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RCRA Facility Investigation/Remedial Investigation Work Plan Addendum for the D-Area Groundwater Operable Unit (D-Area Upgradient Sources) (U)

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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LIST OF ABBREVIATIONS AND ACRONYMNS

AFFF	aqueous film-forming foam
ARAR	applicable or relevant and appropriate requirement
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CM	contaminant migration
CMS	Corrective Measures Study
Core Team	USEPA, SCDHEC, and USDOE
CPRB	Coal Pile Runoff Basin
CSM	conceptual site model
D&D	deactivation and decommissioning
DAB	488-D Ash Basin
DAG	D-Area Groundwater
DAOU	D-Area Operable Unit
DEXOU	D-Area Expanded Operable Unit
DHWF	D-Area Heavy Water Facility
DHWRF	D-Area Heavy Water Rework Facility
DQO	Data Quality Objective
DRP	D-Area Rubble Pit
EAROD	Early Action Record of Decision
ft	feet
FS	Feasibility Study
FFA	Federal Facility Agreement
IOU	Integrator Operable Unit
L	liter
LLC	Limited Liability Company
LUC	Land Use Controls
µg/L	microgram per liter
µg/kg	microgram per kilogram
MCL	maximum contaminant levels
mg/kg	milligram per kilogram
MNA	Monitored Natural Attenuation
ng/g	nanogram per gram
ng/L	nanogram per liter
NTCR	non-time critical removal
OU	Operable Unit
PCE	tetrachloroethylene
pCi/mL	picocuries per milliliter
PFAS	polyfluoroalkyl substances
QA/QC	Quality Assurance/Quality Control
RAO	remedial action objective

LIST OF ABBREVIATIONS AND ACRONYMS *(Continued/End)*

RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Levels
SAP	Sample Analysis Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SRFS	Savannah River Floodplain Swamp
SRNS	Savannah River Site Nuclear Solutions, LLC
SRS	Savannah River Site
TBC	to be considered
TCE	trichloroethylene
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
UTRA	Upper Three Runs Aquifer
VOC	volatile organic compound
WP	Work Plan
WSRC	Washington Savannah River Company, LLC

1.0 INTRODUCTION

This Resource Conservation and Recovery Act (RCRA) Facility Investigation / Remedial Investigation (RFI/RI) Work Plan (WP) Addendum has been prepared for the D-Area Groundwater (DAG) Operable Unit (OU) at the Savannah River Site (SRS) and is supplemental to the Revision 1 RFI/RI WP for the DAG OU (D-Area Upgradient Sources) approved by the regulatory agencies in May 2022 (SRNS 2022). The DAG OU is subject to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Data from the 2022 RFI/RI WP and this WP Addendum supports the development of the RFI/RI/Baseline Risk Assessment due for submittal in December 2026.

Groundwater in D Area has been monitored since 2004 per the *Monitoring Work Plan for the DAG OU* (WSRC 2004a). Groundwater monitoring reports or data summary letters have been submitted annually to the South Carolina Department of Health and Environmental Control (SCDHEC) and U.S. Environmental Protection Agency (USEPA) documenting the monitoring results. Monitoring well data collected for DAG OU indicate that the groundwater is contaminated with tritium, volatile organic compounds (VOCs) (primarily trichloroethylene [TCE]), metals, and per- and polyfluoroalkyl substances (PFAS).

During the DAG OU Post-Characterization scoping meeting on November 30, 2023, the Core Team (i.e., representatives from the SCDHEC, USEPA, and the U.S. Department of Energy [USDOE]) discussed uncertainties associated with a contaminant migration (CM) risk to groundwater from PFAS contamination. The Core Team agreed further sampling was warranted in suspected PFAS source area locations in D Area to manage these uncertainties. A webcast meeting was held on February 20, 2024 where SRS proposed concrete and soil sampling for PFAS constituents in two suspected PFAS source areas, the 411-1D Fire-Fighting Training Area (FFTA) and the former 715-D Gasoline Station.

This WP Addendum presents the characterization investigation designed to determine the nature and vertical extent of PFAS contamination in concrete and vadose zone and Upper Three Runs Aquifer (UTRA) soils. This WP Addendum also includes the plan for confirmation soil sampling for vadose zone soils associated with the D-Area Operable Unit (DAOU) Bubble Tower Subunit soil vapor extraction (SVE) unit to determine if cleanup levels for tetrachloroethylene (PCE) have been met. In addition, a new UTRA well for monitoring of metals, sulfate, and VOCs will be installed in the lower UTRA in the 484-17D D-Area Coal Storage Area (DCSA) to help further evaluate the D-Area Treatability Study and any long-term effects from the DCSA removal action (i.e., lime amendment) (SRNS 2019a). The Sampling and Analysis Plan (SAP) to support the additional data collection is included in this RFI/RI WP Addendum.

1.1 RI Work Plan Addendum Organization

This RFI/RI WP Addendum is focused on the information pertinent to the proposed sampling in this addendum. Previous DAG OU characterization associated with the 2022 RFI/RI WP, D Area historical information, previous investigations, and unit characteristics can be found in the 2022 RFI/RI WP (SRNS 2022).

This RFI/RI WP Addendum is organized into eleven sections. Section 1, Introduction, outlines the regulatory framework, provides a description and history of D Area associated with the PFAS source areas, VOC soil contamination, and a brief groundwater contamination and monitoring summary. Section 2, Preliminary Unit Evaluation, is a description of the specific DAG OU previous investigations, the unit evaluation conclusions, and potential applicable or relevant and appropriate requirements (ARARs) and "to be considered" (TBC) criteria. Section 3, Unit Assessment, outlines the proposed environmental sampling at the DAG OU and path forward for this unit. Section 4, Data Quality Objectives (DQOs), describes the DQOs, identifies possible receptors, and presents the conceptual site model (CSM).

The SAP for additional data collection is incorporated into Sections 5.0 through 7.0 of this RFI/RI WP rather than submitted as a separate SAP report. Section 5.0 describes the design and rational of the unit characterization work proposed in this WP Addendum for fiscal year 2024. Section 6.0 provides the analytical plan and data quality levels for each type of data collected. Section 7.0 describes the field collection procedures and data management for the planned samples.

The project health and safety plan is addressed in Section 8, Safety, Health, and Emergency Response Plan. Section 9.0 presents the Quality Assurance/Quality Control (QA/QC) Plan. Section 10 includes the proposed schedule for key deliverables and submittal dates. Section 11, References, is a list of references used to prepare this document.

1.2 Regulatory Background

During the DAG OU Post-Characterization scoping meeting on November 30, 2023, and the February 20, 2024 DAG OU Work Plan Addendum webcast meeting, the Core Team agreed that submittal of the RFI/RI/BRA report and subsequent documents would be extended approximately 2 years to December 2026 to allow for the collection of additional characterization samples from 1) the concrete, vadose zone, and UTRA soils at the suspected PFAS source areas, 2) VOC vadose zone soil samples at the DAOU SVE unit, and 3) groundwater samples in the lower portion of the UTRA at the 484-17D DCSA and inclusion of the results in the DAG OU RFI/RI/BRA report. SRS requested the schedule extension by letter to USEPA and SCDHEC, and the approved schedule was approved by the regulatory agencies on March 4, 2024. The revised schedule is provided in Section 10.

Detailed information associated with the regulatory background history at the DAOU and DAG OU can be found in the original DAG OU RFI/RI Work Plan submitted in April 2022 (SRNS 2022). The three subsections below provide the regulatory background associated with the sampling efforts proposed in this WP Addendum.

1.2.1 DAG OU PFAS Source Areas

Two areas within D Area, the 411-1D FFTA and the former 715-D Gasoline Station, are known to have used aqueous film-forming foam (AFFF) that contained PFAS in fire extinguishing activities. The 411-1D FFTA was constructed in D Area in the 1980s between the first two rows of deuterium (heavy water) refining bubble towers after the towers were deactivated and decommissioned (D&D). AFFF was used in multiple fire extinguishing fire pits at the 411-1D FFTA between the 1980s into the late 1990s (Figure 1). Additionally, a fuel fire was extinguished using AFFF in the immediate vicinity of the former 715-D Gasoline Station in D Area (Figure 2). The historical use of AFFF in these two areas is likely the source of PFAS contamination in groundwater (Figure 3).

