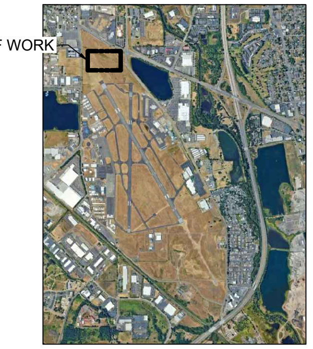
SHEET 3 OF 7

GENERAL NOTES

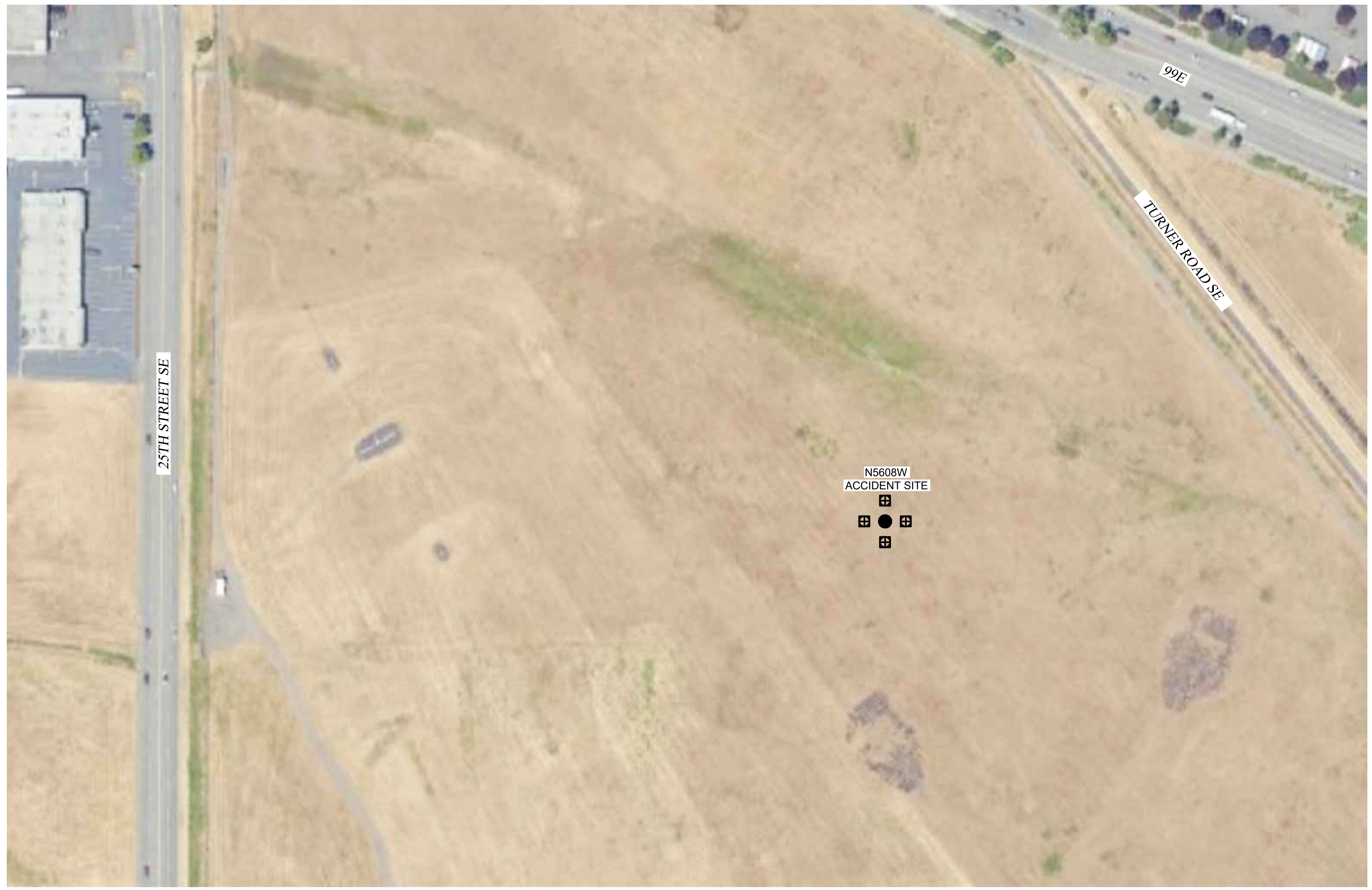
1. THIS DRAWING IS DIAGRAMMATIC. IT IS FOR GENERAL INFORMATION ONLY.

LEGEND

- ● LOCATION OF HISTORIC ACCIDENT SITE
- ⊞ PROPOSED SOIL SAMPLE LOCATION



KEY PLAN
(SEE FIGURE 3)



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SCALE: 1" = 80'
0 40' 80' 160'

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PROPOSED SOIL SAMPLE LOCATIONS - N5608W ACCIDENT SITE
SALEM-WILLAMETTE VALLEY AIRPORT SITE INVESTIGATION
2990 25TH STREET SE, SALEM, OREGON

NO	REVISION	DATE	BY	APPD

DRAWN BY	JAB
CHECKED:	MS
DATE:	JUNE 2025
PROJECT NUMBER:	250007713
SHEET DRAWING NO:	4
SHEET	4 OF 7

Filename: L:\Projects_DVP\C\CIT236\25007713\GIS\25007713_0001_FIG-4.dwg Layout Tab: LAYOUT1 User: James Blanco CAD Plot Date/Time: 6/20/2025 10:06:36 AM

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LEGEND

⊞ PROPOSED SOIL SAMPLE LOCATION

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SCOPE OF WORK

KEY PLAN
(SEE FIGURE 3)

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PROPOSED SOIL SAMPLE LOCATIONS - FIRE TRAINING AREA

SALEM AIRPORT

2990 25TH STREET SE, SALEM, OREGON

NO	REVISION	DATE	BY	APPD
1	ADD PROPOSED SAMPLE - MOVE	7/29/25	JAB	MS

DRAWN BY: JAB
CHECKED: MS
DATE: JUNE 2025
PROJECT NUMBER: 250007713
SHEET DRAWING NO: 5
SHEET 5 OF 7

Filename: L:\Projects_DVP\C\CIT236\25007713\GIS\25007713_0001_FIG-5.dwg Layout Tab: LAYOUT1 User: James Blanco CAD Plot Date/Time: 7/29/2025 3:12:26 PM

FULL SIZE SHEET FORMAT IS 24X36; IF PRINTED SIZE IS NOT 24X36, THEN THIS SHEET FORMAT HAS BEEN MODIFIED & INDICATED DRAWING SCALE IS NOT ACCURATE.

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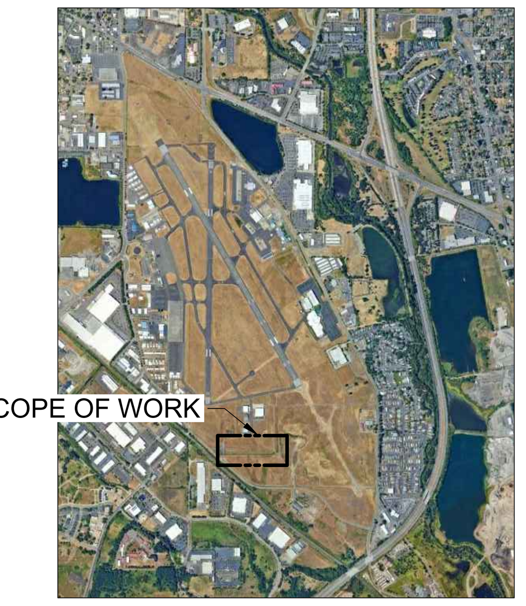
LEGEND

- B-# HISTORICAL SOIL SAMPLE
- PROPOSED SOIL SAMPLE LOCATION

SOURCE: © 2025 GOOGLE EARTH PRO.



KEY PLAN
(SEE FIGURE 3)

SCALE: 1" = 80'
0 40' 80' 160'

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PROPOSED SOIL SAMPLE LOCATIONS - HISTORIC FIRE TRINING AREA

SALEM AIRPORT

2990 25TH STREET SE, SALEM, OREGON

NO	REVISION	DATE	BY	APPD
1	ADD PROPOSED SAMPLES - MOVE	7/29/25	JAB	MS

DRAWN BY: JAB
CHECKED: MS
DATE: JUNE 2025
PROJECT NUMBER: 250007713

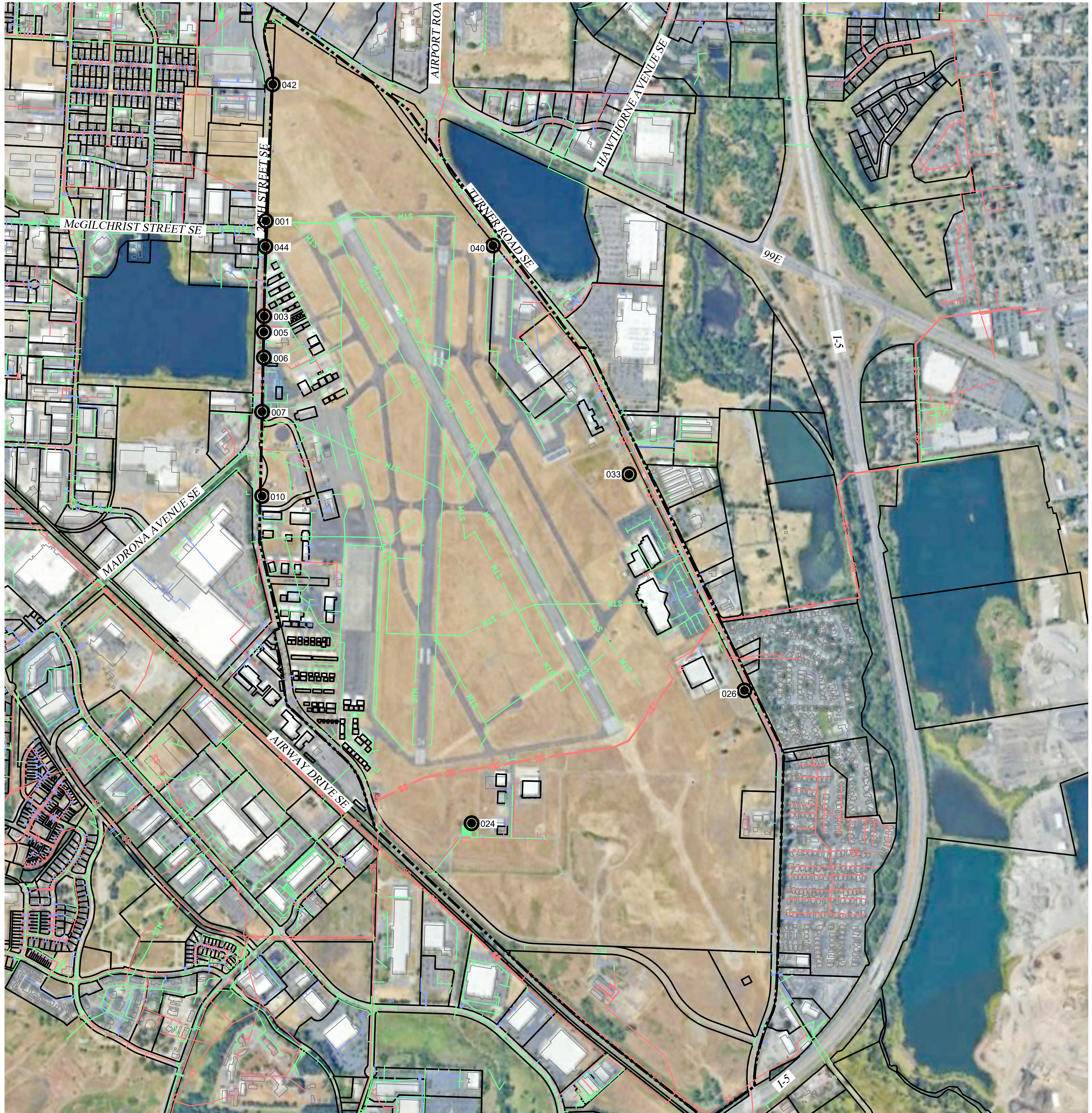
SHEET DRAWING NO: 6
SHEET 6 OF 7

GENERAL NOTES

1. THIS DRAWING IS DIAGRAMMATIC. IT IS FOR GENERAL INFORMATION ONLY.

LEGEND

- PARCELS
- PROJECT SITE BOUNDARY
- PROPOSED STORMWATER OUTFALL SEDIMENT SAMPLE



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SCALE: 1" = 500'

0 250' 500' 1,000'

PREPARED FOR: CITY OF SALEM

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Filename: L:\Projects_DVP\C\CIT236\25007713\GIS\25007713_0001_FIG-7.dwg Layout Tab: LAYOUT1 User: James Blanco CAD Plot Date/Time: 6/20/2025 10:29:12 AM

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PROPOSED SEDIMENT SAMPLE LOCATIONS

SALEM-WILLAMETTE VALLEY AIRPORT SITE INVESTIGATION

2990 25TH STREET SE, SALEM, OREGON

NO	REVISION	DATE	BY	APPD

DRAWN BY: JAB

CHECKED: MS

DATE: JUNE 2025

PROJECT NUMBER: 250007713

SHEET DRAWING NO: 7

SHEET 7 OF 7

Appendix B

Sampling and Analysis Plan

1.0 Introduction

This appendix presents the field and sampling procedures and the analytical testing program that will be used to complete the field and analytical work for this project. Quality assurance and quality control (QA/QC) procedures are also discussed in this appendix.

2.0 Field and Sampling Procedures

The project scope of work includes collection and chemical analysis of groundwater and soil related to the assessment of per- and polyfluoroalkyl substances (PFAS; a component of aqueous film forming foam [AFFF]) at the Salem-Willamette Valley airport. The field and sampling procedures include the following:

- Preparatory activities;
- Soil logging and installation of groundwater wells via push-probe and sonic drilling methods;
- Collection of surface soil and sediment samples;
- Groundwater elevation measurements;
- Collection of groundwater samples from monitoring wells;
- Sample management (i.e., containers, storage, and shipment);
- Decontamination procedures; and
- Handling of investigation-derived waste (IDW).

2.1 Preparatory Activities

Site Health and Safety Plan. A Site-specific health and safety plan (HASP) has been prepared for the proposed activities. The HASP was prepared in general accordance with the Occupational Safety and Health Administration (OSHA) and the Oregon Administrative Rules (OAR). A copy of the HASP will be maintained at the Site during the field activities. Prior to performing any on-site work, Apex will prepare a job safety analysis (JSA) and HASP guiding Site- and project-specific activities, risks, and safety protocols. All field staff and subcontractor personnel supporting the project will be required to review and agree to abide by the HASP. Safety topics will be refreshed daily with the field crew using a daily tailgate safety meeting, to be conducted by Apex's site supervisor or site safety officer.