1.2.2 D-Area Bubble Tower Subunit SVE Unit

In 2007, vadose zone soil samples were collected throughout the D-Area Bubble Tower Subunit in association with the DAOU characterization efforts (SRNS 2009). Based on the contaminant fate and transport evaluation, PCE was identified as a contaminant migration refined constituent of concern (CM RCOC) exceeding the CM threshold of 20 micrograms/kilograms (µg/kg) in soil (SRNS 2011). The remedial action objective (RAO) is to prevent migration of PCE from vadose zone soil to groundwater at concentrations exceeding the maximum contaminant level (MCL).

MicroBlower™-equipped SVE wells were installed at eleven locations associated with the D-Area Bubble Tower Subunit (Figure 4). The SVE system is located within the areal extent of the vadose zone contaminated with PCE. Construction was completed on November 8, 2010 with operation of the SVE system beginning November 9, 2010. Periodic monitoring reports of the SVE system are provided in the 5-year remedy review reports with the last remedy review report submitted in June 2023 (SRNS 2023b).

1.2.3 D-Area Groundwater Contamination and Monitoring

The groundwater in D Area has been contaminated with tritium, VOCs (primarily TCE), metals, and PFAS from surface and/or facility sources associated with the DAOU and the D-Area Expanded Operable Unit (DEXOU). The DAOU is comprised of multiple waste units and facilities associated with the former operation of the 484-D Powerhouse and the production and rework of heavy water moderator for reactor operations. Most of the sources of groundwater contamination associated with the DAOU have been addressed under remedial and/or removal actions. A final Record of Decision (ROD) for DEXOU was issued in 2004 (WSRC 2004b), an Early Action (EA) ROD for DAOU was issued in 2011 (SRNS 2011), and a Second EA ROD for DAOU was issued in 2020 (SRNS 2020). The final action ROD for completion of the DAOU is scheduled in the Federal Facility Agreement (FFA) (FFA 1993) for issuance in January 2046 pending remedial decisions for the remaining DAOU subunits and completion of D&D of facilities in D Area.

In March 2002, the Core Team created the DAG OU to monitor groundwater quality until the operational facilities in D Area become inactive and a final remedial decision is reached for the DAG OU. Groundwater in D Area has been monitored since 2004 with annual and semiannual monitoring of wells and surface water stations per the *Monitoring Work Plan for the DAG OU* (WSRC 2004a). Groundwater monitoring reports or data summary letters have been submitted annually to SCDHEC and USEPA to document the monitoring results. The latest monitoring report was submitted in March 2023 (SRNS 2023a). Additional descriptions of the sources of groundwater contamination can be found in Section 1.2, *Summary of Unit Description*, of the 2022 RFI/RI WP (SRNS 2022).

A treatability study is ongoing to inject potable water into the UTRA upgradient of a low-pH, metals plume to displace the low-pH groundwater and raise the pH in the aquifer to more normal, less acidic conditions. The DAG OU Treatability Study monitors groundwater water elevations, field parameters, and metal concentrations to evaluate the impact of continuous groundwater injections and surface water conditions within the D-Area Effluent Discharge Canal. Details associated with the DAG OU Treatability Study can be found in the latest Data Report from January 2023 (SRNS 2023c). The next DAG OU Treatability Study Data Report will be submitted by April 30, 2024 summarizing 2023 data and activities.

A non-time critical removal (NTCR) action was conducted in 2020 to reduce acidity (raise the pH) of the vadose zone soils by mixing in lime amendment from 0-4 feet (ft) below ground surface (bgs) to help reduce future leaching of metals from the vadose zone to groundwater.

2.0 PRELIMINARY UNIT EVALUATION

This section describes the preliminary unit evaluation of the RFI/RI WP Addendum for the DAG OU and presents the results of a unit reconnaissance and groundwater well monitoring and sampling data. Detailed unit characteristics for all of DAG OU can be found in Section 2.1, *Unit Characteristics*, of the 2022 RFI/RI WP (SRNS 2022). This section of the WP Addendum focuses on the specific information directly associated with the proposed characterization efforts.

2.1 Existing/Previous Investigations

In 2002, a flow and transport groundwater model was developed to support the DEXOU, provide a baseline for D Area groundwater understanding, and to evaluate the nature and extent of existing groundwater plumes in the event of no remedial action (associated with low pH and metals). The model was also used to support the development of the *Monitoring Work Plan for the DAG OU (U)* (WSRC 2004a) which prescribed annual and semiannual monitoring of wells and surface water stations.

2.2 Unit Evaluation Conclusions

2.2.1 DAG OU PFAS Source Areas

With the known use of AFFF in the 411-1D FFTA and at the 715-D Gasoline Station, it was suspected that the emerging PFAS contaminant group may be present in groundwater in D Area. Environmental sampling that has occurred on an annual basis since 2020 has indicated that the groundwater and surface water downgradient of these AFFF usage areas has been contaminated with PFAS compounds. In 2022, the PFAS groundwater plume extended from the source areas downgradient to the west/southwest towards the Savannah River Floodplain and Swamp wetland area and encompassed an area of approximately 111 hectares (275 acres) (Figure 3). The highest groundwater concentration in 2022 was for PFAS contaminant perfluorononanoic acid (PFNA) at a concentration of 1,980 nanograms/liter (ng/L) at well DCB 62. Further details of the groundwater and surface water results were presented in the 2023 Monitoring Report for the DAG OU that was submitted in March 2023 (SRNS 2023a).

In June 2022, vadose zone and saturated UTRA aquifer soil samples were collected at boring locations downgradient and side gradient of the known source areas (Figures 5 and 6). These soil results were presented in Appendix G of the 2023 Monitoring Report for the DAG OU (SRNS 2023a). The maximum soil PFAS result was at boring DBR-02 in the 1 foot (ft) sample with a PFNA concentration of 3.39 ng/gram (ng/g). However, this location is not directly within, beneath, or immediately adjacent to the fire pits where the highest PFAS contamination may be present based on process knowledge. Because it is currently unknown whether the concrete and soils at or near the fire pits and former 715-D Gasoline Station pose a CM risk to groundwater, additional sampling is warranted and proposed in the RFI/RI Addendum.

2.2.2 D-Area Bubble Tower Subunit SVE Unit

SVE operations at the D-Area Bubble Tower Subunit have been ongoing since 2010 to remediate PCE contamination in the vadose zone soils to levels below the CM threshold limit of 20 μg/kg. Calculations based on the SVE flow rates, run times, and contaminant concentrations have determined that approximately 9.7 kgs (21.4 lbs) of PCE have been removed from the soils at the Bubble Tower Subunit over the period of 2010 through 2021 (Figure 7). Additionally, 0.8 kgs (1.8 lbs) of TCE has been removed (Figure 8). The wells were sampled semiannually and include the measurement of air flow.

As shown in the contaminant tables (Figures 7 and 8), the majority of the VOC contamination was removed during 2010, 2011, and 2012. Afterward, contaminant removal has greatly diminished or ceased. The average PCE concentration for the eleven SVE wells during 2011 was 4.13 parts per million by volume (ppmv) and the average during 2021 was 0.0185 ppmv, showing over a 200-times decrease in PCE concentrations.

The average TCE concentration for the eleven SVE wells during 2011 was 0.29 ppmv, and the average during 2021 was 0.0037 ppmv, showing a near 78-times decrease in TCE concentrations. Figure 9 displays the cumulative mass removal of PCE and TCE from 2010 through 2021 and demonstrates how the majority of the contaminants were removed in the first few years of operation.

Two groundwater wells, DCB 62 and DCB 63, are located within or near the DAOU SVE unit (Figure 4). Well DCB 63 is screened across the upper water table with a screen zone of 8-21.3 ft bgs. Well DCB 62 is screened deeper within the aquifer at 30-40 ft bgs. PCE and TCE groundwater concentrations at these wells do not show any increases in contaminant concentrations and concentrations have decreased from 2001 to 2021 (Figure 10). Groundwater concentrations beneath the DAOU SVE unit have remained below the PCE MCL of 5 µg/L.

Due to the diminishing vapor extraction concentrations at DAOU, SRS recommended in the 6th Five-Year Remedy Review Report (SRNS 2023b) to convert the active MicroBlower™ SVE system to passive BaroBall™ SVE system and collect confirmation soil samples to determine whether the PCE CM cleanup goal of 20 µg/kg has been achieved. This RFI/RI Addendum includes the sampling plan for the VOC vadose zone soil for confirmation that the PCE CM threshold limits have been met at the D-Area Bubble Tower Subunit.

2.2.3 DAG OU Groundwater Monitoring

The groundwater in D Area has been contaminated with tritium, VOCs (primarily TCE), metals, and PFAS. Additional descriptions of the DAG OU groundwater contamination can be found in Section 2.3, Unit Evaluation Conclusions, of the 2022 RFI/RI WP (SRNS 2022) as well as the most recent March 2023 DAG OU Groundwater Monitoring Report (SRNS 2023a).

Groundwater and surface water monitoring for DAG OU has been ongoing for the last 20 years in accordance with the Monitoring Work Plan for the DAG OU (WSRC 2004a).

Optimization of the DAG OU monitoring network, with Core Team approval, has occurred over the past two decades to add or remove groundwater or surface water monitoring stations, modify contaminants required for sampling, change sampling frequencies, etc.

Groundwater monitoring is also being conducted as part of the DAG OU Treatability Study to reduce the acidic conditions in groundwater (SRNS 2019b). A subset of the DAG OU groundwater wells and surface water stations are visited and/or sampled more frequently for water elevations, field measurements (including pH), and metals analytical sampling. The most recent DAG OU Treatability Study Report was submitted in January 2023 (SRNS 2023c). The next DAG OU Treatability Study Data Report will be submitted by April 30, 2024, summarizing 2023 data results and activities. Additionally, groundwater monitoring within and downgradient of the 484-17D DCSA where a NTCR action was conducted in the vadose zone to reduce acidity in the 0-4 ft soils can be used to evaluate the efficacy of the removal action over time.

This addendum proposes the installation of a new groundwater monitoring well (DCB087C) at the 484-17D DCSA and collocated with existing wells DCB087A and DCB087D. Well DCB087C, screened in the lower UTRA, will help further evaluate the effects of the D-Area Treatability Study and any long-term effects from the Coal Storage Area removal action (i.e., lime amendment). The new well will be added to the DAG OU monitoring network and include annual analysis for metals, sulfate, VOC, and PFAS analysis. Tritium will also be sampled for at DCB087C at least twice; however, it is not expected to be detected so it is not included for ongoing monitoring.

2.3 Operable Unit Strategy

The DAG OU groundwater investigation is based on collecting and evaluating historical and real-time analytical data. A characterization effort is being planned per this RFI/RI WP Addendum and SAP for the following: (1) collect samples in concrete, vadose zone, and UTRA soils to determine the nature and vertical extent of PFAS contamination from the 411-1D FFTA and 418-D Gasoline Station; (2) conduct confirmation soil sampling for vadose zone soils associated with the DAOU Bubble Tower Subunit SVE unit to determine if cleanup levels for PCE have been met; and (3) install a new UTRA well for monitoring of metals, sulfate, VOCs, and PFAS in the lower UTRA in the 484-17D DCSA to help further evaluate the D-Area Treatability Study and any long-term effects from the DCSA removal action.

Table 1 identifies the new sampling locations and constituents to be analyzed for. Figures 11, 12, and 13 display the locations of the borings and new monitoring well. Results from this addendum sampling effort will be incorporated into the DAG OU RFI/RI/BRA currently scheduled for submittal to the USEPA and SCDHEC in December 2026.

The RFI/RI/BRA will evaluate and document the results of the groundwater investigation and identify the groundwater RAOs and cleanup levels. MCLs, or regional screening levels (RSLs) in the absence of MCLs, will be used as a point of comparison for defining the problem(s) warranting action and the scope of the problem(s). An updated baseline groundwater flow and contaminant fate and transport model will be developed in conjunction with the RFI/RI/BRA. The Corrective Measures Study/Feasibility Study (CMS/FS) to evaluate remedial alternatives for groundwater will be developed and submitted in March 2028.

2.4 Potential ARARs and TBC Criteria

A preliminary list of potential ARARs and TBC criteria for the DAG OU is presented in Table 2. Development of ARARs and TBC criteria is an iterative process performed throughout the assessment and corrective action of the DAG OU. This list of potential ARARs is expected to be modified and refined as more data are collected. ARARs may be location-, chemical-, or action-specific.

Because groundwater monitoring data indicate that groundwater in the DAG OU is contaminated, the USEPA Primary Drinking Water Standards of the Safe Drinking Water Act and South Carolina Drinking Regulations are potential ARARs. The Atomic Energy Act is likely to be applicable since radioactive material are thought to be associated with disposal activities at DAG OU. Certain other requirements may be applicable depending on specific remedial actions implemented at the unit. RCRA and South Carolina Hazardous Waste Management Regulations may be considered ARARs if waste material is removed from the unit. If groundwater extraction wells or monitoring wells are required for remedial action, then the South Carolina Well Standards would be considered an action-specific ARAR.

Certain potential ARARs can be identified as inappropriate based on existing information available about DAG OU. No critical habitats for endangered species are associated with groundwater; therefore, the Endangered Species Act is not applicable. No archeological or historic sites are located at or near the DAG OU; therefore, the National Archeological and Historic Preservation Act is not included as an ARAR.

2.5 Potential Corrective Measures Study/Feasibility Study Options

2.5.1 Standard Remedial Technologies

Historical groundwater data indicate that groundwater may require remediation. Likely response actions are identified early in the life cycle of the project to ensure that the planning for data collection will support the response action alternative selection process. The likely response actions for the DAG OU identified in the RFI/RI WP (SRNS 2022) for evaluation in the CMS/FS include Monitored Natural Attenuation (MNA) with Land Use Controls (LUCs), groundwater monitoring and LUCs (for metals), pH adjustment (for metals), targeted bioremediation (for VOCs), phytoremediation (for tritium), and carbon treatment, resin encapsulation, or other emerging remediation technologies for PFAS, as appropriate.

2.5.2 Innovative Remedial Technologies

Although standard remedial technologies and process options should provide appropriate protection to human health and the environment, innovative technologies will be considered and evaluated for the DAG OU in the CMS/FS stage of development.

2.6 Potential Early and/or Interim Remedial Actions

Characterization data will be evaluated with the USDOE, USEPA, and SCDHEC to cooperatively develop the best strategy for implementing early actions at the DAG OU, if warranted. A modeling task will be developed to implement a flow and transport model that will assist in assessing the feasibility and effectiveness of early, interim, or final actions.

3.0 UNIT ASSESSMENT

The unit assessment for the DAG OU makes use of existing datasets developed from historical data and groundwater monitoring. These data have been used to identify remaining data needs, streamline characterization efforts, eliminate unnecessary sampling, and provide sufficient data to make decisions at various points in the environmental assessment process. The data will be used to support fate and transport analysis, support a comparison of groundwater concentrations to ARARs, MCLs or RSLs (as appropriate) to satisfy the CERCLA requirements and identify problems warranting response action, and evaluate RAOs for the DAG OU. The process to qualify the risk to human health and ecological receptors in the Savannah River and other surface water features in D Area is being addressed by the Savannah River Floodplain Swamp (SRFS) Integrator Operable Unit (IOU).

3.1 Objectives

This section presents the unit characterization objectives as they address the conceptual site model (CSM) and meet the DQO process needs. The following data needs were identified as an outcome of reviews conducted on the DAG OU characterization and monitoring datasets for this RFI/RI WP Addendum:

- Collect PFAS source area sampling of concrete, vadose zone soils, and saturated soils of the UTRA to help evaluate CM risks and provide vertical source area characterization of PFAS constituents;

- Collect VOC vadose zone soil sampling at the D-Area Bubble Tower Subunit SVE Units for confirmation sampling that CM threshold limits for PCE have been met; and
- Install new monitoring well in the lower UTRA and sample for VOCs, pH, metals, sulfate, tritium, and PFAS as necessary.

The primary objective of the additional characterization sampling for the DAG OU is to address data needs identified by the USDOE, USEPA, and SCDHEC that concern groundwater conditions within the DAG OU that exceed MCLs (or tap water RSLs in the absence of an MCL) that may warrant action. This additional information, in conjunction with existing characterization data, will be used to develop a RFI/RI/BRA.

All concrete, soil, and groundwater samples will be analyzed by SCDHEC-certified laboratories. Samples will be definitive-level data and will be analyzed for VOCs, metals, tritium, and PFAS.

The field investigation will be conducted in compliance with SRS Manual 3Q1, *Hydrogeological Data Collection (U)* (SRS 2019b).

During groundwater unit assessment, field quality control (QC) samples consisting of duplicates, splits, rinsate blanks, field blanks, and trip blanks, will be collected, with samples designated for screening-level analyses. Duplicates and splits will be analyzed for the same parameters as the associated samples. Rinsates will be collected at the rate of one per 40 samples and will only be analyzed for TCL VOCs and PFAS. Field blanks will be collected at 10% of the sampling locations. Trip blanks will be collected and shipped. If contamination is detected in any field QC blank, contamination of associated samples will be assumed.