Property Access. Apex will coordinate access to each drilling site with airport management (who will coordinate with the Federal Aviation Administration [FAA] as needed for access to work areas). Depending on the location of work, a badged escort may be necessary (such as within the fence line of the controlled airfield perimeter). It is also anticipated that restrictions will be in place for the timing of airfield work (limiting access to certain days or times of day). Coordination for access will also include discussion of equipment being used, height restrictions, and flagging of elevated equipment such as drilling masts.

Flagging/Barricading. Work in trafficked areas will be designated with cones and vehicles with amber flashing beacons or as required by airport management.

Underground Utility Location. Apex's project manager or designee will mobilize to the Site to mark out the proposed sampling locations with marking paint to enable the identification of nearby underground utilities by Dig-Alert/Underground Service Alert (USA). Because Dig-Alert does not mark out underground utilities on private property and because the drilling activities will be performed inside the boundaries of the Site, it is anticipated that airport personnel will conduct an underground utility locate to mark out underground utilities located within the proximity of each proposed sampling location prior to performing the subsurface work.

If any underground utilities are identified within 5 feet of the proposed sampling location, Apex will adjust the proposed sampling location before drilling commences. Apex will also adjust the proposed drilling location to provide a safety buffer for buildings, heavy traffic areas, overhead utilities, and similar Site features so that sampling can be performed safely and with minimal disruption to existing businesses.

As an additional safety measure, all borings will be hand-cleared using a hand auger, air-knife, or post hole digger.

2.2 Groundwater Monitoring Well Installation

Well Installations. Groundwater monitoring wells will be installed using both push-probe and sonic drilling equipment. As a local water source will be needed for decontamination of the drilling equipment between explorations and potentially needed during the drilling and installation of the deeper monitoring well, Apex will coordinate with the City for access to an on-site water supply. If recent data documenting that the water supply is free of the full suite of PFAS compounds (included in EPA Method 1633), then a sample will be collected from the water supply to verify that the water is free of PFAS.

The scope includes the installation of eight shallow aquifer wells using push-probe methods to a depth of 20 feet below ground surface (bgs) and one deeper zone well using sonic methods to a depth of 50 feet bgs, though the final depths will be determined based on actual lithological conditions. The locations of the eight shallow aquifer monitoring wells are shown on Figure 3. The location of the deeper zone well will be determined following the installation and sampling of the shallow aquifer wells using the results of the shallow well sampling to identify the downgradient perimeter well with the relatively highest PFAS concentrations to site the co-located deeper zone well. Field screening and boring installation will be conducted in accordance with Apex SOP 2.1, SOP 2.4, and SOP 2.9 (attached).

The monitoring wells will be installed and constructed of 2-inch diameter, Schedule 40 PVC casing with 10 to 15 feet of Schedule 40 PVC screen with 0.010-inch slots (determined based on depth of the well and depth of the seasonal groundwater level fluctuation, set such that for the shallow aquifer wells, the top of the well screen is above the seasonal high water level, potentially requiring a longer screen section). A clean 20/30 silica sand pack will be placed between the boring wall and the PVC screen and riser from the bottom of the well to approximately 1 to 2 feet above the screened interval. A bentonite seal will be placed above the sand pack to within approximately 1 to 2 feet of the ground surface. The surface will be completed with a traffic-rated flush-mounted concrete well pad and monument. A watertight locking cap and lock will secure the wellhead, and tamper-resistant bolts will secure the monument cover.

Lithologic Descriptions. Soil sampling for lithologic descriptions will be conducted for the full length of the borings for each well. Soil cores will be screened for volatile organic compounds using a photoionization detector (PID), and lithologic descriptions will be made in general accordance with American Society for Testing Materials Standard 2487/2488. If adding water to a boring becomes necessary to prevent or minimize sand heaving during well installation, significantly more water will be removed during well development to confirm removal of added water prior to groundwater sampling. This will ensure collected samples are representative of subsurface conditions.

Documentation. The field geologist will document the well installation and construction activities. Details to be noted include the following:

- Length of well components;
- Measurements of bentonite, sand, and concrete depths;
- Types, brands, weights, and amounts of materials used;
- Documentation of decontamination; and
- Any deviation from standard procedures or problems encountered during the well installation activities.

The drilling contractor will be responsible for conforming to all applicable regulations pertaining to well construction.

2.3 Monitoring Well Development

The newly installed monitoring wells will be developed to establish an unobstructed connection with the aquifer. Well development will occur approximately 24 hours after well installation is completed. The wells will be developed by surging and purging a minimum of five casing volumes of water from the well using a downhole pump. Field parameters will be collected during development and include temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), and conductivity. Development will be considered complete when the water is visually clear and field parameters have stabilized to within 5 percent of the previous measurement for three consecutive borehole volumes. Purge water will be drummed and handled in accordance with Section 2.9. The top of inner well casing elevation, as well as the x and y location coordinates for the newly-installed wells, will also be recorded by an Oregon licensed surveyor following well installation activities.

2.4 Surface Soil and Sediment Sampling

Surface soil and sediment samples will be collected in accordance with SOP 2.2, using hand tooling to collect three subsamples from each location at a depth of 6 inches bgs. The shallow soil samples will also include composite subsamples collected from 2 feet bgs collocated with the 6-inch subsamples. Composite samples for each depth will be combined by homogenizing an equal amount of soil from each respective subsample in a stainless-steel bowl.

At each location, Apex will conduct field screening in accordance with SOP 2.1 and soil logging in accordance with the Unified Soil Classification System (USCS) to record soil texture, grain size, etc.

Each exploration location will be backfilled with granular bentonite and hydrated with water and the surface will be patched to match the surrounding area.

2.5 Groundwater Elevation Measurements

Water level measurements will be collected in general accordance with SOP 2.16 for water level measurement procedures, provided in this appendix. These measurements will be collected from all wells in the monitoring well network. Well covers and well caps will be opened, and the water level will be allowed to equilibrate under atmospheric conditions for at least five minutes before water level measurements are taken. Depth to water, depth to product, and/or presence of sheen will be recorded in the field notes. Noticeable odors, damage to wells, or other conditions will also be documented in the field notes.

2.6 Collection of Monitoring Well Samples

Apex will collect groundwater samples from monitoring wells in accordance with the low-flow sampling techniques described in SOP 2.5, included in this appendix. Water level monitoring will be attempted during sampling, and pumping drawdown will be restricted to less than 0.3 feet. Groundwater samples collected from wells will be analyzed for PFAS by US Environmental Protection Agency (EPA) Method 1663.

Groundwater samples will be collected using dedicated PFAS-free tubing (e.g., high-density polyethylene [HDPE]) and a peristaltic pump. During sample collection, the tubing will be placed in the middle of the screened interval. Groundwater will be purged prior to sampling. During purging, groundwater field parameters (pH, ORP, DO, specific conductivity, and temperature) will be measured using a flow cell connected to the discharge tubing of the sample pump. Turbidity of the water will be monitored visually with color and clarity being recorded on the sampling data sheet. Purging will be considered complete when the water quality parameters have stabilized to within 10 percent and the water is visually clear for three consecutive three-minute intervals. Sample containers will be provided by the laboratory ready for sample collection. Table B-1 lists sample container requirements.

2.7 Sample Management

Cross-Contamination. To avoid PFAS contamination of the soil and groundwater samples, sampling personnel will avoid using items containing polytetrafluoroethylene (PTFE, also known as Teflon), low-density polyethylene (LDPE), or polypropylene as well as other items that contain PFAS, such as aluminum foil, Post-It notes, waterproof field books, markers, chemical ice packs (e.g. blue ice), certain decontamination soaps, and certain product packaging (e.g. such as that found on pre-wrapped foods and snacks). Any of these types of items that are known to be PFAS-free may be used. Similarly, many clothing items contain PFAS, such as those coated with Teflon or incorporating a Gore-Tex membrane. Clothing items will only be worn if they have been washed at least six times, and known PFAS-containing products will be avoided during sample collection. Field personnel will avoid the use of cosmetics, moisturizers, and hand cream. Insect repellant and sunscreen will be avoided, and alternative skin barriers (e.g., long sleeve clothing, wide-brimmed hats, etc.) will be used. PFAS contamination prevention protocols will be reviewed with personnel daily during the field activities. Before any samples are collected, the sample handler will wash their hands and wear nitrile gloves while collecting and sealing sample containers.

Containers. Clean sample containers will be provided by the analytical laboratory ready for sample collection (container requirements are listed in Table B-1). For samples collected for PFAS analysis, sample containers (including lids) will be HDPE or polypropylene and will not contain PTFE (Teflon).

Labeling Requirements. A sample label will be affixed to each sample container before sample collection. Containers will be marked with the project name, sample I.D. (unique I.D. for each sample location), date and time stamp (military time) of collection, sampler's initials, and the type of analysis.

Sample Storage and Shipment. Water samples will be stored in a cooler chilled with ice to below six degrees Celsius (°C). The cooler lid will be sealed with chain-of-custody seals. Samples will be sent via overnight courier to the analytical laboratory for chemical analysis. Chain-of-custody will be maintained and documented at all times.

2.8 Decontamination Procedures

Personnel Decontamination. Personnel decontamination procedures depend on the level of protection specified for a given activity. The HASP identifies the appropriate level of protection for the type of work and expected field conditions associated with this project. In general, clothing and other protective equipment can be removed from the investigation area. Field personnel will thoroughly wash their hands and faces at the end of each day and before taking any work breaks.

Sampling Equipment Decontamination. To prevent cross-contamination between samples, clean, dedicated sampling equipment (e.g., groundwater sampling tubing) will be used for each sample and will be discarded after use. Cleaning of non-disposable items (i.e., field meter, telescoping swing sampler, and water level probe) will consist of washing in a detergent (Alconox®) solution, rinsing with tap water, and rinsing with de-ionized (DI; laboratory-supplied and certified PFAS-free) water. Decontamination water will be collected and handled in accordance with Section 2.9.

2.9 Handling of Investigation-Derived Waste

Investigation-derived waste (IDW) will consist of purge water, soil, and decontamination water. IDW will be placed in properly labeled Oregon Department of Transportation-approved drums. The drums will be transferred to a designated storage area pending receipt of chemical data and characterization of the waste for disposal (followed by transportation and the proper disposal of the waste). Sampling materials and personal protective equipment will be disposed of as solid waste.

3.0 Analytical Testing Program

Analytical laboratory QA/QC procedures are discussed in Section 5 of this appendix.

Tables B-1 through B-3 provide the proposed analytical method, the laboratory reporting limits, and the anticipated number of samples to be collected. Samples will be collected and handled using methods described in Section 2 of this appendix. Specific container and storage requirements for samples will be discussed with the analytical laboratory prior to sample collection and will be in accordance with the container requirements presented in Table B-1.

The contaminants of interest (COI) for this project are PFAS by EPA Method 1663 which utilizes isotope dilution and solid phase extraction. Reported PFAS will include the method list of 40 compounds (see Table B-2).

4.0 Field Quality Assurance Program

Table B-3 provides a summary of anticipated field QA/QC samples.

Field Chain-of-Custody. A chain-of-custody form will be used to record possession of a sample and to document analyses requested. Each time the sample bottles or samples are transferred between individuals, both the sender and receiver will sign and date the chain-of-custody form. When a sample shipment is transported to the laboratory, a copy of the chain-of-custody form will be included in the transport container (e.g. ice chest).

Field Duplicate Samples. One groundwater field duplicate sample will be collected to achieve a 10 percent ratio of duplicate to primary samples. The duplicate sample will be analyzed for PFAS. A field duplicate consists of two samples collected sequentially from one sample location to assess data variability. The field duplicate will be analyzed by the same analytical methods used for primary samples. Relative percent difference (RPD) for the field duplicate will be calculated to assess the data precision and accuracy as well as the potential variability caused by sample handling.

Equipment Rinse Blanks. An equipment blank will be collected and analyzed for PFAS compounds along with the field samples. The blank will be collected using laboratory-supplied and verified PFAS-free water. An equipment blank is analyzed to determine the success of equipment decontamination and can also show laboratory sources of contamination.

5.0 Quality Assurance Plan

The purpose of the Quality Assurance Plan (QAP) is to specify procedures and methods for office and field documentation, sample handling and custody, recordkeeping, equipment handling, and laboratory analyses that will be used during sampling and analysis.

5.1 Quality Assurance Objectives for Data Management

The general QA objectives for this project are to develop and implement procedures for obtaining and evaluating data of acceptable quality. To collect such information, analytical data must have an appropriate degree of accuracy and reproducibility, samples collected must be representative of actual field conditions, and samples must be collected and analyzed using unbroken chain-of-custody procedures.
Specific QA objectives are as follows.

1. Establish sampling techniques that will produce analytical data representative of the media being measured.
2. Collect and analyze a sufficient number of field duplicate samples to establish sampling precision. Laboratory duplicates of the same sample will provide a measure of precision within the sample (sample homogeneity).
3. Analyze a sufficient number of analytical duplicate samples to assess the performance of the analytical laboratory.

4. Analyze a sufficient number of blank, standard, duplicate, spiked, and check samples within the laboratory to evaluate results against numerical QA goals established for precision and accuracy.

Precision, accuracy, representativeness, completeness, and comparability parameters used to indicate data quality are defined below.

5.1.1 Precision

Precision is a measure of the reproducibility of data under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. For duplicate measurements, precision can be expressed as the RPD. Analysis of field duplicate samples will serve to measure the precision of sampling. Laboratory duplicate measurements will be carried out with at least a 5 percent frequency for each sample matrix.

5.1.2 Accuracy

Accuracy is the measure of error between the reported test results and the true sample concentration. True sample concentration is never known due to analytical limitations and error. Consequently, accuracy is inferred from the recovery data from spiked samples.

Because of difficulties with spiking samples in the field, the laboratory will spike samples. The laboratory will perform sufficient spike samples of a similar matrix (water or soil) to allow the computation of the accuracy.

Perfect accuracy is a 100 percent recovery.

5.1.3 Representativeness

Representativeness is a measure of how closely the results reflect the actual concentration of the chemical parameters in the medium sampled.

Sampling procedures, as well as sample-handling protocols for storage, preservation, and transportation, are designed to preserve the representativeness of the samples collected. Proper documentation will confirm that protocols are followed. This helps to assure the sample identification and integrity.

Laboratory method blanks will be run in accordance with established laboratory protocols.

5.1.4 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is essentially that a sufficient amount of valid data be generated to allow for the evaluation of site cleanup.

5.1.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The objective of this QAP is to assure that data developed during the sampling are comparable to other data from projects with the same media and sampling techniques. Comparability of the data will be assured by using EPA-defined procedures which specify sample collection, handling, and analytical methods.

5.1.6 Documentation

EPA Level III documentation will be generated during sampling/analysis. This level of documentation is generally considered legally defensible and consists of the following:

- Chain-of-custody;
- Holding times;
- Laboratory method blank data;
- Sample data;
- Shipping receipts;
- Laboratory notes;
- Raw data validation;
- Matrix/surrogate spike data; and
- Duplicate sample data.

5.2 Sampling Protocols

5.2.1 Methods

Sampling methods are presented in Section 2. These procedures are designed to ensure that:

- Samples collected are consistent with project objectives; and
- Samples are identified, handled, and transported in a manner that does not alter the representativeness of the data from the actual site conditions.

QA objectives for sample collection will be accomplished by a combination of the following items.

- **Standardized Procedures.** Standardized procedures will be followed and documented.
- **Laboratory QA.** Laboratory duplicate measurements will be carried out on at least 5 percent of laboratory samples. Analytical procedures will be evaluated using the protocols of the analytical laboratory. These protocols can be submitted upon request.
- **Chain-of-Custody.** Procedures for chain-of-custody are described in Section 5.3.

5.3 Sample and Document Custody Procedures

The various methods used to document field sample collection and laboratory operation are presented below.

5.3.1 Field Chain-of-Custody Procedures

Sample chain-of-custody refers to the process of tracking the possession of a sample from the time it is collected in the field through the laboratory analysis. A sample is considered to be under a person's custody if:

- It is in a person's physical possession;
- It is in view of the person after possession has been taken; or
- It is secured by that person so that no one can tamper with the sample or secured by that person in an area which is restricted to authorized personnel.

A chain-of-custody form is used to record possession of a sample and to document analyses requested. Each time the sample bottles or samples are transferred between individuals, both the sender and receiver will sign and date the chain of custody form. When a sample shipment is transported to the laboratory, a copy of the chain of custody form will be included in the transport container (i.e. ice chest).

The chain-of-custody forms are used to record the following information:

- Sample identification number;
- Sample collector's signature;
- Date and time of collection;
- Description of sample;
- Analyses requested;
- Shipper's name and address;
- Receiver's name and address; and
- Signatures of persons involved in chain-of-custody.

Procedures for the handling, documenting, and shipping of samples are described in Section 2.

5.3.2 Laboratory Operations

The analytical laboratory has a system in place for documenting the following laboratory information:

- Calibration procedures;
- Analytical procedures;
- Computational procedures;
- Quality control procedures;
- Bench data;
- Operating procedures or any changes to these procedures; and
- Laboratory notebook policy.

Laboratory chain-of-custody procedures provide the following:

- Identification of the responsible party (sample custodian) authorized to sign for incoming field samples;
- A log consisting of sequential lab-tracking numbers; and
- Specification of laboratory sample custody procedures for sample handling, storage, and internal distribution for analysis.

5.3.3 Corrections to Documentation

Original data are recorded in field notes and on chain-of-custody forms using indelible ink. Documents will be retained even if they are illegible or contain inaccuracies that require correction.

If an error is made on a document, the individual making the entry will correct the document by crossing a line through the error, entering the correct information, and initialing and dating the correction. Any subsequent error discovered on a document is corrected, initialed, and dated by the person who made the entry.

5.4 Equipment Calibration Procedures and Frequency

Instruments and equipment used during this project will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations. Operation, calibration, and maintenance will be performed by laboratory personnel fully trained in these procedures.

For PFAS analysis, the instrumentation will be tuned once per week and calibrated with a minimum of five standards resulting in a linear calibration (r^2>0.985). A second source check standard will be analyzed with every batch and must be ±15 percent of the average response of the mid-point calibration standard. Sample concentrations should be within bracketing calibration standards. If not, samples must be diluted to be within the calibration range.

5.5 Analytical Procedures

Samples will be analyzed using SW 846 analytical protocols and EPA methodology.

Analytical instrumentation used for quantitation of PFAS must be free of PTFE transfer lines and frits to avoid elevated background levels. Only polypropylene containers will be used in the sample, standard, and extraction procedures due to potential adsorption of analytes onto glass. Laboratory reagent blanks (LRB) will be used to monitor interferences and should be less than one-third the minimum reporting limit (MRL) for each method analyte.

The limit of detection (LOD) for PFAS will be defined using the method blank and is three times the peak-to-peak amplitude of the baseline noise near the target peak. The limit of quantitation (LOQ), or MRL, is defined as five times the LOD for a specific analyte and is the lowest point of calibration. The LOD and LOQ are determined semiannually.

High-quality PFAS standards will be used to quantitate both branched and linear isomers. Documentation of these standards will be available from the analytical laboratory upon request.

5.6 Data Reduction, Validation, and Reporting

Reports generated in the field and laboratory will be included with project reports.

The project manager will assure the validation of the analytical data. The laboratory generating analytical data for this project will be required to submit results that are supported by sufficient backup and QA/QC data to enable the reviewer to determine the quality of the data. The validity of the laboratory data will be determined based on the objectives outlined in Section 5.1 and Section 5.8. Data validity will also be determined based on the sampling procedures and documentation outlined in Sections 5.2 and 5.3. Upon completion of the review, the Project Manager will be responsible for assuring the development of a QA/QC report on the analytical data. Data will be stored and maintained according to the standard procedures of the laboratory. The method of data reduction will be described in the final report.

5.7 Performance Audits

Performance audits are an integral part of an analytical laboratory's standard operating procedures and are available upon request.

5.8 Data Measurement Assessment Procedures

The quality of the data will be assessed based on precision, accuracy, and completeness. Procedures to compute each are discussed below.

5.8.1 Precision

The RPD is used to assess the precision of the analytical method and is calculated using the following equation:

(1) $$RPD = \frac{X_s - X_d}{(X_s + X_d)/2} \times 100\%$$

where:

X_s = analytical result of the sample
X_d = analytical result of the duplicate sample

5.8.2 Accuracy

The accuracy of the data set is determined from the analysis of spiked samples. The accuracy is calculated using the following equation.

(2) $$A = \frac{(X_{ss} - X_s)}{T} \times 100\%$$

where:

A	=	accuracy
X_{ss}	=	analytical result obtained from the spiked sample
X_s	=	analytical result obtained from the sample
T	=	true value of the added spike

The overall accuracy is the arithmetic mean of the spiked samples.

5.8.3 Completeness

Completeness (percent complete) of the data is determined by the following equation.

(3) $$PC = \frac{\text{Number of samples with acceptable data}}{\text{Number of samples collected}} \times 100\%$$

5.9 Corrective Actions

If the quality control audit detects unacceptable conditions or data, the project manager will be responsible for developing and initiating corrective action. Corrective action may include the following:

- Reanalyzing the samples, if holding time criteria permit;
- Resampling and analyzing;
- Evaluating and amending sampling and analytical procedures; and
- Accepting data and acknowledging the level of uncertainty or inaccuracy by flagging the data.

5.10 Quality Assurance Reports

A quality assurance review will be conducted that presents a QA/QC evaluation of the data collected during the sampling activities for inclusion in the final report. In addition to an opinion regarding the validity of the data, the QA/QC evaluation will address the following:

- Any adverse conditions or deviations from the Sampling and Analysis Plan;
- Assessment of analytical data for precision, accuracy, and completeness;
- Significant QA problems and recommended solutions; and
- Corrective actions taken for any problems previously identified.

Table B-1
Analytical Methods - Sample Container Requirements
Former Fire Stations
Port of Portland

Analyte and Method	Lab	Matrix	Container	Preservative	Storage Temperature	Holding Time	
						Sampling to Preparation	Preparation to Analysis
PFAS by EPA Method 1663	Enthalpy Analytical	Groundwater Soil	2 x 500 mL HDPE 1 x 6 ounce HDPE	None	4±2°C	28 days	28 days

Notes:

1. PFAS = Per-and polyfluoroalkyl substances.
2. HDPE containers for PFAS analysis must be PFAS-free and not have Teflon-lined lids.
3. mL = Milliliter.
4. °C = Degrees Celsius.

Table B-2
Analytical Methods, Anticipated Sample Number, and Laboratory Reporting Limit
Former Fire Stations
Port of Portland

Analyte	Acronym	Method	Groundwater		Soil/Sediment	
			Anticipated Number of Samples	Laboratory Reporting Limit (ng/L)	Anticipated Number of Samples	Laboratory Reporting Limit (ng/g)
Perfluorobutanoic acid	PFBA	EPA Method 1663	8 / event	6.40	61	0.5
Perfluoro-3-methoxypropanoic acid	PFMPA	EPA Method 1663	8 / event	3.20	61	0.5
3-Perfluoropropyl Propanoic acid	3:3 FTCA	EPA Method 1663	8 / event	8.00	61	15
Perfluoropentanoic acid	PFPeA	EPA Method 1663	8 / event	3.20	61	0.5
Perfluoro(4-methoxybutanoic) acid	PFMBA	EPA Method 1663	8 / event	3.20	61	0.5
Fluorotelomer sulfonate	4:2 FTS	EPA Method 1663	8 / event	6.00	61	0.5
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	EPA Method 1663	8 / event	3.20	61	0.5
Perfluorobutane sulfonic acid	PFBS	EPA Method 1663	8 / event	1.42	61	0.5
Perfluorohexanoic acid	PFHxA	EPA Method 1663	8 / event	1.60	61	0.5
Hexafluoropropylene oxide-dimer acid (GenX)	HFPO-DA	EPA Method 1663	8 / event	6.68	61	0.5
5:3 Fluorotelomer carboxylic acid	5:3 FTCA	EPA Method 1663	8 / event	40.0	61	15
Perfluoro(2-ethoxyethane)sulphonic acid	PFEESA	EPA Method 1663	8 / event	2.85	61	0.5
Perfluoroheptanoic acid	PFHpA	EPA Method 1663	8 / event	1.60	61	0.5
Perfluoropentane sulfonic acid	PFPeS	EPA Method 1663	8 / event	1.50	61	0.5
4,8-Dioxa-3H-perfluorononanoate	ADONA	EPA Method 1663	8 / event	6.32	61	0.5
Fluorotelomer sulfonate	6:2 FTS	EPA Method 1663	8 / event	6.07	61	0.5
Perfluorooctanoic acid	PFOA	EPA Method 1663	8 / event	2.00	61	0.5
Perfluorohexane sulfonic acid	PFHxS	EPA Method 1663	8 / event	1.60	61	0.5
7:3 Fluorotelomer carboxylic acid	7:3 FTCA	EPA Method 1663	8 / event	40.0	61	15
Perfluorononaoic acid	PFNA	EPA Method 1663	8 / event	1.60	61	0.5
Perfluoroheptane sulfonic acid	PFHpS	EPA Method 1663	8 / event	1.52	61	0.5
Fluorotelomer sulfonate	8:2 FTS	EPA Method 1663	8 / event	6.14	61	0.5
Perfluorodecanoic acid	PFDA	EPA Method 1663	8 / event	1.60	61	0.5
Methyl perfluorooctanesulfonamidoacetic acid	MeFOSAA	EPA Method 1663	8 / event	1.60	61	0.5
Perfluorooctane sulfonic acid	PFOS	EPA Method 1663	8 / event	1.49	61	0.5
Ethyl perfluorooctanesulfonamidoacetic acid	EtFOSAA	EPA Method 1663	8 / event	1.60	61	0.5
Perfluoroundecanoic acid	PFUnA	EPA Method 1663	8 / event	1.60	61	0.5
9-Chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	EPA Method 1663	8 / event	6.24	61	0.5
Perfluorononane sulfonic acid	PFNS	EPA Method 1663	8 / event	1.54	61	0.5
Perfluorooctane sulfonamide	PFOSA	EPA Method 1663	8 / event	1.60	61	0.5
Perfluorododecanoic acid	PFDoA	EPA Method 1663	8 / event	1.60	61	0.5
Perfluorodecane sulfonic acid	PFDS	EPA Method 1663	8 / event	1.54	61	0.5
Perfluorotridecanoic acid	PFTrDA	EPA Method 1663	8 / event	1.60	61	0.5
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	EPA Method 1663	8 / event	6.00	61	0.5
Perfluorotetradecanoic acid	PFTeDA	EPA Method 1663	8 / event	1.60	61	0.5
Perfluorodecane Sulfonic Acid	PFDoS	EPA Method 1663	8 / event	1.55	61	0.5
Methylperfluorooctanesulfonamidoethanol	MeFOSE	EPA Method 1663	8 / event	16.0	61	0.5
Methylperfluorooctanesulfonamide	MeFOSA	EPA Method 1663	8 / event	1.60	61	0.5
Ethyl perfluorooctane sulfonamido ethanol	EtFOSE	EPA Method 1663	8 / event	16.0	61	0.5
Ethylperfluorooctanesulfonamide	EtFOSA	EPA Method 1663	8 / event	1.60	61	0.5

Notes:
ng/L = nanograms per Liter
ng/g = nanograms per gram
EPA = US Environmental Protection Agency

Table B-3
Quality Assurance Samples
Former Fire Stations
Port of Portland

QA Sample Matrix	QA Sample Type	Analyses Requested	Anticipated Number of Samples
Groundwater	Field Duplicate Equipment Blank	PFAS PFAS	1 / event 1 / event

Notes:
1. QA = Quality assurance.
2. PFAS = Per- and polyfluoroalkyl substances.

Apex Standard Operating Procedures

SOP 2.1 – Standard Field Screening Procedures
SOP 2.2 – Surface Soil Sampling Procedures
SOP 2.4 – Push-Probe Exploration Procedures for PFAS
SOP 2.5 – Low Flow Groundwater Sampling Procedures
SOP 2.9 – Sonic Drilling Exploration Procedures
SOP 2.13 – Monitoring Well Installation Procedures
SOP 2.14 – Monitoring Well Development Procedures
SOP 2.16 – Water Level Measurement Procedures

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides instructions for standard field screening. Field screening results are used to aid in the selection of soil samples for chemical analysis. This procedure is applicable during Apex Companies, LLC (Apex) soil sampling operations.

Standard field screening techniques include the use of a photoionization detector (PID) to assess for volatile organic compounds (VOCs), for the presence of separate-phase petroleum hydrocarbons using a sheen test. These methods will not detect all potential contaminants, so selection of screening techniques shall be based on an understanding of the site history. The PID is not compound or concentration-specific, but it can provide a qualitative indication of the presence of VOCs. PID measurements are affected by other field parameters such as temperature and soil moisture. Other field screening methods, such as screening for dense non-aqueous phase liquid (DNAPL) using dye or UV light, are not considered “standard” and will be detailed in the site-specific sampling and analysis plan (SAP).