3.2 Primary Source Characterization

The following were previously identified to be the sources of groundwater contamination in the DAG OU:

- 484-17D DCSA;
- 488-D Ash Basin;
- 489-D CPRB;
- DHWRF (primarily 420-2D Concentrator Building);
- 420-2D Rework Handling Facility;
- D-Area Heavy Water Facility (411-1D, 411-D, 412-1D, 412-D, 413-1D. and 413-D);
- 431-2D D-Area Rubble Pit;
- 421-2D Moderator Handling and Storage Building;
- Fire-Fighting Training Area (411-1D and 411-3D); and
- Gasoline Station (715-D).

Almost all of these sources of groundwater contamination have been removed or remediated under separate actions and do not present continuing sources of groundwater contamination. It is currently unknown whether the Fire-fighting Training Area (411-1D) and the 715-D Gasoline Station pose a CM risk for PFAS. Any residual PFAS concrete or vadose zone soil contamination would be associated with DAOU, not DAG OU; however, the contamination my impact the DAG OU due to CM risks.

3.3 Secondary Source Characterization

Secondary sources include impacted concrete or soils in and around the facilities as listed in Section 3.2. Concrete and soil sampling will be conducted at 9 boring locations near the 411-D Fire Training Area (Figure 11; Table 3) and 5 boring locations near the 715-D Gasoline Station (Figure 12) during drilling for the analysis of PFAS (Table 4) and/or VOC constituents (Table 5). This will include PFAS concrete samples from former fire pits and soil sampling at multiple depths throughout the vadose zone and UTRA, as well as VOC soil samples within the vadose zone.

3.4 Exposure Media Characterization

Groundwater is the primary exposure media at the DAG OU as presented in the CSM (Figure 14) and in Section 4. Groundwater samples have been collected from existing groundwater wells and will be collected from the new groundwater monitoring well. This new data will be used to determine the extent of the groundwater plumes, provide vertical delineation of the plumes, and help further evaluate changes/impacts from the DAG OU Treatability Study and also the 484-17D DCSA NTCR action over time.

3.4.1 New Groundwater Monitoring Wells

One (1) new UTRA monitoring well (DCB087C) will be installed to further characterize PFAS, metals/sulfate, VOC, and tritium groundwater contamination (Table 1, Figure 13).

Groundwater samples obtained from the new groundwater monitoring wells will be analyzed for VOCs, pH, metals, tritium and PFAS as necessary to provide data for the assessment of plume extent and movement.

3.5 Physical Characteristics

Geologic descriptions of the soil cores collected as part of the Fire Training Pits soil borings and well installations will be conducted. The physical and lithologic descriptions will be used to enhance the hydrogeologic CSM at those locations.

4.0 DATA QUALITY OBJECTIVES (DQO)

The data quality objective (DQO) process was developed by USEPA as guidance for data collection activities (USEPA 2006). The DQOs are developed using an interactive and iterative process approach to decision-making based on seven steps outlined by USEPA guidance: 1) state the problem, 2) identify the goal(s), 3) identify the information inputs, 4) define the boundaries of the study, 5) develop the analytic approach, 6) specify performance or acceptance criteria, and 7) develop the plan for obtaining data.

DQOs are useful in identifying data gaps and in developing SAPs that describe the procedure for collecting sufficient data of known and defensible quality. These data are used to define the nature, magnitude, and extent of contamination and to define human health risks. In turn, these finding will facilitate development of sound decisions concerning remedial response activities. DQOs also assist in determining appropriate detection limits, analytical methods, and sampling and handling procedures/ requirements.

The focus of the DQO development process is efficient planning for data collection. This process is participatory, encouraging input and consensus from all data users, thus facilitating the understanding and acceptance of project goals. The DQO process applies to the entire planning team, including management, regulators, and technical personnel. The DQO process is a series of planning steps based on the scientific methods (Section 4.1.2 through 4.1.8 of this document) detailed in *Guidance of Systematic Planning Using Data Quality Objectives Process* (USEPA 2006). This process provides a systematic, flexible approach to decision-making. Although the steps are described sequentially, the DQO process is iterative. The results of the DQO process are a set of data specifications and an efficient, cost-effective SAP. Thus, major benefits of the DQO process are as follows:

- Promotes efficient, cost-effective, and timely data collection;
- Provides a thorough, systematic approach to relate data collection specifications to the end needs of the data users;
- Involves the decision-makers and the assessment technical team in establishing a definitive plan with objective criteria;
- Aids in communicating and understanding the levels of risk and the basis for decisions; and
- Encourages critical thinking about data gathering and interpretation.

4.1 DQO Evaluation

4.1.1 Conceptual Site Model (CSM)

USEPA guidance for CERCLA RIs stresses the need and utility of conceptual representation of the unit under consideration. Such a representation provides an objective framework around which existing information can be organized and synthesized, data gaps can be identified, and sampling programs can be designed to address critical data needs identified in the DQO process.

The conceptual site model (CSM) follows USEPA guidance for conceptual representation. It depicts the preliminary understanding of the site and focuses on identifying potential CM from the sources to potential receptors. The CSM for DAG OU is presented in Figure 14. The CSM identifies potential sources of contamination, release mechanisms, media of concern, exposure routes, and potential receptors. Each of these components is described below.

4.1.1.1 Exposure/Physical Attributes

The primary sources to the DAG OU are contaminant releases and process spills or leaks from subunits associated with the DEXOU and DAOU. These primary sources include the 488-DAB, 489-D CPRB, 432-2D DRP, 484-17D DCSA, DHWF (411-D, 412-1D, and 413-D), DHWRF (420-D Concentrator Building), 420-2D Rework Handling Facility, 421-2D Moderator Handling and Storage Building, Fire Training Area (411-1D/411-3D) and the Gasoline Station (715-D).

4.1.1.2 Primary Release Mechanisms

Contaminants may have been released from the primary sources by the following primary release mechanisms:

- Operation of facilities;
- Spills and leaks from process-related activities and maintenance;

- Runoff and deposition from the surface units; and
- Infiltration/percolation/seepage from the surface units.

4.1.1.3 Secondary Sources of Contamination

Secondary sources of contamination at the DAG OU may include concrete, surface soil (0 to 0.3 m [0 to 1 ft]) and subsurface/deep soil (0.3 m [1 ft] to water table depth) in areas where the primary sources may have been released through infiltration, seepage, surface runoff, and/or discharge.

4.1.1.4 Secondary Release Mechanisms

The secondary sources may release contamination to other media through infiltration/ percolation and leaching of contaminants from soils (all depths) to groundwater.

4.1.1.5 Exposure Pathways (Media)

Contact with contaminated environmental media creates pathways for human and ecological receptors. The exposure pathway (media) at the DAG OU is groundwater (human receptors only).

4.1.1.6 Exposure Routes

The final element in the CSM that links the primary sources to the potential receptors are the exposure routes. Exposure routes for human receptors may including ingestion of contaminated groundwater and showering (includes dermal contact and inhalation).

A quantitative risk assessment is not planned to be conducted for the DAG OU, but rather contaminant concentrations in the groundwater (and surface water) will be compared to MCLs or tap water RSL in the absence of a MCL to determine exceedances. Formal human health and ecological risk assessments for the surface water and sediment media will be performed under the SRFS IOU.

4.1.1.7 Receptors

A hypothetical future resident receptor scenario will be used to evaluate exposure to the groundwater media for the DAG OU. Both human health and ecological risk assessment to surface water and sediment will be evaluated as part of the SRFS IOU.

4.1.2 State the Problem

The initial step in the DQO process is to define the problem for the DAG OU so that the focus of the investigation will be clear and disciplined. This step entails summarizing and evaluating data from previous investigations (Section 2). A CSM is then developed (Section 4.1.1), and potential exposure pathways are identified.

Previous characterization and monitoring activities indicate the presence of VOCs, tritium, low pH/metals, and PFAS in the groundwater. Although previous groundwater investigations and recurrent groundwater and surface water sampling for DAG OU have determined the extent of groundwater contamination is well known, one new additional monitoring well, DCB087C, will be beneficial in further characterizing the plumes and provide additional trending information at the 484-17D DCSA.

VOCs (primarily TCE), tritium, low pH/metals, and PFAS are the primary contaminants and exceed MCLs (or RSLs as appropriate) in groundwater. The resultant groundwater plumes discharges to the southwest to the D-Area Effluent Discharge Canal and Beaver Dam Creek and into the D Area wetlands. Surface waters in the D-Area Effluent Discharge Canal and Beaver Dam Creek exhibit low pH and metal concentrations that exceed respective MCLs and RSLs.

Additionally, source area sampling for PFAS constituents at both the 411-1D/411-3D FFTA and 715-D Gasoline Station has been minimal, and there is not sufficient PFAS sample data to determine if the concrete and/or vadose zone soils pose a CM risk to groundwater.

Additional concrete and soil sampling will determine if there are any continuing sources of PFAS and VOCs (PCE) for any further groundwater contamination. It is currently unknown if the vadose zone soils at the D-Area Bubble Tower Subunit SVE Unit have successfully been remediated to below the 20 µg/kg CM threshold limit.

4.1.3 Identify the Decisions

The purpose of this DQO step is to identify the decisions that must be supported with the collected data to address the problem. This step helps define the objectives of the field investigation.

Figure 15 show the locations of the groundwater plumes in DAG OU. The following are decisions that need to be addressed for the groundwater under this RFI/RI WP Addendum:

- Install and/or augment existing groundwater monitoring well network to monitor groundwater quality and movement of the groundwater plumes;
- Collect applicable suite of analytes from selected monitoring wells;
- Collect concrete and vadose zone soil samples at the two previous areas in D-Area with known use of AFFF (411-1D/411-3D FFTA and the 715-D Gasoline Station) to collect data for use in CM risk determinations; and
- Collect vadose zone soil confirmation samples at the D-Area Bubble Tower Subunit SVE Unit at previously elevated PCE soil contaminated areas to determine if the active MicroBlower™ SVE units have successfully reduced soil concentration levels below the CM threshold limit of 20 µg/kg for PCE.

Environmental measurements are necessary to adequately characterize the data gaps. Resources available to resolve the problem include concrete and soil sample collection, the installation of a monitoring well, and groundwater sampling.

Unit screening data will be compiled and evaluated as part of this investigation in accordance with USEPA guidance (USEPA 2006). In conjunction with existing data, the new data will be used to address the decisions listed above and to determine whether the contaminants exceed ARAR criteria, MCLs or RSLs (as appropriate), or background concentrations. Unit-specific stratigraphic and hydrostratigraphic data will support the design and implementation of remedial actions. A strategy for determining potential remedial alternatives is discussed in Section 2.5.

4.1.4 Identify the Inputs to the Decisions

The purpose of this step is to identify the information needed to support the decisions presented in Section 4.1.3 and to specify which inputs require new environmental measurements. Existing data that supports the decisions are also addressed. Each of the following inputs requires new environmental measurements:

- Definitive-level PFAS analytical data for concrete and vadose zone soil media to determine if CM threshold limits to groundwater are exceeded;
- Definitive-level analytical data for vadose zone soil media to determine if VOC (PCE) cleanup levels have been achieved;
- Definitive- and screening-level analytical groundwater data to determine if MCLs, or in the absence of MCLs, RSLs are exceeded and to perform groundwater modeling; and
- Hydrostratigraphic and groundwater hydrologic characteristics to provide inputs into contaminant fate and transport analyses.

4.1.5 Define the Boundaries of the Study

The purpose of this step is to identify the spatial limits of the affected media and to determine the discrete area affected by the remedial decisions. This step also investigates temporal changes in the plumes over time. This WP addendum only applies to the characterization efforts presented in Section 4.1.3.

4.1.6 Develop Decision Rules

The purpose of this step is to integrate the output from the previous steps of the DQO process to form a statement that defines the conditions of the OU so that the decision maker can chose among the appropriate alternative actions. These actions encompass the entire CERCLA process. Figures 11 through 13 depicts the location of the soil borings and monitoring well. It is expected that the extent of PFAS contamination in the source areas will be adequately defined after completion of these WP Addendum activities. VOC soil samples will be collected to confirm if soil cleanup levels below 20 µg/kg have been achieved.

MCLs will be the primary point of comparison for groundwater constituent concentrations according to the protocols established in the FFA (FFA 1993). In the absence of an MCL for a constituent, the USEPA tap water RSL will be the primary point of comparison for an Action Level. PFAS soil concentrations will be used to determine if future potential impacts to groundwater exist.

Completion of the comprehensive sampling analysis will lead to the presentation and analysis of sampling results for potential continued characterization of contamination extent, determination of COCs, and evaluation of remedial alternatives with the support of groundwater modeling.

4.1.7 Specify the Limits on Decision Errors

This section presents guidelines for the decision maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Due to the inherent uncertainty introduced by heterogeneity and error in sampling, storing, transporting, and analyzing environmental media, it is important to specify the acceptable decision error rates. Potential errors resulting from field sampling modifications implemented will be minimized by using standardized sampling and analytical procedures. SRNS developed specific technical instructions for collecting samples for PFAS analysis that minimize the risk of anthropogenic PFAS contamination.

All constituents will be analyzed at levels that allow comparison against established MCLs or RSLs or risk-based concentrations (RBCs). The analytical method chosen must be capable of achieving a Practical Quantitation Limit (PQL) below the established MCL, RSL, or RBC. The project will use the results to determine COCs and support a remedial decision that can be agreed to by the USDOE, USEPA and SCDHEC.

Existing groundwater data are summarized in Section 2.3 of the April 2022 RFI/RI WP (SRNS 2022) and provide a baseline for comparison to data obtained under this proposed WP addendum. Over 20 years of results have been obtained at the DAG OU, which provide a high level of confidence in the data quality and allow for the easy identification of any data anomalies.

4.1.8 Optimize Design for Obtaining Data

This section discusses the most effective sampling and analysis design for generating the data that are expected to satisfy the DQO process needs by reviewing all existing data, performing a characterization, and interpreting the results in a time frame that allows for timely completion of the RFI/RI/BRA.

The final step in the DQO process is development of a SAP that takes into account the problems key decisions, environmental variables, and method for identifying the spatial and temporal boundaries of the contamination and populations at risk. SAP content is provided in Sections 5.0 through 7.0.

4.2 Summary of DQO Evaluation

This section discusses the unit characterization objectives as they address the CSM and meet the DQO needs. The data needs developed under the DQO process are summarized in Tables 6 through 9.

Groundwater samples will be collected from the UTRA to monitor for VOCs, low pH/metals, tritium, and PFAS. Results will be compared to the appropriate MCLs or RSLs.

VOC soil samples will be compared to the DAOU RGs to confirm if the soil contamination has been reduced to below CM threshold limits of 20 µg/kg for PCE. PFAS soil samples will be compared to RSLs as available and will be used in the future to determine CM risks to groundwater.

5.0 SAMPLING DESIGN AND RATIONALE

Implementation of the SAP to obtain decision-quality data for each subunit/media is documented in the remaining sections of this sampling and analysis plan. The following section describes how the plan is implemented to collect the physical data to meet the criteria developed during the DQO process. Tables 9 and 10 list the laboratory analytical specifications for the samples as described below. Table 12 lists the preservatives, holding times and bottle requirements for concrete, soil and groundwater samples.

5.1 PFAS Concrete and Soil Samples

To aid in the determination if PFAS contamination exists in concrete and vadose zone soils at levels that pose a CM risk to groundwater multiple depth discrete intervals will be sampled throughout the vadose zone. This includes concrete samples from the fire pits and concrete from the 715-D Gasoline Station parking area as well as and five (5) soil intervals within the vadose zone soils at each boring location (Tables 3 and 4). Additionally, saturated soil samples within the UTRA will also be collected as a comparison to the vadose zone samples and for vertical contaminant delineation. All PFAS samples will be analyzed with method EPA1633 as shown in Table 10.

5.2 VOC Soil Samples

The VOC vapor concentrations extracted from the vadose zone at the D-Area Bubble Tower Subunit SVE Units has greatly diminished suggesting the vadose zone soil concentrations may have been reduced to below CM threshold limit of 20 µg/kg. Three (3) boring locations at the SVE unit area where previous soil samples were above remedial goals will be investigated at the same intervals to determine current VOC contaminant levels (Figure 12 and Table 5). All VOC samples will be collected using EPA 5035A and analyzed with method EPA 8260B as shown in Table 10.

5.3 Groundwater Samples

The one additional groundwater well to be installed, DCB087C, will have groundwater samples collected after well development for VOCs, metals/sulfate, and tritium (Figure 13). The well will be added to the quarterly sampling for metals/sulfate under the DAG OU Treatability Study. Annual groundwater samples will be collected under the regular DAG OU monitoring for VOCs, tritium, and PFAS. Refer to Table 9 for the list of groundwater analyses to be performed.