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- PID with calibration gas (record daily calibration/calibration check in field notes);
- Plastic resealable bags (for PID measurement); and
- Glass jars or stainless steel bowls (for sheen testing).

3. METHODOLOGY

Each soil sample will be field screened for VOCs using a PID and for the presence of separate-phase petroleum hydrocarbons using a sheen test. If the presence of DNAPL is suspected, then screening using dye and UV light may also to be completed. For information regarding screening using dye or UV light, refer to the site specific sampling and analysis plan.

PID lamps come in multiple sizes, typically 9.8, 10.6, and 11.7 electron volts (eV). The eV rating for the lamp must be greater than the ionization potential (in eV) of a compound in order for the PID to detect the compound. For petroleum hydrocarbons, a lamp of at least 9.8 eV should be used. For typical chlorinated alkenes (dichloroethene, trichloroethene, tetrachloroethene, or vinyl chloride.), a lamp of at least 10.6 eV should be used. The compatibility of the lamp size with the site constituents should be verified prior to the field event and will be detailed in the site-specific SAP.

PID Calibration Procedure: The PID used on-site should be calibrated daily or more frequently if needed. Calibration of the PID should be documented in field notes. Calibrations procedures should be conducted according to the manufacturer’s instructions. .

<u>PID Screening Procedure:</u>

- Place a representative portion (approximately one ounce) of freshly exposed, uncompacted soil into a clean resealable plastic bag.
- Seal the bag and break up the soil to expose vapors from the soil matrix.
- Allow the bag to sit to reach ambient temperature. Note: Ambient temperature and weather conditions/humidity should be recorded in field notes. Changes in ambient temperature and weather during the field work should also be recorded, as temperature and humidity can affect PID readings.
- Carefully insert the intake port of the PID into the plastic bag.
- Record the PID measurement in the field notes or boring logs.

<u>Sheen Test Procedure:</u>

- Following the PID screen, place approximately one ounce of freshly exposed, uncompacted soil into a clean glass jar or stainless steel bowl.

- Add enough water to cover the sample.
- Observe the water surface for signs of discoloration/sheen and characterize

No Sheen (NS)	No visible sheen on the water surface
Biogenic Film (BF)	Dull, platy/blocky or foamy film.
Slight Sheen (SS)	Light sheen with irregular spread, not rapid. May have small spots of color/iridescence. Majority of water surface not covered by sheen.
Moderate Sheen (MS)	Medium to heavy coverage, some color/iridescence, spread is irregular to flowing. Sheen covering a large portion of water surface.
Heavy Sheen (HS)	Heavy sheen coverage with color/iridescence, spread is rapid, entire water surface covered with sheen. Separate-phase hydrocarbons may be evident during sheen test.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods used for obtaining surface soil samples for physical and/or chemical analysis. For purposes of this SOP, surface soil (including shallow subsurface soil) is loosely defined as soil that is present within 3 feet of the ground surface at the time of sampling. Various types of sampling equipment are used to collect surface soil samples including spoons, scoops, trowels, shovels, and hand augers.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Spoons, scoops, trowels, shovels, and/or hand augers. Stainless steel is preferred.
- Stainless steel bowls
- Laboratory-supplied sample containers
- Field documentation materials
- Decontamination materials
- Personal protective equipment (as required by Health and Safety Plan)

3. METHODOLOGY

Project-specific requirements will generally dictate the preferred type of sampling equipment used at a particular site. The following parameters should be considered: sampling depth, soil density, soil moisture, use of analyses (e.g., chemical versus physical testing), type of analyses (e.g., volatile versus non-volatile). Analytical testing requirements will indicate sample volume requirements that also will influence the selection of the appropriate type of sampling tool. The project sampling plan should define the specific requirements for collection of surface soil samples at a particular site.

Collection of Samples

- **Volatile Analyses.** Surface soil sampling for volatile organics analysis (VOA) is different than other routine physical or chemical testing because of the potential loss of volatiles during sampling. To limit volatile loss, the soil sample must be obtained as quickly and as directly as possible. If a VOA sample is to collected as part of a multiple analyte sample, the VOA sample portion will be obtained first. The VOA sample should be obtained from a discrete portion of the entire collected sample and should not be composited or homogenized. Sample bottles should be filled to capacity, with no headspace. Specific procedures for collecting VOA samples using the EPA Method 5035 are discussed in SOP 2-7.
- **Other Analyses.** Once the targeted sample interval has been collected, the soil sample will be thoroughly homogenized in a stainless steel bowl prior to bottling. Sample homogenizing is accomplished by manually mixing the entire soil sample in the stainless steel bowl with the sampling tool or with a clean teaspoon or spatula until a uniform mixture is achieved. If packing of the samples into the bottles is necessary, a clean stainless steel teaspoon or spatula may be used.

General Sampling Procedure:

- Decontaminate sampling equipment in accordance with the Sampling and Analysis Plan (SAP) before and after each individual soil sample.
- Remove surface debris that blocks access to the actual soil surface or loosen dense surface soils, such as those encountered in heavy traffic areas. If sampling equipment is used to remove surface debris,

the equipment should be decontaminated prior to sampling to reduce the potential for sample interferences.

- When using a hand auger, push and rotate downward until the auger becomes filled with soil. Usually a 6- to 12-inch long core of soil is obtained each time the auger is inserted. Once filled, remove the auger from the ground and empty into a stainless steel bowl. If a VOA sample is required, the sample should be taken directly from the auger using a teaspoon or spatula and/or directly filling the sample container from the auger. Repeat the augering process until the desired sample interval has been augered and placed into the stainless steel bowl.

Backfilling Sample Locations:

Backfill in accordance with federal and state regulations including OAR 690-240 (e.g., bentonite requirements). The soils from the excavation will be used as backfill unless project-specific or state requirements include the use of clean backfill material.

1. *Purpose*

This Standard Operating Procedure (SOP) describes the methods for observing and sampling from push-probes (i.e., GeoProbe™). Subsurface soil cores may be obtained using this system for purposes of determining subsurface soil conditions and for obtaining soil samples for physical and/or chemical evaluation. Grab groundwater samples may be collected using temporary well screens. Shallow (less than 50 feet), small-diameter (2-inch maximum) pre-packed wells may also be installed using push-probe equipment. This procedure is applicable during all Apex Companies, LLC (Apex) push-probe activities that will be conducted to collect grab soil and/or groundwater samples for analysis of per- and polyfluorinated alkyl substances (PFAS). The protocols in this SOP are consistent with push-probe activities for non-PFAS compounds. They include added protocols to address potential for cross-contamination from materials containing PFAS.

2. *Scope*

This SOP applies to all Apex field events where grab soil and groundwater samples will be collected for analysis of PFAS using push-probe drilling methods.

3. *Equipment and Materials*

The following materials are necessary for this procedure:

- Traffic cones, measuring tape, spatula, and buckets/drums.
- Groundwater sampling equipment (water level probe, pumps, tubing).
- Soil sampling equipment (spoons, scoops, and/or trowels). Stainless steel is preferred.
- Stainless steel bowls.
- Laboratory-supplied PFAS-free (high-density polyethylene [HDPE]) sample containers. Sample containers should not have Teflon®-lined lids. PFAS may adsorb to glass containers; therefore, glass should be avoided for both water and soil samples.
- Field documentation materials.
- Decontamination materials.
- Personal protective equipment (as required by project Health and Safety Plan).

Prior to conducting the sampling event, a materials screening should be performed to identify field equipment and personal protective equipment (PPE) that are PFAS-free to reduce the risk of cross-contamination. The materials screening should include a review of safety data sheets (SDS) and ingredient lists (in personal care products, sunscreens, insect repellants, etc.). Additional details regarding which materials are allowed and which are prohibited are provided below.

The following PFAS-containing equipment and materials are PROHIBITED and should be avoided when sampling soil for PFAS:

- Teflon®-containing materials (polytetrafluoroethylene [PFTE]) (e.g. sample containers, tubing, bailers, plumbing paste, tape, etc.). In cases where Teflon®-containing materials are unavoidable, ensure adequate purging is performed prior to sampling and equipment blanks are collected prior to sampling.
- Low-density polyethylene (LDPE)-containing materials (e.g. disposable plastic storage bags, containers used to transport samples, tubing, etc.). In cases where LDPE-containing materials are unavoidable, an equipment blank can be collected to ensure the LDPE is PFAS-free. LDPE does not typically contain PFAS in the raw materials; however, LDPE products are often cross-contaminated with PFAS during manufacturing.
- Materials containing polyvinylidene fluoride (PVDF; Kynar®), which can be found in tubing, films/coatings on aluminum, lithium-ion batteries, and wire insulators.
- Materials containing polychlorotrifluoroethylene (PCTFE; Neoflon®), which can be found on food packaging, valves, seals, and gaskets.
- Materials containing ethylene-tetrafluoroethylene (ETFE; Tefzel®), which can be found on wire insulation, pipe liners, and cable tie wraps.
- Materials containing fluorinated ethylene propylene (FEP; Teflon®; Hostaflon®; Neoflon®), which can be found in labware, wire insulation, and pipe linings.
- Paper products such as waterproof field books (e.g. Rite-in-the-Rain), plastic clipboards, binders, spiral hard cover notebooks, sticky notes, or glue materials.
- Markers.
- Chemical (blue) ice packs.
- Latex gloves.
- Coated materials, including aluminum foil.
- Decontamination soaps containing fluorosurfactants such as Decon 90.
- Water that is not verified to be "PFAS-free" by the laboratory to be used for trip, equipment, and decontamination blanks and decontamination processes.
- Water resistant, waterproof, stain-treated clothing or shoes, including Gore-Tex™ and Tyvek® materials. If PFAS-free shoes cannot be used, PFAS-free over-boots may be worn and donned in the staging area prior to sampling.

Additionally, there is documentation that some personal care products, as well as food and drinks, may introduce PFAS contaminants to the samples. Therefore, these additional precautions should be taken during the sampling event:

- Many personal care products, such as cosmetics, moisturizers, and hand creams, contain PFAS. These products should be avoided during sampling events and 24 hours prior to sampling. Please note that many products marketed as 'natural' or 'organic' contain PFAS. If personal care products must be used, the ingredient list should be checked for PFAS.
- Many manufactured sunblocks and insect repellents contain PFAS. Only PFAS-free sunblock and insect repellent should be used during sampling events. If sunscreens or insect repellants are used during a PFAS sampling event, the product(s) should be applied in the staging area. After application, hands should be washed, and new nitrile gloves used.
- Many food and drink wrappers and containers, paper plates, aluminum foil, and paper towels contain PFAS. Food containers and related items should be kept out of the sampling area. Samplers should wash hands thoroughly with PFAS-free water and soap after handling food wrappers and containers.

The following equipment and materials are typically PFAS-free and recommended for use when collecting samples for PFAS analysis:

- HDPE, polypropylene, acetate, nylon, polyvinyl chloride (PVC), cotton, stainless steel, natural rubber, and silicone materials (e.g. tubing, bailers, tape, plumbing paste).
- Nitrile gloves that are changed frequently.
- Loose paper with Masonite or aluminum clipboards.
- Bags of ice.
- Alconox® or Liquinox®.
- Laboratory-supplied and verified PFAS-free water to be used for trip, equipment, and decontamination blanks and decontamination processes.
- Cotton textiles are recommended for field clothing and should be laundered a minimum of 6 times from time of purchase due to possible PFAS-related treatments. Fabric softener must be avoided. Rain gear should be made from polyurethane, PVC, and/or wax-coated materials.

There is some documentation that field vehicles could have seats treated with stain resistant products and could represent a source of cross-contamination. If possible, cover treated vehicle seats with a well-laundered cotton blanket or sheet. Do not handle sample containers on the vehicle seats. Always change gloves after exiting the vehicle.

4. Methodology

Field Preparation:

Prior to sampling, set up separate eating, staging, and sampling areas to help avoid PFAS cross-contamination. Due to the high risk of cross-contamination, any visitors to the site should remain at a distance from the sampling area. A sequence should be set up prior to sampling. Sample collection should start with areas suspected to be least contaminated and end with areas suspected to be most contaminated.

Coring Procedure (Conducted by Drilling Subcontractor):

The sampling procedure includes driving a 2-inch outside-diameter, 5-foot-long, push-probe soil sampler to the desired depth using a combination of hydraulic pressure and mechanical hammer blows. When the sampling depth is reached, the pin attaching the sampler's tip is released (if a tip is used), which allows the tip to slide inside the sampler (Macro-Core Sampler with removable plastic liner [acetate or equivalent PFAS-free material]). The sampler is driven to its full length to collect a soil core, which is then withdrawn from the exploration. When the sampler is retrieved from the borehole, the drive head/cutting shoe is detached and the liner is removed. Soil cores are collected continuously to the full depth of the exploration unless otherwise specified in a project-specific sampling and analysis plan (SAP). Verify that the subcontractor decontaminates the sampling device prior to its initial use and following collection of each soil sample. Decontamination will consist of steam washing with PFAS-free water. Care should be taken to contain the steam and water; PFAS may aerosolize during decontamination procedures and deposit on the site surface, creating a contamination risk.

Logging and Soil Sample Collection:

Remove the soil core from the sampler for field screening, description, and placement into sample jars. Soil samples will be collected for field screening and possible chemical analysis on two-foot intervals unless otherwise specified in a project-specific SAP. Complete field screening as specified in SOP-2.1. The sampling interval will be determined in the field based on recovery, soil variability, and evidence of contamination. With PFAS specifically, considering soil sample depth is important and may affect the concentration of PFAS detected at the laboratory. Current research suggests that PFAS concentrate in the air/water interfaces; therefore, sampling soil just above the water table may generate a different (generally higher) PFAS concentration than sampling other soil intervals. PFAS concentrations in soil can also be heavily influenced via downward leaching during precipitation events.

Soil samples for PFAS analysis will be thoroughly homogenized in a stainless steel bowl prior to bottling. Sample homogenizing is accomplished by manually mixing the entire soil sample in the stainless steel bowl with a clean sampling tool until a uniform mixture is achieved. The sample jar should be filled completely.

Any extra soil generated during probing activities will be placed in Department of Transportation (DOT)-approved drums or ground-applied based on client preferences and/or local regulations and guidance.

Place collected samples into cooler(s) kept at temperatures that do not exceed 6 degrees Celsius (°C). Chemical/blue ice packs should not be used to keep PFAS samples chilled. The samples and regular ice should be double-bagged using bags made of non-PFAS materials.

Grab Groundwater Sample Collection:

Collect grab groundwater samples using a sampling attachment with a 4 to 5-foot-long temporary screen. (Specify to drillers whether to use decontaminated stainless steel or disposable PVC. Also, specify whether a filter pack is necessary based on field observations). Obtain samples using a peristaltic pump unless otherwise specified in the SAP with new PFAS-free tubing for each boring. Record field parameters (e.g., temperature, conductivity, and pH) prior to sampling. The grab groundwater sample should be collected using low-flow methods. High volume purge methods should not be used.

Place collected samples into cooler(s) kept at temperatures that do not exceed 6 °C. Chemical/blue ice packs should not be used to keep PFAS samples chilled. The samples and regular ice should be double bagged using bags made of non-PFAS materials.

Backfilling the Excavation (Conducted by Drilling Subcontractor):

After sampling activities are completed, abandon each exploration in accordance with local regulations and procedures. The abandonment procedure typically consists of filling the exploration with granular bentonite and hydrating the bentonite with water. Match the surface completion to the surrounding materials.

Decontamination Procedures:

Field sampling equipment, including water level indicators, oil/water interface meters, pumps, stainless steel bowls and trowels, and other non-dedicated equipment should be decontaminated before first use and between sampling each boring location. The SDS of detergents or soaps used for decontamination procedures should be reviewed to ensure that fluorosurfactants are not listed as ingredients. Laboratory-certified PFAS-free water should be used for the final rinse during decontamination of sampling equipment. When possible, equipment should also be rinsed with PFAS-free water immediately prior to first use. Sampling equipment can be scrubbed with a polyethylene or PVC brush as needed to remove particulates.

5. References

California State Water Quality Control Board, Division of Water Quality, 2020. Per-and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines for Non-Drinking Water. September 2020.

Massachusetts Department of Environmental Protection, 2019. Fact Sheet, Interim Guidance on Sampling and Analysis for PFAS at Disposal Sites Regulated under the Massachusetts Contingency Plan. June 19, 2018. Updated December 27, 2019.

Michigan Department of Environmental Quality, 2018. General PFAS Sampling Guidance. October 16, 2018.

New Hampshire Department of Environmental Services, 2019. Per- and Polyfluoroalkyl Substances (PFAS) Sample Collection Guidance. May 2019.

New York Department of Environmental Conservation, 2021. Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS). January 2021.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods for collection of groundwater samples from monitoring wells applying low flow protocols. Low flow sampling is a method of collecting samples that does not require the removal of large volumes of water and therefore does not overly agitate the water, suspend particles, or potentially aspirate VOCs. Typical flow rates for low flow sampling range from 0.1 L/min to 0.5 L/min depending on site characteristics. The groundwater monitoring activities will consist of measuring water levels, purging and sampling groundwater, and measuring groundwater field parameters. This procedure is applicable during Apex Companies low flow groundwater sampling activities.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Traffic cones, tools, keys, and buckets/drums
- Water quality meter with calibration solutions (record daily calibration/calibration check in field notes)
- Sampling equipment (water level probe, pumps, tubing) and laboratory-supplied sample containers
- Field documentation materials
- Well construction details, if available
- Decontamination materials
- Personal protective equipment (as required by project Health and Safety Plan)

3. METHODOLOGY

Water Levels:

Water levels in the wells will be measured and recorded for the purpose of determining groundwater elevations and gradient prior to initiating purging of any of the wells. The wells will be opened and the water level allowed to equilibrate before the measurements are taken. Measurements of the depth to water will be made to the nearest 0.01 foot using an electronic probe.

Purging:

Purge using low-flow sampling equipment (e.g., peristaltic pump or bladder pump) at a low-flow rate to limit water table drawdown. Unless specified otherwise in the project-specific sampling and analysis plan (SAP) the sample tubing/pump will be lowered to the middle of the saturated screened interval. To assess the effectiveness of purging, groundwater field parameters (pH, specific conductance, dissolved oxygen, oxidation/reduction potential, temperature and turbidity) will be measured using a flow cell connected to the discharge tubing of the sample pump. Purging will be considered complete when the water quality parameters meet the following criteria:

pH +/- 0.1 pH units
Specific Conductance +/- 3% of prior reading
Dissolved Oxygen +/- 10% of prior reading for values greater than 0.5 mg/L. If three DO values are less than 0.5 mg/L, consider the DO stabilized
Oxidation/Reduction potential +/- 20 mV
Temperature +/- 3% of prior reading
Turbidity (if measured) 10% of prior reading for values greater than 5 NTUs. If three turbidity values are less than 5 NTUs, consider the values as stabilized. Measure turbidity before flow-through cell.

Consult the project-specific SAP for additional parameters and stabilization criteria. Purge water will be placed in Department of Transportation (DOT) approved drums.

Sample Collection:

After the purging of each well is complete, collect groundwater samples for chemical analyses using the same pump used for the well purging. Disconnect the flow-through cell and collect the samples directly from the pump tubing. Do not collect samples from the downstream side of the flow-through cell.

Low Yield Sampling Procedure:

If drawdown of the water table is unavoidable and a well pumps dry during purging, discontinue measurement of water quality parameters. Collect groundwater samples once the water level recovers to 90 percent of the pre-purge water column. Contact project manager in the event of slow recharge conditions. Always collect samples for VOC analysis as soon after recharge as possible.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods for observing and sampling using sonic drilling techniques. Subsurface soil cores may be obtained using this system for purposes of determining subsurface soil conditions and for obtaining soil samples for physical and/or chemical evaluation. Grab groundwater samples may be collected using temporary well screens. Groundwater monitoring wells may also be installed using sonic drilling methods. This procedure is applicable during Apex Companies, LLC (Apex) drilling activities using sonic drilling methods.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Traffic cones, measuring tape, spatula, and buckets/drums
- Sampling equipment (water level probe, pumps, tubing) and laboratory-supplied sample containers
- Field documentation materials
- Decontamination materials
- Personal protective equipment (as required by project Health and Safety Plan)

3. METHODOLOGY

Coring Procedure (Conducted by Drilling Subcontractor):

Sonic drilling advances a temporary casing while drilling, thereby eliminating communication between strata of different elevations during the drilling process. The sonic drilling technology combines harmonics (vibration) and rotation as the basis for tool advancement, and reduces the volume of IDW created during the completion of the boring. Drilling is conducted using an inner casing (a 6-inch diameter core barrel) followed by an outer casing that sleeves over the inner casing. The core barrel advances 5-10 feet into the subsurface, followed by the outer casing. The core barrel is then removed from the borehole and the soil is bagged for preservation (and sampling) or for disposal. The core barrel is put back into the borehole and pushed another 5-10 feet. An additional 5-10-foot length of outer casing is added to the outer casing that is in the ground and it is drilled to meet the bottom of the core barrel. This process continues until total depth is reached. Soil cores are collected continuously to the full depth of the exploration unless otherwise specified in a project-specific sampling and analysis plan (SAP). Verify that the subcontractor decontaminates the sampling device prior to its initial use and following collection of each soil sample.

Logging and Soil Sample Collection:

The driller will remove the soil core from the sampler into a plastic tube bag by vibrating and moving the sampler so that the full soil core is laid flat within the bag. Inspect the soil core and expose for field screening, description, and placement into sample jars as needed by broaching the side of the sample bag. Soil samples will generally be collected for field screening and possible chemical analysis on two to five foot intervals unless otherwise specified in a project-specific SAP. The sampling interval will be determined in the field based on recovery, soil variability, and evidence of contamination. Complete field screening as specified in SOP-2.1. Soil samples should be collected using different procedures for volatile or non-volatile analyses, as follows.

- **Volatile Analyses.** Sampling for volatile organics analysis (VOA) is different than other routine physical or chemical testing because of the potential loss of volatiles during sampling. To limit volatile loss, the soil sample must be obtained as quickly and as directly as possible. If a VOA sample is to be collected as part of a multiple analyte sample, the VOA sample portion will be obtained first. The VOA sample should be obtained from a discrete portion of the entire collected sample and should not be composited or homogenized. Sample bottles should be filled to capacity, with no headspace. Specific procedures for collecting VOA samples using the EPA Method 5035 are discussed in SOP 2.7.

- **Other Analyses.** Soil samples for non-volatile analyses will be thoroughly homogenized in a stainless steel bowl prior to bottling. Sample homogenizing is accomplished by manually mixing the entire soil sample in the stainless steel bowl with a clean sampling tool until a uniform mixture is achieved. The sample jar should be filled completely.

Any extra soil generated during probing activities will be placed in Department of Transportation (DOT) approved drums.

Grab Groundwater Sample Collection:

Collect grab groundwater samples by installing a temporary well casing in the boring (i.e., 1 to 2-inch PVC well casing with a 4 to 5-foot-long temporary screen), including sand pack. Obtain samples using the methods described in SOP 2.5. Record field parameters (e.g., temperature, conductivity, and pH) prior to sampling. Temporary well screen is pulled from boring and materials drilled out of hole prior to abandonment.

Backfilling the Excavation (Conducted by Drilling Subcontractor):

After sampling activities are completed, abandon each exploration in accordance with Oregon Water Resources Department (OWRD) regulations and procedures. The abandonment procedure typically consists of filling the exploration with granular bentonite and hydrating the bentonite with water. Match the surface completion to the surrounding materials.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods for installing monitoring wells (using conventional PVC or pre-packed well screens). A pre-packed well screen generally consists of 5-foot sections of an inner PVC well screen and an outer stainless steel wire mesh. The sand filter pack is housed between the inner screen and outer wire mesh. Well installations are typically completed using push probe drilling to save time and cost but may include many other techniques for drilling a borehole to install the well. This procedure is applicable during all Ash Creek Associates (ACA) drilling activities for installation of monitoring wells.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Field documentation materials
- Personal protective equipment (as required by project Health and Safety Plan)

3. METHODOLOGY

The soil boring for the monitoring well will be completed in accordance with SOP-2.4.

Installation/Construction of Monitoring Well:

Filter Pack. Wells will be constructed of flush-threaded Schedule 40 PVC casing connected to a conventional PVC well screen or pre-packed well screen, placed at the bottom of the boring. A clean silica sand pack will be placed between the boring wall and the PVC screen/riser (i.e., the annulus) from the bottom of the well to approximately one to two feet above the screened interval. Prior to installation of the seal, the well will be surged using a surge block or similar technique. The depth to sand will be measured prior to setting the bentonite seal.

Seal. A bentonite seal, 1 to 2 feet thick, will be placed above the sand. The bentonite will be hydrated and allowed to sit for a minimum of 30 minutes for proper hydration and sealing. The depth to the top of the seal will be measured prior to placing grout. In Washington State and some California counties, the bentonite seal may be placed to within 1 foot of the ground surface in place of grout (per local/state regulations).

Grout. A cement-bentonite slurry will be placed above the bentonite seal following proper hydration. The cement-bentonite slurry will be placed to within 1 foot of the ground surface.

Surface Seal. A concrete surface seal will secure a flush-mounted, traffic-rated monument, or a bollard protected stove-pipe stickup. A locking cap and lock will secure the wellhead, and tamper-resistant bolts (either pentagonal or Allen wrench) will secure a monument cover if a flush-mounted monument is used for surface completion. Flush-mounted surface completions will be completed slightly above grade to prevent the ponding of water in, and around, the monument. All monuments will be permanently marked with well identification numbers. The identification number should be marked on the well (e.g., punched into monument ring, written on the well casing and/or cap with permanent marker, etc.). A survey point should also be added to the well casing (e.g., v-notch cut in PVC).

Documentation:

The field geologist will document the well construction activities. Details to be noted include the following:

- Length of well components;
- Measurements of bentonite, sand, and concrete depths;
- Types, brands, and amounts of materials used;
- Documentation of decontamination; and
- Any deviation from standard procedures or problems during the installation activities.

The drilling contractor will be responsible for conforming to all applicable regulations pertaining to well construction.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods for developing monitoring wells following construction; however, this procedure is also applicable for the redevelopment of existing monitoring wells. Monitoring wells will be allowed to sit for a minimum of 48 hours following completion, or applicable local or state regulated waiting period, before initiating the well development process. This procedure is applicable during all Ash Creek Associates (ACA) well development activities.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Field documentation materials
- Well Purge Equipment (i.e., High flow centrifugal down-hole pump or bailer)
- Multi-parameter meter (temperature, pH, and conductivity)
- Decontamination materials
- Drums and/or high-capacity tank for storage of purged water
- Personal protective equipment (as required by project Health and Safety Plan)

3. METHODOLOGY

The well will be set up in a manner such that the volume of water generated can be easily determined and field parameters can be collected. The development activities will be completed to maximize the removal of sediment from the well casing.

<u>Procedures:</u>

- Measure depth to water (DTW) and total depth of the well prior to development and calculate the casing volume.
- Field parameters (temperature, pH, and conductivity) will be measured for each casing volume removed.
- Purge water will be placed in Department of Transportation (DOT) approved drums or high-capacity tank.
- After the removal of eight casing volumes, field parameters will be monitored for stability.

The well will be considered developed after a minimum of 10 casing volumes have been removed, field parameters have stabilized, and purged water is as free of sediment as possible. Field parameters will be considered stable if temperature, pH, and conductivity are within 10% for three consecutive casing volumes. Wells will also be considered developed if the well is pumped dry during the development process. Consult the project-specific SAP for additional parameters and stabilization criteria.

<u>Documentation:</u>

The field representative will document the well development activities. Details to be noted include the following:

- Depths to water;
- Total depth of the well;
- Purging type and rate;
- Field parameters; and
- Total volume of water purged.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes procedures for the collection of groundwater level measurements and separate phase hydrocarbon (SPH) measurements. Measurements may be collected as an independent event or in conjunction with groundwater sampling or SPH removal. This SOP is applicable for Apex Companies, LLC (Apex) sites and projects.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Water level or oil/water interface probe (as appropriate);
- Field documentation materials;
- Decontamination materials;
- Bailers or tape/paste (to confirm unusual SPH detections) and
- Personal protective equipment (PPE; as required by project Health and Safety Plan).

3. METHODOLOGY

Preparation. Obtain and review table of well construction details and historical groundwater and SPH levels/thicknesses. Bring tables into the field for ready reference.

Field Procedure. Water level and SPH measurements should be collected upon arrival at the site. Appropriate PPE (as required by the project-specific Health and Safety Plan) should be worn during measurement activities. During groundwater sampling events, measurements should be collected (1) prior to, during, and after purging and sampling. Water level measurements during low-flow sampling are conducted to ensure that drawdown is not occurring during purging/sampling. Low-flow sampling methods are described in SOP 2.5. The following procedures should be followed when collecting groundwater level and SPH measurements from wells:

No SPH in monitoring well

1. The electronic probe should be tested to ensure proper instrument response. If response is inadequate, replace batteries or repair probe as needed.
2. Well covers and caps will be opened and the water level allowed to equilibrate under atmospheric conditions. Observe for indications that water levels may not be at equilibrium such as:
   a. Escaping air upon loosening of well cap; or
   b. Water level above the top of the well screen.