6.0 ANALYTICAL PLAN

This section describes the data quality levels for each type of data being collected. All data collected under this SAP will follow the Area Completion Projects (ACP) Quality Assurance Program Plan (QAPP) for Environmental Data Collection and Management (SRNS 2012). The data quality level is determined by the intended use of the data.

6.1 Data Quality Levels for Analytical Results

The data quality level for the permanent well groundwater samples will be Verified and Validated (V&V) data level. The data quality level for all soil samples will be Definative (D) data level. Requirements for V&V and D data are listed in Table 11. Groundwater samples may be analyzed using USEPA approved methods for constituent analysis or screening methods to determine field results (i.e., dissolved oxygen, pH, turbidity, etc. Data will be qualified by the SRNS auto-validation software module for the following aspects of USEPA Functional Guideline Criteria to achieve the V&V quality level: Quantitation Limits, surrogate or tracer recoveries, blanks (method/lab/prep, trip, field, rinsate), lab control sample recoveries, matrix spike recoveries/duplicates, lab replicates, field duplicates, cooler temperatures, chemical preservation, holding times. The laboratory will provide an electronic data deliverable and case narrative and respond to inquiries about the analytical data package for SRNS to run the auto-validation software. All fatal errors, data errors, and warnings will be fixed during the verification process, and the data set will be reviewed for completeness. The auto-validation routines will be conducted, and the data qualified accordingly. Data usability will be assessed using the following PARCC parameters:

1. **Precision** is the mutual agreement between individual measurements of the same property under similar conditions. Precision is determined from the field and laboratory duplicate analyses and indicates the consistency of field and laboratory techniques.

2. **Accuracy** is determined from the laboratory control samples; matrix spikes; serial dilutions; surrogates/tracers; internal standards/carriers; and the results of the method, field, trip, and equipment rinsate blanks. Accuracy indicates the ability of the field and laboratory process to generate correct results. Blank results specifically monitor for any contamination from sample processing. Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters, Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

3. **Representativeness** of data will also be ensured through consistent application of established field and laboratory procedures. Laboratory, field, and trip blank samples will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data determined to be nonrepresentative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

4. **Completeness** is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with

sampling matrix table and QC procedures outlined in this document, and none of the QC criteria that affect data usability are exceeded. When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

5. **Comparability** expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data. Field procedures are standardized, and field operations will adhere to SOPs to ensure comparability. The comparability of laboratory data will be assured by use of established and approved analytical methods and by certified laboratories, consistency in the basis of analysis (wet weight, volume, or similar units), and consistency in reporting units (ppm, pCi/mL, etc.). Comparability will be determined from split and duplicate sample comparisons or screening level and definitive level comparisons. Comparability is an indicator of both precision and accuracy.

Table 12 lists the preservatives, holding times and bottle requirements for groundwater and surface water to meet the data qualities necessary to meet the DQOs.

6.2 Field Analytical Sampling Quality Assurance/Quality Control

QC samples will consist of field duplicates, rinsate/equipment blanks, trip blanks and split samples. Field quality assurance/quality control (QA/QC) will be maintained through the use of QA/QC samples and methods as described below.

1. Field Duplicate (co-located) Samples: Two or more independent samples collected from side by-side locations at the same point in time and space so as to be considered identical. These separate samples are intended to represent the same population and are carried through all steps of the sampling and analytical procedures in an identical manner. These samples are used to assess precision of the total method, including sampling, analysis, and site heterogeneity. Field duplicate samples are planned at a

combined minimum rate of 5% according to ER-SOP-043, or typically 1 per 20 samples and analyzed for the same parameters as the associated samples.

2. Equipment Blank: A sample of water free of measurable contaminants poured over or through decontaminated field sampling equipment that is considered ready to collect or process an additional sample. The purpose of this blank is to assess the adequacy of the decontamination process. Also called rinse blank or rinsate blank. Equipment blanks are typically planned at a rate of 1 blank per 40 samples.

3. Trip Blank: A clean sample of water free of measurable contaminants that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures. Trip blanks are analyzed to assess whether contamination was introduced during sample shipment (typically analyzed for VOCs only). A blank consists of distilled-deionized water provided by the laboratory to be placed in every cooler with VOC samples typically at the rate of 1 trip blank per cooler.

4. Split Samples: Two or more representative portions from a sample in the field, analyzed by at least two different laboratories and/or methods. Prior to splitting, a sample is mixed (except volatiles, oil and grease, or when otherwise determined) to minimize sample heterogeneity. These are quality control samples used to assess precision, variability, and data comparability between laboratories. Split samples are planned at a combined minimum rate of 5% or typically 1 per 20 samples and analyzed for the same parameters as the associated samples. For PFAS samples, if a secondary laboratory is not available to run the recently approved EPA 1633 method, an alternate analytical method may be used (e.g., EPA 537.1).

Table 11 provides the minimum field QC/QA requirements (numbers of duplicate, split, and blank samples) for VV and D level data.

6.3 Sample Matrix Table

Tables 1 and 3 through 5 includes the detailed information for all locations where samples are to be collected. The number of duplicate and split samples will meet or exceed the requirements of Table 11 and trip and equipment blanks will be collected at a frequency shown in Table 11.

6.4 Sample Location Maps

Figures 11 and 12 illustrates the existing and proposed locations of concrete and soil samples to be collected and Figure 13 illustrates the groundwater well sample location.

7.0 FIELD IMPLEMENTATION

The following sections outline the field implementation procedures and processes for the DAG OU RFI/RI WP Addendum characterization effort. Additional implementing documents such as the environmental evaluation checklist, automated hazard analysis, and site-specific health and safety plan are internal to SRS, and detail day-to-day sampling operations and safety requirements.

7.1 Sample Collection Procedures and Processes

The DAG OU characterization effort will include concrete, soils, and groundwater as part of this SAP, using SRS Manual 3Q1, *Environmental Requirements and Program Documents* (SRS 2019b). The following specific procedures will be followed:

- Technical Oversight (TO) Requirements for Groundwater Monitoring Wells and Soil Borings, SRNS Manual 3Q1, Section 9004
- Soil Boring Investigations, SRNS Manual 3Q1, Section 9006
- Specifications for Installation of Piezometers and Monitoring Wells, SRNS Manual 3Q1, Section 9007

- Sampling Groundwater Monitoring Wells, Tanks/Vessels (Sample Ports or Spigots) and Surface Water, SRNS Manual 3Q1, Section 9015

These procedures are consistent with the *USEPA Region 4 Field Branches Quality System and Technical Procedures* sampling procedures. Prior to beginning all field activities, all field crews will be required to read the procedures listed above and the TO will have had experience with those activities.

As described earlier, PFAS sampling involves a rigorous routine to avoid cross contamination. As of issuance of this SAP, the sampling regime is described in the technical report *SRS Sample Collection Guidelines for Per- and Polyfluoroalkyl Substances (PFAS)* (SRNS 2021). VOC samples will be collected as prescribed by the preparation method EPA5035A. Concrete samples will be crushed into smaller particles, homoginzed, and bottled.

7.2 Equipment and Decontamination Procedures

The following equipment will be required to sample groundwater and surface water:

- Camera for photo documentation;
- Field Logbook and/or Field Data Recorder with backup batteries;
- Global positioning system unit and backup batteries;
- Personal Protective Equipment;
- KIJ5 radio, Cell phone, and pager;
- All sample bottles with preservatives;
- PFAS compliant pumps, tubing, and other sampling devices; and
- Cooler and frozen blue ice or equivalent for packing samples in the field (PFAS samples require bagged wet ice).

Equipment needs will vary from day to day based on sampling requirements and field conditions. Specific needs will be addressed at plan-of-the-day meetings by the TO, industrial hygiene personnel, and safety personnel. Decontamination of field sampling equipment will be done in accordance to the 3Q1 Manual Procedure 9016, Section 5.4. Disposal of IDW will follow the job specific waste management plan.

7.3 Sample Documentation

Overall documentation will be done in accordance with *Area Completion Projects Quality Assurance Project Plan for Environmental Data Collection and Management* (SRNS 2012). Sample documentation will be conducted according to Manual C3, ER-SOP-043, standard operating procedure for *Obtaining and Managing Environmental Data for Environmental Compliance & Area Completion Projects*, which provides the general requirements and guidelines that are necessary for the documentation, record keeping, mobilization, collection, processing, reporting and storage of environmental data. Data Management Plan Q-DMP-B-00001, Environmental Restoration Data Management System, requires sampling information, such as barcoded dates, times, sample identifications, weather, etc., to be recorded and maintained in logbooks and chain-of-custody documents included in the sampling package delivered to the project. Sampling documentation is tracked through a series of documents including:

- Mobilization Report;
- Chain-of-Custody Forms;
- Field Log Books;
- Analytical Data Packages; and
- SCDHEC and SRS required logs and forms.