   For either of these conditions, equilibrium should be verified by repeating water level measurements over five-minute intervals until successive equal measurements are obtained. Otherwise allow water levels to equilibrate for a minimum of five minutes before measurements are taken. Unless otherwise indicated in the work scope of site-specific sampling plan, water level measurements should be taken from the least contaminated wells first to avoid cross-contamination.
3. Locate the reference point on the well riser pipe.
4. Slowly lower the probe until the probe signal indicates that water has been contacted.
5. Record the depth-to-water (DTW) probe reading at the reference point. Measurements should be collected to the nearest 0.01 foot.
6. Withdraw the probe and repeat steps 5 and 6. Measurements should agree within a precision of 0.01 feet. Repeat if needed until a precision of 0.01 feet is obtained.
7. If the work scope or site specific sampling plan requires that the depth-to-bottom (DTB) of monitoring wells is measured, then the probe should be lowered to the bottom of the well and the DTB reading at the reference point should be measured to the nearest 0.01 foot.
8. Remove probe and decontaminate the tape using alcohol wipes then wash the tape and probe in a detergent (Alconox®) solution, rinse with tap water, and a final deionized water rinse. DO NOT USE ALCOHOL WIPES ON THE PROBE TIP. Describe in field notes unusual characteristics of SPH that may bias thickness readings (e.g. unusually viscous product).

SPH in monitoring well

1. Repeat above steps 1 through 5.
2. Slowly lower the oil/water interface probe until the signal indicates that SPH has been contacted (generally a steady tone and signal light).
3. Record the depth-to-product (DTP) probe reading at the reference point. Measurements should be collected to the nearest 0.01 foot.
4. Continue lowering the probe until the signal indicates that water has been contacted (generally an intermittent tone and signal light).
5. Record the DTW probe reading at the reference point. Measurements should be collected to the nearest 0.01 foot.
6. Withdraw the probe and repeat steps 5 and 6. Measurements should agree within a precision of 0.01 feet. Repeat if needed until a precision of 0.01 feet is obtained.
7. Remove probe and initially decontaminate the tape using alcohol wipes then wash/scrub the tape and probe in a detergent (Alconox®) solution, rinse with tap water, and a final deionized water rinse. DO NOT USE ALCOHOL WIPES ON THE PROBE TIP. Describe in field notes unusual characteristics of SPH that may bias thickness readings (e.g. unusually viscous product).
8. If unusual SPH thicknesses are detected (e.g. SPH is detected in well with no prior history of SPH or thicknesses are greater than prior detections), verify presence/thickness using alternative technique (e.g. bailer, tape and water/petroleum colorimetric paste).

Appendix C

Health and Safety Plan

This Level 2 HASP is intended to provide health and safety guidelines for project field work meeting the following criteria:

- **Short-duration work not exceeding 30 consecutive days**
- **"Buddy System" in use (or communication plan implemented for "lone worker"**
- **Some likelihood of chemical and/or physical hazard exposure**
- **Limited number of job tasks (5 or less)**
- **No supplied-air respirator use**
- **Limited number of subcontractors involved (3 or less)**

The Project Manager should review this Health and Safety Plan with all Apex project personnel. A copy of the HASP must be kept in the field with the project team as well as maintained in project files.

<table>
<tr><td rowspan="6">Administrative Information

This document is valid for a maximum time period of one year after initial completion and must be re-evaluated by the project team at that time.

A minimum of two persons with appropriate training and medical surveillance must be onsite or an appropriate communication plan must be implemented. A mix of Apex and other personnel can satisfy this requirement.</td><td colspan="2">Site Name and Location
Salem-Willamette Valley Airport, Salem, Oregon</td></tr>
<tr><td colspan="2">Client Contact
Nitin Joshi</td></tr>
<tr><td colspan="2">Project Name
Salem-Willamette Valley Airport Site Characterization</td></tr>
<tr><td>Health & Safety Plan Date
6/10/2025</td><td>Revision Number and Date</td></tr>
<tr><td>Field Work Start Date
TBD</td><td>Anticipated Field Work End Date
TBD</td></tr>
<tr><td>Project Manager (responsible for implementing the site health and safety program on this project)
Michael Stevens</td><td>Site Safety Officer (SSO) (responsible for overall site health and safety performance on this project).
Chris Weer</td></tr>
</table>

Project Background and Scope of Work **Include numbered list of tasks to be completed by Apex personnel during this project, and a separate list of tasks to be completed by any subcontractors at the site.** **JSAs are to be prepared for each task listed. Subcontractors are responsible for preparing JSAs for their activities.**	Apex Scope of Work: 1. Gauge groundwater monitoring wells for depth to water. 2. Sample groundwater at Site monitoring wells. 3. Oversee the installation of groundwater monitoring wells via Sonic Rig. 4. Collect soil samples 5. Log soil lithology and conduct field screening. 6. Develop and sample groundwater monitoring wells. 7. Sample Management/COC Subcontractor Scope of Work: One Call will be conducted more than 48 hours before fieldwork begins. The Airport will provide private utility location services. Drilling subcontractor will operate a the sonic drill rig. As an additional safety measure, all wells will be hand-cleared using a hand auger, air-knife, or post hole digger. Holes will be cleared to 5 feet using an air-knife and vacuum truck or with hand auger.

Site/Project General Information **An asterisk (*) indicates that additional checklists or permits are required and must be completed and attached to this document.** **A double asterisk (**) indicates that a Risk Review performed by a member of the Corporate Safety Committee must take place prior to beginning fieldwork on the project.**	Site Type (check all applicable boxes) [x] Active Facility [ ] Remote Facility [ ] Inactive Facility [ ] Residential [ ] Mine [ ] Railroad [ ] Industrial [x] Secured [ ] Uncontrolled [x] Other (specify) Active facility with multiple forms of transportation. Main Site Hazards (check all applicable boxes) [x] Slip/Trip/Fall [ ] Cold Stress [ ] Heat Stress [ ] Extreme Weather [x] Biological [x] Organic/Inorganic Chemicals [x] High Noise [ ] Construction Traffic [x] Vehicular Traffic [x] Respirable Particles [ ] Excavations [x] Buried/Overhead Utilities [ ] Non-Ionizing Radiation [x] Security [ ] ASTs/USTs [ ] Manlift/Cherry Picker Use [ ] Work Over 6' High* [x] Hand/Portable Power Tools [ ] Oxygen Deficiency [ ] Construction [ ] Blasting Agents [ ] Confined Spaces [ ] Welding or Hot Work [ ] Lockout/Tagout* [ ] Lockout/Tagout [ ] Forklift Use [ ] Chemical Mixing** [x] Commercial Vehicle [ ] Scaffold Use [ ] Portable Ladders [ ] Other (*specify*)

Chemical Products Apex will Use or Store Onsite **For each chemical product identified, an SDS must be attached to this HASP**			
	☒ Alconox or Liquinox	☐ Calibration gas (Methane)	☐ Isopropyl Alcohol
	☒ Hydrochloric acid (HCl)*	☐ Calibration gas (Isobutylene)	☐ Household bleach (NaOCl)*
	☒ Nitric acid (HNO_3)*	☐ Calibration gas (Pentane)	☒ Sulfuric acid (H_2SO_4)*
	☐ Sodium hydroxide (NaOH)*	☐ Calibration gas (4-gas mixture)	☐ Hexane
		☐ Other (specify)	☐ Other (specify)

***NOTE: Eyewash solution shall be readily available on ALL projects where corrosive materials are used or stored, including sample preservatives.**

Safe Work Practices

Place a checkmark by applicable SWPs and attach to this document

For hazards not covered by SWPs listed in this section, ensure the hazard is addressed in the JSA for that task. Otherwise, the JSA may reference the SWP for that hazard.

SWPs Applicable To This Project (check all applicable boxes)

☒ Hazard Communication	☒ Medical Services and First Aid	☒ Airborne Contaminants	☐ Heat Stress
☐ Cold Stress	☒ Natural Hazards	☒ Personal Protective Equipment	☒ Respiratory Protection
☐ Confined Space Entry	☒ Drum Handling	☐ Excavation	☐ Fall Protection and Prevention
☐ Forklift and Truck Operations	☒ Hand/Power Tool Use	☒ Heavy and Material Handling Equipment	☐ Ladder Safety
☐ **Other Task (specify)**	☐ **Other Task (specify)**	☒ **Other Task (specify)** **Traffic awareness/delineation**	☐ **Other Task (specify)**
☐ **Other Task (specify)**	☐ **Other Task (specify)**	☐ **Other Task (specify)**	☐ **Other Task (specify)**

Levels of Protection Required for each Task

Signature of the SSO on page 1 of this document signifies certification of PPE Hazard Assessment

Task Description	Level A	Level B	Level C	Level D
Supervision of well installations and borings.	☐	☐	☐	☒
Groundwater and soil sampling.	☐	☐	☐	☒
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐

Personal Protective Equipment	**Equipment**	**Req**	**Rec**	**NA**	**Equipment**	**Req**	**Rec**	**NA**
	Steel Toe Boots	☒	☐	☐	Tyvek Suit	☐	☐	☐
Req=Required	Safety Glasses Shields	☒	☐	☐	Outer Disposable Boots	☐	☐	☐
Rec=Recommended	Hi Vis Vest (Specify Class 2/3)	☒	☐	☐	Indirect Vented Goggles	☐	☐	☐
	Hi Vis Shirt	☐	☐	☐	Poly-Coated Tyvek	☐	☐	☐
An asterisk (*) indicates that employees must be a participant in the respiratory program, including, annual training and fit testing.	Hard Hat	☒	☐	☐	Dust Mask*	☐	☐	☐
	Fire Resistant Clothing (FRC)	☐	☐	☐	Full-Face Respirator*	☐	☐	☐
	Hearing Protection	☒	☐	☐	Half-Face Respirator*	☐	☒	☐
	Work Gloves – Type: Nitrile	☐	☒	☐	Inner Chemical Gloves	☐	☐	☐
	Outer Chemical Gloves	☒	☐	☐	Other (specify)	☐	☐	☐
Training and Medical Surveillance	**Training**	**Req**	**Rec**	**NA**	**Medical Surveillance**	**Req**	**Rec**	**NA**
	40 Hour HAZWOPER	☒	☐	☐	Medical Clearance (fit for duty)	☒	☐	☐
Req=Required	Current 8 Hour HAZWOPER	☒	☐	☐	Respirator Clearance	☒	☐	☐
Rec=Recommended	8 Hour HAZWOPER Supervisor	☐	☐	☐	Blood Lead and ZPP	☐	☐	☐
	24Hour HAZWOPER	☐	☐	☐	Other (specify)	☐	☐	☐
	Current CPR and First Aid	☒	☐	☐	Other (specify)	☐	☐	☐
	10 Hour Construction	☐	☐	☐	Other (specify)	☐	☐	☐
	Other (specify)	☐	☐	☐	Other (specify)	☐	☐	☐
	Other (specify)	☐	☐	☐	Other (specify)	☐	☐	☐
	Other (specify)	☐	☐	☐	Other (specify)	☐	☐	☐
Safety Supplies	**Supplies**	**Req**	**Rec**	**NA**	**Supplies**	**Req**	**Rec**	**NA**
Req=Required	First Aid Kit	☒	☐	☐	Fire Extinguisher	☒	☐	☐
Rec=Recommended	Eyewash Solution	☒	☐	☐	Water/Sports Drink	☐	☒	☐
	Air Horn	☐	☐	☐	Oral Thermometer (heat monitoring)	☐	☐	☐
	Noise Meter (Dosimeter)	☐	☐	☐	Decontamination Supplies	☒	☐	☐

Work Zones **If exclusion zones are necessary because of chemical OR equipment hazards, describe the plan**	Exclusion Zone: The work area should be surrounded by multiple traffic cones so that the work area is highly visible to traffic. Work areas will be designated with cones, lights, vehicles with amber flashing beacons, and the drilling subcontractor will adhere a flag to the drill rig mast if required by Airport operations. Additional exclusion zone requirements may be implemented based on correspondence with PDX Airport operations during portions of the field activities near or adjacent to runways or taxiways.
	Contamination Reduction Zone:
	Support Zone:

Site Access/Control **How do we limit unauthorized entry to the site itself?**	Access Control Procedures: Access to work areas will be coordinated with Airport management.
DECON Procedures	Decontamination Procedures: Follow Level D PPE decontamination procedures.

Communication Plan **In the event work must be completed alone by an Apex employee or work is performed in a rural area with limited communication, this Communication Plan must be completed.**	The purpose of the communication plan is to provide a "What to Do" if the project manager/supervisor cannot contact field personnel. The field team and PM must coordinate a call in time daily. The check-in intervals will depend on the project setting and hazards. More importantly, if the field team does not check in, what is the requirement or actions of the PM.			
	Daily Check in Time	Responsible Person	Daily Check In Time	Responsible person
	1400	Chris Weer		
	Plan of Action (in the event of no communication): If no communication, project manager or safety officer will attempt to call responsible person or other on-site field staff. If no one is reachable, a message will be left and a second contact attempt will be made in 10 minutes. If no communication is made after 30 minutes, then the facility manager will be contacted directly. Alternatively, a representative from the Apex office may be sent to the terminal directly to communicate with field staff. The terminal is approximately a 45 minute drive from the Apex office.			