A logbook for recording sample collection activities will be kept for this project. The subcontractor will ensure the logbook is correctly filled out and returned within two weeks after completion of sampling. Essential field information is: sample name, date of collection, time of collection, and sampler's name. Space should be provided for any field observations or comments relating to the quality or representativeness of the sample. Information on the parent sample of each field duplicate should be recorded.

7.4 Chain-of-Custody

Chain-of-Custody procedures establish requirements for sample custody and documenting custody from the time of collection through laboratory analysis. Chain-of-Custody demonstrates that samples obtained in the field have been securely collected and transported and have reached the analytical laboratory without alteration. Chain-of-Custody requirements are established by SRNS Manual 3Q1, Procedure 1001, *Chain-of-Custody Procedure*. At a minimum, Chain-of-Custody documents will include the following information which is compliant with USEPA requirements:

- Project name – i.e., monitoring well name, RFI/RI project name, etc.;
- Sample identification;
- Number of sample containers/bottles;
- Sampler's signature for each sample, the sampler indicates;
- Date of sample collection;
- Time of sample collection;
- Sample identifiers (bar-coded labels);
- Sample description;
- Whether a sample is persevered or unpreserved;
- Whether a sample is filtered or unfiltered; and
- Analyses to be performed.

A Chain-of-Custody record is used as physical and legal evidence of sample custody to trace the sample from collection through delivery to the analyzing laboratory and where the samples were stored. The Chain-of-Custody record must originate with the responsible organization or the person collecting the sample. Every sample is assigned a unique identification number that is entered on the Chain-of-Custody document. The Chain-of-Custody records each transfer of custody of the samples by a relinquishing party to a receiving organization whose name and identifying contact information is located on the form.

7.5 Sample Management and Shipping

Samples will be collected in accordance with SRNS Manual 3Q1, Section 9000, *Hydrogeologic Data Collection Procedures and Specifications* (SRS 2019b). Sample management for analytical laboratories and intra-SRS facilities is primarily controlled by SRNS Quality Assurance Manual 1Q, Procedure 13-1, *Packaging, Handling, Shipping, Storage and Receiving*. The purpose of this procedure is to define the requirements and specify the responsible parties and their roles for the packaging, handling, shipping, storage, and receiving of items to ensure that they are properly controlled to prevent damage or loss and to minimize their deterioration. Sample shipment is also regulated by SRNS Manual 19Q, Procedure 1.02, *General Transportation Requirements for Radioactive and Non-Radioactive Hazardous Materials*. These manuals provide specific requirements to sampler personnel for the required packaging, labeling, record-keeping, selection of appropriate transportation carrier, and appropriate transport container based on the analytically pre-tested nature of a sample. Samples associated with this RFI/RI WP Addendum are non-hazardous and non-radiological as they represent environmental media rather than waste materials.

Samples will be stored in coolers with blue ice, if applicable, in the custody of the sampler, or designee, until delivered to the ACP Sample Packaging personnel in B-Area. If samples need to be stored over-night prior to delivery to the B Area sample-packaging group, then they will be stored in a locked facility with the Chain-of-Custody record, and in a refrigerator (4°C + 2°C) if required for sample preservation. ACP Sample Packaging personnel in B Area will manage, package, and ship samples to the laboratories in accordance with Manual C3, Volume IX Procedure ER-SOP-803B, *Packaging of Non-Department of Transportation (DOT) Samples for On-Site Transfers/Off-Site Shipments*. Table 12 lists proper preservatives, holding times, and sample containers for samples collected in the field, stored, and transported to the analytical laboratories.

7.6 Data Validation and Data Management

Requirements for data validation/verification and data management procedures are found in SRNS Procedures and Standard Operating Procedures, the USEPA Functional Guidelines, and two USDOE National Policies and Procedures:

- SRNS Manual C1, ER-AP-305 – Use of Field-Generated Blanks;
- SRNS Manual C1, ER-AP-306 – Laboratory Data Records Review;
- SRNS Manual C3, Volume X, ER-SOP-033 – Analytical Data Qualification;
- SRNS Manual C3, Volume X, ER-SOP-043 – Obtaining and Managing Environmental Data for Environmental Compliance & Area Completion Projects;
- Data Management Plan, Q-DMP-B-00001, Environmental Restoration Data Management System;
- Department of Energy Consolidated Audit Program, Policies and Practices, Procedure AD-1, Revision 2, November 10, 2009; and
- Quality Systems for Analytical Services, Revision 2.5, Department of Energy, November 9, 2009.

In addition, SRS procedures incorporate the criteria found in the USEPA National Functional Guidelines to verify, validate, and qualify analytical data to assess its usability for risk and remedial management decisions. Adherence to this complex list of procedures and guidelines establishes: (a) if data meets the specific technical and QC criteria established by the DQOs and laboratory QAPPs; and (b) the usability of any data not meeting the specific technical and QC criteria. All data is qualified for usability using USEPA Functional Guidelines. Adherence to the guideline requirements and the USDOE Audit Program for analytical laboratories allows the data to be qualified based upon a set of nationally established functional guideline qualifiers for uniformity.

Depending upon the PQOs, data will be verified and/or validated according to the following criteria:

- Verification – Confirmation by examination and provision of objective evidence that the specified analytical requirements have been met. This is to be an electronic data deliverable completeness check for all required fields. Data verification consists of a completeness check to confirm that all sampling data and data fields requested from the laboratory have been received and comply with specified requirements.

- Validation – Confirmation by manual examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Data validation consists of any analyte and sample specific process for evaluating compliance of the laboratory data received with methods, procedures, or contract requirements.

The ACP Data Management group will enter sample collection and laboratory data into the Environment Restoration Data Management System (ERDMS) in accordance with Procedure ER-SOP-43. Properly completed and qualified data is entered into the ERDMS Database. Data records are updated, re-qualified, and continuously corrected for usability based on the results of electronic verification and manual validation evaluations as corrective actions are resolved with the analytical laboratories. A data usability report will be prepared that will accompany the DAG OU RFI/RI/BRA and CMS/FS reports.

7.7 Investigation-Derived Waste Identification, Generation, and Management

Sampling activities associated with the DAG OU may generate aqueous investigation-derived waste (IDW). These materials will be managed in accordance with the IDW Management Plan (WSRC 2007). Aqueous IDW may consist of decontamination rinsates or monitoring well purge water, which may contain listed waste. Additional IDW-specific information will be documented in an IDW Management Strategy, which will be maintained in the project record file.

8.0 SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN

A unit-specific health and safety plan (HASP) (if required) will be prepared in accordance with 29 Code of Federal Regulations 1910.120 and approved prior to field investigations. This plan will meet Occupational Safety and Health Administration requirements and follow Savannah River Site safety, health, and emergency response plan guidance (WSRC 1996). All personnel involved in the performance of the work shall be familiar with the provisions of the HASP.

9.0 QUALITY ASSURANCE / QUALITY CONTROL PLAN

Precision, accuracy, completeness, representativeness, comparability, and documentation of the characterization are specified in the Savannah River Site site-level quality assurance manuals listed below:

- WSRC-RP-96-234, Revision 1, Savannah River Site RCRA Facility Investigation / Remedial Investigation Work Plan Safety, Health, and Emergency Response Plan, Quality Assurance / Quality Control, and Data Management Requirements (WSRC 1996)
- SRS Procedure Manual 1Q, *Quality Assurance Manual (U)* (SRS 2019a)
- *Area Completion Projects Programmatic Quality Assurance Project Plan for Environmental Data Collection and Management*, ERD-AG-2005-00001, Revision 5, April 2012 (SRNS 2012)

Table 11 shows the QA/QC requirements of the sampling plan.

10.0 SCHEDULE

This section includes the currently updated and approved (03/04/2024) schedule of field activities, documents, and report submittals for the DAG OU.

The estimated completion date for field activities is December 2034.

A summary of key deliverables and submittal dates are as follows:

Deliverable	Submittal Date
RFI/RI Work Plan Addendum /SAP	04/04/2024
Revision 0 RFI/RI Report with Baseline Risk Assessment	12/10/2026
Revision 0 Corrective Measures Study /Feasibility Study	03/09/2028
Revision 0 Statement of Basis / Proposed Plan	11/09/2028
Record of Decision	07/17/2029
Record of Decision Issuance	03/29/2030
Remedial Action Start	06/22/2031

The review schedule for these documents is shown in Figure 16, which also shows the schedule for preparation and review associated with regulatory documents.