Chemicals of Concern			
In the section to the right, check any chemicals present onsite in any media (air, soil water). In the table below, list chemicals suspected or confirmed to be onsite, and provide requested information.	☐ Friable Asbestos ☐ 3,3'-Dichlorobenzidine ☐ Benzidine ☐ beta-Propiolactone ☐ N-Nitrosomethylamine ☐ Lead ☒ Benzene ☐ Acrylonitrile ☐ Methylenedianiline ☒ Other:____PFAS_______	☐ alpha-Napthylamine ☐ bis-Chloromethyl ether ☐ 4-Aminodiphenyl ☐ 2-Acetylaminoflourene ☐ Vinyl chloride ☐ Chromium (VI) ☐ Coke oven emissions ☐ Ethylene oxide ☐ 1,3-Butadiene ☐ **No Apex exposure to these**	☐ Methyl chromoethyl ether ☐ beta-Napthylamine ☐ Ethyleneimine ☐ 4-Dimethylaminoazobenzene ☐ Inorganic arsenic ☐ Cadmium ☐ 1,2-Dibromo-3-chloropropane ☐ Formaldehyde ☐ Methylene chloride ☐ Sub Slab VOCs

Materials Present or Suspected at Site	Highest Reported Concentration (specify units and sample medium)	Exposure Limit (specify ppm or mg/m^3)	IDLH Level (specify ppm or mg/m^3)	Primary Hazards of the Material (explosive, flammable, corrosive, toxic, volatile, radioactive, biohazard, oxidizer, or other)	Symptoms and Effects of Acute Exposure	Ionization Potential (eV)
Petroleum Hydrocarbons		PEL = 500 REL = 350 TLV = Skin Hazard ☐	1,100ppm	Flammable	Fatigue, headache, nausea, dizziness. Exposure to high levels can lead to coma or death.	
Benzene		PEL = 1 ppm REL = 0.1 ppm TLV = Skin Hazard ☐	500 ppm	Flammable	Drowsiness, dizziness, rapid heart rate, headache, tremors, confusion, and unconsciousness. Exposure to very high levels can lead to death.	
PCB's		PEL = 0.5 mg/m3 REL = TLV = Skin Hazard ☐	5 mg/m3	Strong oxidizers	irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen	
Toluene		PEL = 200 ppm REL = 100 ppm TLV = Skin Hazard ☐	500 ppm	Flammable	Causes mild to moderate skin irritation. Inhalation or ingestion may cause nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness	

PEL = OSHA Permissible Exposure Limit
REL = NIOSH Recommended Exposure Limit
TLV = ACGIH Threshold Limit Value
IDLH = Immediately Dangerous to Life or Health

Monitoring Equipment: All monitoring equipment on site must be calibrated before and after each use and results recorded.				
Instrument (Check all required)	**Task**	**Instrument Reading**	**Action Guideline**	**Comments**
☐ Combustible gas indicator model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	0 to 10% LEL	Monitor; evacuate if confined space	
		10 to 25% LEL	Potential explosion hazard	
		>25% LEL	Explosion hazard; interrupt task; evacuate site	
☐ Oxygen meter model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	>23.5% Oxygen	Potential fire hazard; evacuate site	
		23.5 to 19.5% Oxygen	Oxygen level normal	
		<19.5% Oxygen	Oxygen deficiency; interrupt task; evacuate site	
☐ Radiation survey meter model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Normal background	Proceed	Annual exposure not to exceed 1,250 mrem per quarter Background reading must be taken in an area known to be free of radiation sources
		Two to three times background	Notify SSO	
		>Three times background	Radiological hazard; interrupt task; evacuate site	
☐ Photoionization detector model: ☐ 11.7 eV ☒ 10.6 eV ☐ 10.2 eV ☐ 9.8 eV ☐ _____ eV	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Any response above background to 5 ppm above background	Level D is acceptable	Action levels must be determined based on the COCs and concentrations identified in the media sampled. If no COC conentrations are known, then use 5 ppm sustained within the breathing zone as your action level until the contaminants are identified.
		ppm above background	Level C (not anticipated)	
		ppm above background	Discontinue work	
☐ Flame ionization detector model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Any response above background to ppm above background	Level C is acceptable Level B is recommended	Action levels must be determined based on the COCs and concentrations identified in the media sampled. If no COC conentrations are known, then use 5 ppm sustained within the breathing zone as your action level until the contaminants are identified.
		ppm above background	Level B	
		above background	Level A	
☐ Detector tube models:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Specify:	Specify:	The action level for upgrading the level of protection is one-half of the contaminant's PEL. If the PEL is reached, evacuate the site and notify a safety specialist.
☐ Other (specify):	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Specify:	Specify:	

Emergency Response Planning	
In the pre-work briefing and Daily Tailgate Safety meetings, all onsite employees will be trained in the provisions of emergency response planning, site communication systems, and site evacuation routes. **Signal a site emergency or medical emergency with three blasts of a loud horn (car horn, fog horn, or similar device).** **To complete this section, attach a hospital route map to the HASP.**	**All work-related incidents must be reported. For all medical emergencies, call 911 or the local emergency number. For non-emergency incidents, you must:** • Give appropriate first aid care to the injured or ill individual and secure the scene. • Immediately call WorkCare at (888) 449-7787 (available 24 hours/7 days per week) if the injured person is an Apex employee. • Notify the Project Manager and/or SSO after calling WorkCare. • Enter the safety incident into the Apex Incident Report and submit to incidents@apexcos.com within 24 hours. **In the event of an emergency that necessitates evacuation of the work task area or the site as a whole, the following procedures shall occur:** • The Apex site supervisor or Project Manager will contact all nearby personnel using the onsite communications system to advise of the emergency. • Personnel will proceed along site roads to a safe distance upwind from the hazard source to a pre-determined assembly area. • Call 911 • Personnel will remain in that area until the site supervisor or Project Manager or other authorized individual provides further instruction. **In the event of a severe spill or leak, site personnel will follow the procedures listed below:** • Evacuate the affected area and relocate personnel to an upwind, pre-determined assembly area. • Inform the Apex site supervisor or Project Manager, an Apex office, and a site representative immediately. • Locate the source of the spill or leak and stop the source if it is safe to do so until appropriately trained personnel are onsite to do so. • Begin containment and recovery of spilled or leaked materials. • Notify appropriate local, state, and federal agencies after obtaining client consent to do so. **In the event of severe weather, site personnel will follow the procedures listed below:** • Site work shall not be conducted during severe weather, including high winds and lightning. • In the event of severe weather, stop work, lower any equipment (drill rigs), and evacuate the affected area. • Monitor internet or other sources for sever weather alerts before resuming work. • In the event of lightning, outdoor work must be halted for a minimum of 30 minutes from the last lightning observation.

Emergency Contacts	Name	Location	Phone	Cell Phone
Hospital (attach map)	Salem Hospital	890 Oak St SE Bldg A, Salem	503-461-5200	
Police	911		911	
Fire	911		911	
Project Manager	Michael Stevens	Portland, OR	503-974-0425	319-360-4128
Field Manager (if not PM)	Chris Weer	Portland, OR	503-924-4704	971-806-1637
Site Safety Officer (if not PM)	Chris Weer		503-924-4704	
Division H&S Contact	Lauren Bellinger	Portland, OR	503-924-4704	
Corporate H&S Contact	Josh House	Rockville, MD	301-417-0200	
Incident Intervention	WorkCare	NA	888-449-7787	
Subcontractor Safety Contact				
Subcontractor Safety Contact				

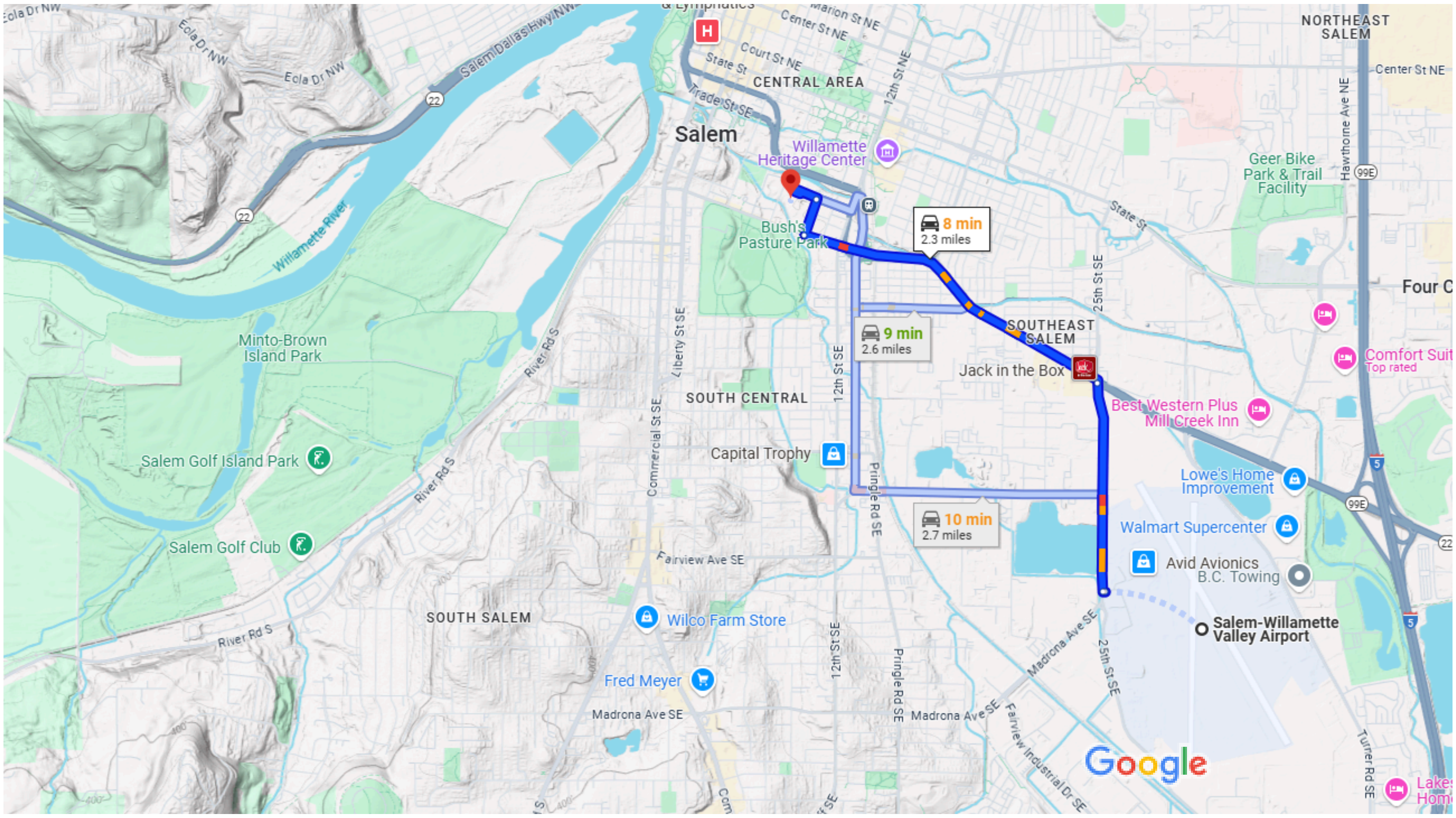
Acknowledgement	*I have read, understood, and agree with the information set forth in this Health & Safety Plan, and will follow guidance in the plan and in the Apex Corporate Health and Safety Manual. I understand the training and medical monitoring requirements for conducting activities covered by this HASP and have met these requirements.* *Apex has prepared this plan solely for the purpose of protecting the health and safety of Apex employees. Subcontractors, visitors, and others at the site are required to follow provisions in this document at a minimum, but must refer to their organization's health and safety program for their protection.*		
Printed Name	Signature	Organization	Date

Approval Signatures

Signatures in this section indicate the signing employee will comply with and enforce this HASP, as well as procedures and guidelines established in the Apex Corporate H&S Manual. Signatures in this section also indicate that any subcontractors performing work under contract to Apex agree to comply with this HASP.

Salem-Willamette Valley Airport, 2990 25th St SE, Salem, OR 97302 to Salem Hospital, 890 Oak St SE Bldg A, Salem, OR 97301

Drive 2.3 miles, 8 min



Map data ©2025 Google 2000 ft

🚗	via 25th St SE and Mission St SE Fastest route, despite the usual traffic	8 min 2.3 miles
🚗	via 25th St SE	9 min 2.6 miles
🚗	via McGilchrist St SE and 13th St SE Some traffic, as usual	10 min 2.7 miles

Explore nearby Salem Hospital

APEX

Groundwater Sampling
Job Safety Analysis (JSA)

Project Number:	**32-25007713**	Project/Client Name:	**City of Salem**
Project Manager:	**Michael Stevens**	Project Location:	**SLE**

Specific Task:	**Collect samples from monitoring wells**
Minimum Required PPE for Task:	☑ Hard Hat ☑ Safety Toed Boots ☑ Safety Glasses ☑ Hearing Protection ☐ Long Sleeved Shirt ☐ Fire Resistant Clothing ☐ Hi-Vis Shirt ☑ Hi-Vis Vests Class 2 ☐ Hi-Vis Vests Class 3 ☐ Coverall ☑ Gloves <type> ☐ Respirator <type and cartridge> ☐ Face Shield ☐ Other (specify): <enter additional PPE here>

Additional Task-Step Specific PPE: (as indicated below under controls)	**NA**	**Equipment/Tools Required:**	**Peristaltic pump, hand tools**
Training Required for this Task:	**HAZWOPER40**	**Permits Required for this Task: (e.g. confined space, LOTO)**	**NA**
Forms Associated with this Task:	**HASP, Daily Tailgate Meeting form, monitoring and gauging forms.**		

JSA Developed/Reviewed By:			**Date and Revision Number:**	6/19/2024
Employee Name/Job Title	Employee Name/Job Title	Employee Name/Job Title	H&S Team Leader to ensure all personnel performing this task have reviewed JSA and agree to follow it. Site specific changes to this JSA have been made as warranted based on this review. H&S Team Leader Signature/Date:	
Michael Stevens/Principal Engineer				

Task Steps	Potential Hazards and Consequences	Likelihood	Severity	Risk	Controls to Eliminated/Reduce Risks
1. Pre-Field Safety Meeting	N/A			**0**	All employees will attend a pre-field meeting which will include the pertinent SOPs, client-specific Job Safety Analysis, Permit(s) to Work (if required), Subsurface Investigation Procedures, potential hazards, and actual hazards present and controls for those hazards
2. Travelling to/from the Site	2a. Traffic accident - Injury	3	3	**9**	Follow posted speed limits and traffic signs. Stay alert to to other vehicles, cyclists, pedestrians and be a defensive driver by maintaining a safe distance with other vehicles on the road.
	2b. Improperly secured load - Accident or injury	2	3	**6**	Maintain good housekeeping to securely load vehicles and ensure that loose or light items that may shift during travel are secured. Use ratcheting straps, covers, etc to secure loads.
3. Loading and Unloading Equipment	3a. Moving equipment - back or muscle strain	2	3	**6**	Ensure proper lifing techniques. Do not attempt to bodily move large equipment. Use the buddy lift to move heavy objects.
	3b. Slip/trips/falls - Injury	2	3	**6**	Maintain good housekeeping. Inspect the area of tripping hazards. If grass or vegetation is tall, objects may be obscured. Ensure good footing in the work area. Sturdy work boot required
4. Calibration of equipment	Skin or eye contact with calibration chemicals	2	2	**4**	Wear disposable gloves and safety glasses, avoid direct contact with calibration solutions. Properly dispose of calibration solution waste.

APEX

Groundwater Sampling Job Safety Analysis (JSA)			
Project Number:	**32-25007713**	Project/Client Name:	**City of Salem**
Project Manager:	**Michael Stevens**	Project Location:	**SLE**

Specific Task:	**Collect samples from monitoring wells**

Task Steps	Potential Hazards and Consequences	Likelihood	Severity	Risk	Controls to Eliminated/Reduce Risks
5. Setup and installation of low-flow pump	5a. Potential hand injuries during pump setup.	2	2	4	Wear gloves when preparing pump and equipment for sampling
	5b. Traffic consideration - Injury	3	3	9	Some well are located adjacent to roadways in the right-of-way. Maintain a well delineated work area using cones, field vehicle, or other barricades to avoid hazards from vehicular traffic.
	5c. Slip/trips/falls - Injury	2	3	6	Maintain good housekeeping. Inspect the area of tripping hazards. If grass or vegetation is tall, objects may be obscured. Ensure good footing in the work area. Sturdy work boot required
	5d. Lifting or moving equipment - Injury	2	3	6	Ensure proper lifing techniques. Do not attempt to bodily move large equipment. Use the buddy lift to move heavy objects.
	5e. Unexpected release of pressure from compressor - Injury	2	2	4	Check compressor and air plines for damange to avoid unexpected pressure release. Maintain recommended pressure.
6. Sample Collection	6a. Contact with potentially contaminated groundwater - Exposure	2	2	4	Wear disposable goves and safety glasses when collecting samples to minimize contact with contaminated media.
	6b. Contact with acids from sample preservation.	2	2	4	Wear disposable gloves and safety glasses or goggles when handling acids. Quantites handled are generally very small, so large spills are unlikely. In the event of contact with acid, wash area thoroughly with fresh water.
	6c. Slip/trips/falls - Injury	2	3	6	Maintain good housekeeping. Inspect the area of tripping hazards. Sturdy work boot required. Maintain 3-points of contact when using stairways.
	6d. Sample mangement - Injury from damaged glassware	2	2	4	Inspect bottles before use. Wear gloves and use care when handling glass sampling containers to avoid hand lacerations.
	6e. Moving equipment or full sample coolers - Back or muscle injury.	2	3	6	Ensure proper lifing techniques. Do not attempt to bodily move large equipment. Use the buddy lift to move heavy coolers.
	6f. Cutting or Disconnecting sample tubing - Hand injury	2	3	6	Wear leather gloves (or similar) when using cutting tools to cut and/or disconnect tubing.
7. Cleanup and movement between sample locations.	7a. Visitor mishaps resulting in bodily harm.	3	3	9	Pay attention to visitors approaching work area. When necessary, setup traffic cones and/or other traffic barriers to keep vehicles and visitors out of the work area. Use caution tape if available

APEX

Groundwater Sampling
Job Safety Analysis (JSA)

Project Number:	**32-25007713**	Project/Client Name:	**City of Salem**
Project Manager:	**Michael Stevens**	Project Location:	**SLE**
Specific Task:	**Collect samples from monitoring wells**		

Task Steps	Potential Hazards and Consequences	Likelihood	Severity	Risk	Controls to Eliminated/Reduce Risks
	7b. Tripping over equipment as it is taken apart and laying on ground before being loaded.	3	2	6	All personnel should be constantly watching for trip hazards such as uneven terrain, holes, ditches, stretched wires or ropes, or any other materials or pieces of equipment in their path
	7c. Hurting back trying to lift heavy objects.	3	3	9	Use proper lifting techniques to avoid back strain. Get help if the object is too heavy by yourself.
8. Management of Investigation Derived Waste	8a. Slip/trips/falls - Injury	2	3	6	Maintain good housekeeping. Inspect the area of tripping hazards. Sturdy work boot required. Maintain 3-points of contact when using stairways.
	8b. Potential hand injuries while opening/closing accumulation drum	2	3	6	Wear leather (or similar) work gloves and hand tools when opening and closing the lids to accumulation storage drums to avoid pinching hand in the ring or cutting hand on the drum or lid..
	8c. Spill - Environmental impact	2	2	4	Have absorbant pads and/or rags available in the event of a spill. Wear gloves when handling pads or potentially contaminated material.
9. Site wide Activities	9a. Slip/trips/falls - Injury	2	3	6	Maintain good housekeeping. Inspect the area of tripping hazards. Sturdy work boot required. Maintain 3-points of contact when using stairways.
	9b. Traffic considerations - Injury	2	3	6	Some wells are located in active traffic areas for terminal operation. Maintain a well delineated work area using cones, field vehicle, or other barricades to avoid hazards from vehicular traffic.

			Hazard Severity				
			1	2	3	4	5
			INSIGNIFICANT negligible or no injury could result	**MINOR** minor injury requiring only first aid	**MODERATE** injury resulting in lost time could occure	**HIGH** serious injury or death could occur	**VERY HIGH** multiple deaths could occur
Likelihood	1	VERY UNLIKELY	1	2	3	4	5
	2	UNLIKELY	2	4	6	8	10
	3	POSSIBLE	3	6	9	12	15
	4	LIKELY	4	8	12	16	20
	5	VERY LIKELY	5	10	15	20	25

APEX

Drill Rig Well Installation
Job Safety Analysis (JSA)

Project Number:	32-25007713	Project/Client Name:	City of Salem
Project Manager:	Michael Stevens	Project Location:	SLE

Specific Task:	Oversee Soil Borings and Well Intallation
Minimum Required PPE for Task:	☑ Hard Hat ☑ Safety Toed Boots ☑ Safety Glasses ☑ Hearing Protection ☐ Long Sleeved Shirt ☐ Fire Resistant Clothing ☐ Hi-Vis Shirt ☑ Hi-Vis Vests Class 2 ☐ Hi-Vis Vests Class 3 ☐ Coverall ☑ Gloves Nitril ☐ Respirator ☐ Face Shield ☐ Other (specify):

Additional Task-Step Specific PPE: (as indicated below under controls)	NA	**Equipment/Tools Required:**	Oversight of drill rig
Training Required for this Task:	HAZWOPER40	**Permits Required for this Task: (e.g. confined space, LOTO)**	
Forms Associated with this Task:	HASP, Daily Tailgate Meeting form, field logs		

JSA Developed/Reviewed By:			**Date and Revision Number:** 4/15/2023
Employee Name/Job Title	Employee Name/Job Title	Employee Name/Job Title	H&S Team Leader to ensure all personnel performing this task have reviewed JSA and agree to follow it. Site specific changes to this JSA have been made as warranted based on this review. H&S Team Leader Signature/Date:
Michael Stevens/Principal Engineer			

Task Steps	Potential Hazards and Consequences	Likelihood	Severity	Risk	Controls to Eliminated/Reduce Risks
1. Pre-Field Safety Meeting	N/A			0	All employees will attend a pre-field meeting which will include the pertinent SOPs, client-specific Job Safety Analysis, Permit(s) to Work (if required), Subsurface Investigation Procedures, potential hazards, and actual hazards present and controls for those hazards
2. Site Setup and Mobilization	2a. Striking underground lines or objects with drill.	3	2	6	The one-call notification system should be called 2 days before commencing any drilling activities. Observe surrounding before starting to drill. Private Locate onsite before drilling to begin.
	2b. Vehicle traffic - striking/hitting workers	3	3	9	Setup traffic safety perimeter with traffic cones to delineate work area - use caution tape if available. Keep a watchful eye on traffic when moving outside of delineated work area. Wear high visiblity PPE.
3. Drilling Activities	3a. Noise related injuries.	3	2	6	Wear approved safety ear plugs when working in the vicinity of the drill rig.

APEX

Drill Rig Well Installation Job Safety Analysis (JSA)					
Project Number:	32-25007713	Project/Client Name:	City of Salem		
Project Manager:	Michael Stevens	Project Location:	SLE		
Specific Task:	Oversee Soil Borings and Well Intallation				
3. Drilling Actitivities (continued)	3b. Physical injuries from moving parts of machinery.	3	3	**9**	Avoid moving parts in the machinery. Keep fingers, hands, and arms away from the rotating drill head near the top or near the bottom. Keep fingers away from pinch points when screwing pipe joints together. Wear leather gloves when handling objects and wear hard hat and steel-toed boots at all times.
	3c. Exposure to contaminated media	3	2	**6**	Monitor the air space of each drill location before, during, and after drilling with a photoionization detector for VOCs and follow the site-specific Health and Safety Plan
	3d. Physical hazards to personnel in the vincinity of machinery.	3	3	**9**	Personnel should keep away from the drill unless they are required for the task. Drillers should beaware of people in area. Do not approach driller without first establishing eye contact with the operator.
	3e. Physical injury from drill.	3	3	**9**	Stand clear as drill is moving. Wear gloves and hard hat.
	3f. Oxygen depletion from indoor use of equipment	3	3	**9**	Drilling company will use engineering controls (vent to outdoors) to mitigate. Apex will monitor CO with meter. OSHA PEL is 50 ppm, our action level will be 20 ppm based on literature information that suggest manual dexterity is affected at 35 ppm.
	3g. Injury during moving of drill	3	2	**6**	Be aware of water and equipment on the ground when moving.
4. Cleanup and movement of the drill locations.	4a. Visitor mishaps resulting in bodily harm.	3	3	**9**	Pay attention to visitors approaching work area. When necessary, setup traffic cones and/or other traffic barriers to keep vehicles and visitors out of the work area. Use caution tape if available
	4b. Striking overhead lines or objects with drill.	3	2	**6**	Observe for overhead lines or other objects during movement of drill rig.
	4c. Tripping over equipment as it is taken apart and laying on ground before being loaded.	3	2	**6**	All personnel should be constantly watching for trip hazards such as uneven terrain, holes, ditches, stretched wires or ropes, or any other materials or pieces of equipment in their path
	4d. Hurting back trying to lift heavy objects.	3	3	**9**	Use proper lifting techniques to avoid back strain. Get help if the object is too heavy by yourself.

			Hazard Severity				
			1	2	3	4	5
			INSIGNIFICANT negligible or no injury could result	**MINOR** minor injury requiring only first aid	**MODERATE** injury resulting in lost time could occure	**HIGH** serious injury or death could occur	**VERY HIGH** multiple deaths could occur
Likelihood	1	VERY UNLIKELY	1	2	3	4	5
	2	UNLIKELY	2	4	6	8	10
	3	POSSIBLE	3	6	9	12	15
	4	LIKELY	4	8	12	16	20
	5	VERY LIKELY	5	10	15	20	25

APEX

Airside Construction
Job Safety Analysis (JSA)

Project Number:	**32-25007713**	Project/Client Name:	**City of Salem**
Project Manager:	**Michael Stevens**	Project Location:	**SLE**

Specific Task:	**Arrival at airport and travel and setup for drilling.**
Minimum Required PPE for Task:	☑ Hard Hat ☑ Hearing Protection ☐ Hi-Vis Shirt ☐ Coverall ☐ Face Shield ☐ Other (specify): ☑ Safety Toed Boots ☐ Long Sleeved Shirt ☑ Hi-Vis Vests Class 2 ☑ Gloves <type> <enter additional PPE here> ☑ Safety Glasses ☐ Fire Resistant Clothing ☐ Hi-Vis Vests Class 3 ☑ Respirator <type and cartridge>

Additional Task-Step Specific PPE: (as indicated below under controls)	**NA**	**Equipment/Tools Required:**	**Drill rig**
Training Required for this Task:	**HAZWOPER40, Port security badge**	**Permits Required for this Task: (e.g. confined space, LOTO)**	**NA**
Forms Associated with this Task:	**HASP, Daily Tailgate Meeting form, field log, lithologic log, and sampling sheets**		

JSA Developed/Reviewed By:			**Date and Revision Number:**	6/19/2024
Employee Name/Job Title	Employee Name/Job Title	Employee Name/Job Title	H&S Team Leader to ensure all personnel performing this task have reviewed JSA and agree to follow it. Site specific changes to this JSA have been made as warranted based on this review. H&S Team Leader Signature/Date:	
Michael Stevens/Principal Engineer				

Task Steps	Potential Hazards and Consequences	Likelihood	Severity	Risk	Controls to Eliminated/Reduce Risks
1. Pre-Field Safety Meeting	N/A				All employees will attend a pre-field meeting which will include the pertinent SOPs, client-specific Job Safety Analysis, Permit(s) to Work (if required), Subsurface Investigation Procedures, potential hazards, and actual hazards present and controls for those hazards.
2. Arrival at airport	Dangerous to travel to site, planes or other heavy traffic.	1	4	**4**	Coordinate with airport operations prior to travel to sample locations.
3. Travel to work area.	Plane traffic and other vehicle traffic in the area.	1	4	**4**	Use route that has been determined as safest, stay on roadway and use flashers on vehicle when on airfield. Obey posted speed limits. Make sure drill crew is escorted to site. Follow airport rules.
4. Set up work area	4a. Not being visible to planes and other vehicles .	2	4	**8**	Use cones and signage to deliniate the work area and that operations knows where you are going to be located.

APEX

Airside Construction Job Safety Analysis (JSA)					
Project Number:	**32-25007713**	Project/Client Name:		**City of Salem**	
Project Manager:	**Michael Stevens**	Project Location:		**SLE**	
Specific Task:	**Arrival at airport and travel and setup for drilling.**				
Task Steps	**Potential Hazards and Consequences**	**Likelihood**	**Severity**	**Risk**	**Controls to Eliminated/Reduce Risks**
	4b. Drill mast not being visible to low flying aircraft.	2	4	**8**	Secure all material inside of vehicles, be aware of FOD (Foreign Object Debris). Practice good houskeeping.
5. Perform work at site	Material not secured and blowing around could get sucked into aircraft engines.	1	4	**4**	Secure all material inside of vehicles, be aware of FOD (Foreign Object Debris). Practice good houskeeping.
6. Clean up site	6a. Material left behind and blowing onto runway. Debris on tires.	1	4	**4**	Check work area to make sure nothing is left behind. Check tires for FOD. Use GOAL (Get out and look). Practice good housekeeping.
7. Travel from work area.	Plane traffic and other vehicle traffic in the area.	1	4		Use route that has been determined as safest, stay on roadway and use flashers on vehicle when on airfield. Obey posted speed limits. Make sure drill crew is escorted from site. Follow airport rules.
8. Departure from work area	N/A				Call airport operations to inform of departure of airfield.

			Hazard Severity				
			1	2	3	4	5
			INSIGNIFICANT negligible or no injury could result	**MINOR** minor injury requiring only first aid	**MODERATE** injury resulting in lost time could occure	**HIGH** serious injury or death could occur	**VERY HIGH** multiple deaths could occur
Likelihood	1	VERY UNLIKELY	1	2	3	4	5
	2	UNLIKELY	2	4	6	8	10
	3	POSSIBLE	3	6	9	12	15
	4	LIKELY	4	8	12	16	20
	5	VERY LIKELY	5	10	15	20	25