11.0 REFERENCES

SRNS, 2009. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan and RFI/RI Report with Baseline Risk Assessment for the D-Area Operable Unit (U),* WSRC-RP-2007-4079, Revision 1.1, April, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *Early Action Record of Decision Remedial Alternative Selection for the D-Area Operable Unit*, SRNS-RP-2010-00162, Revision 1.2, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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SRNS, 2019a. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the D-Area Coal Storage Area (484-17D) (U)*, SRNS-RP-2018-00813, Revision 1, June 2019, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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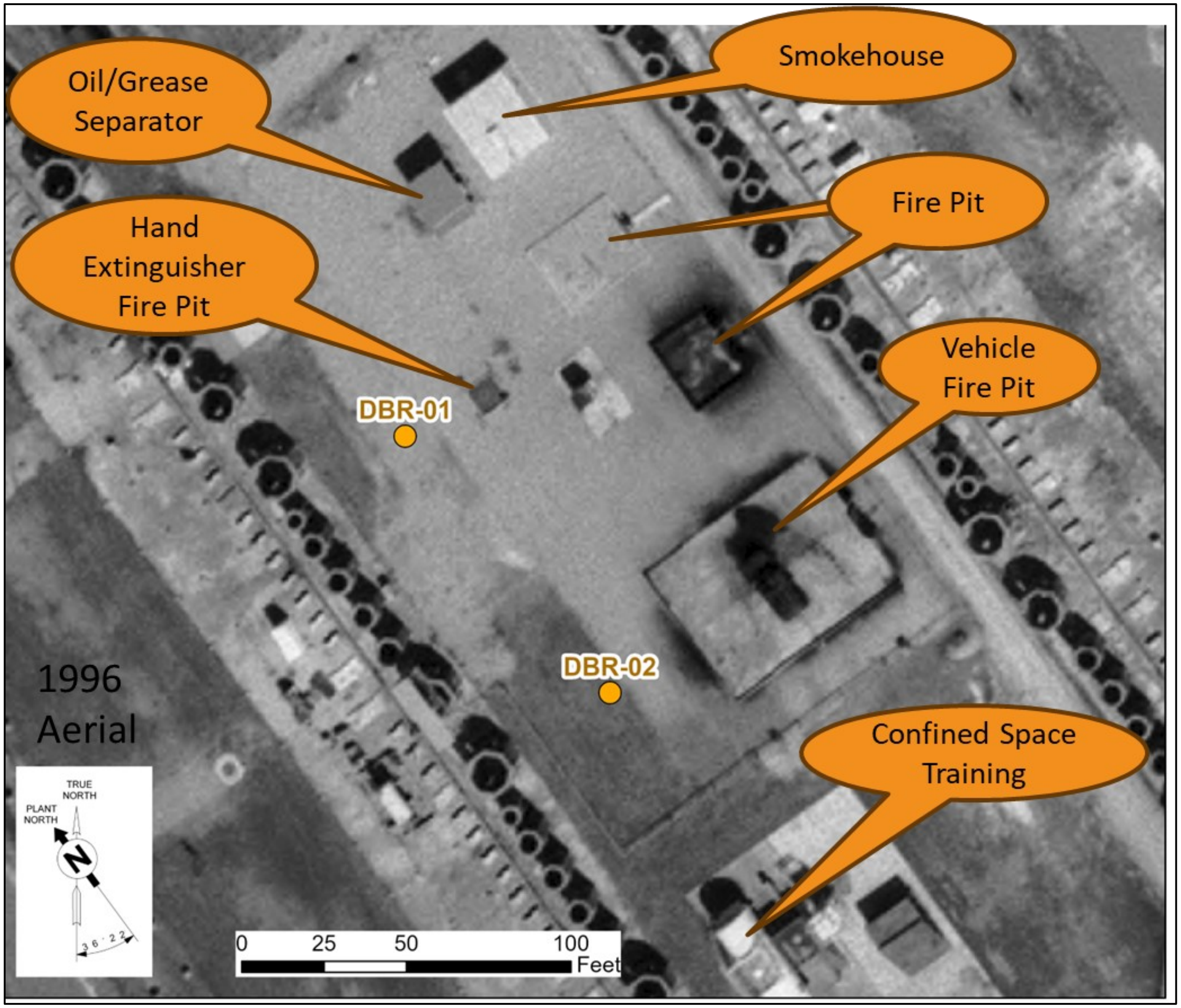

Figure 1. D-Area 411-1D Fire-Fighting Training Area (FFTA)

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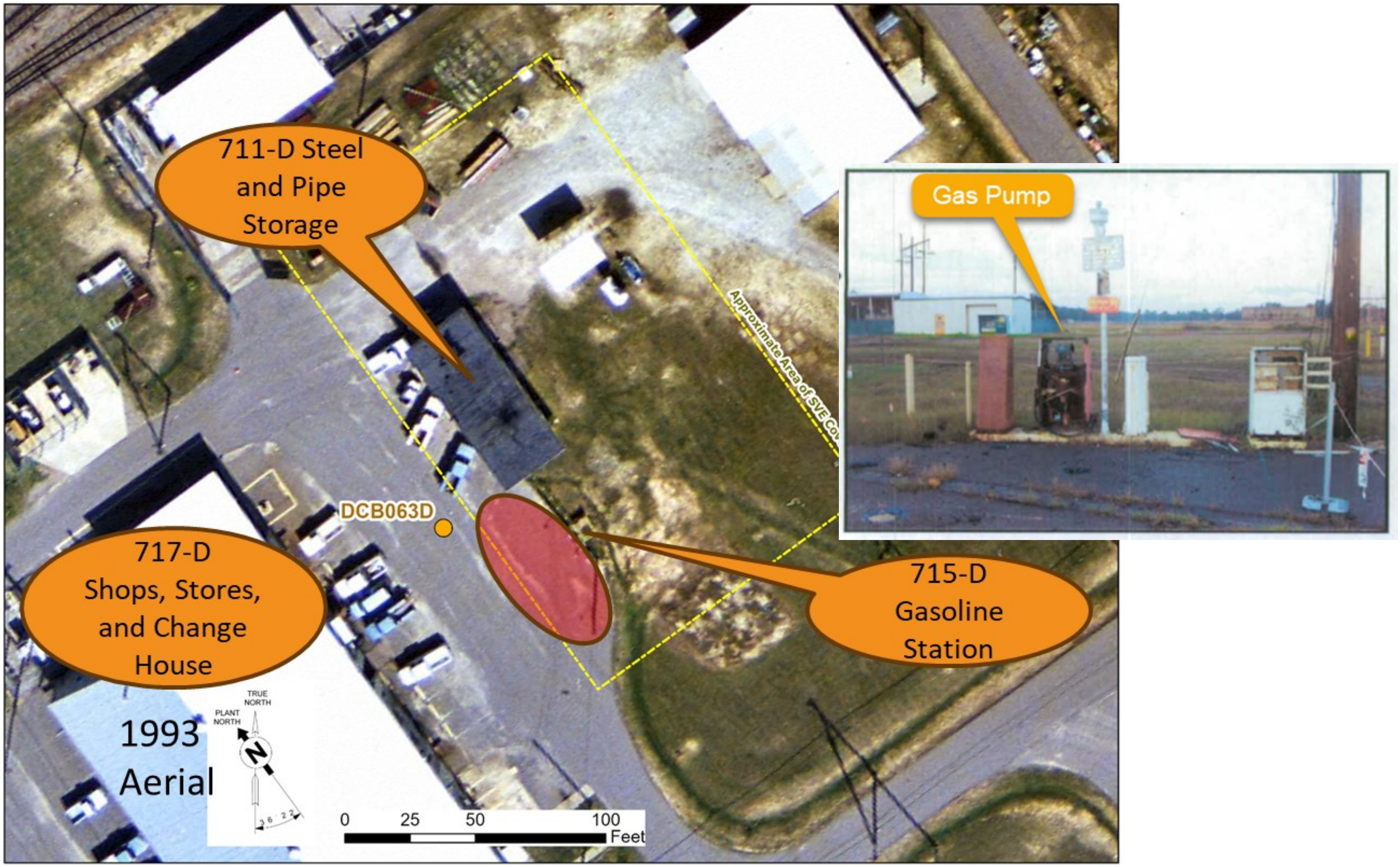

Figure 2. D-Area 715-D Gasoline Station Area

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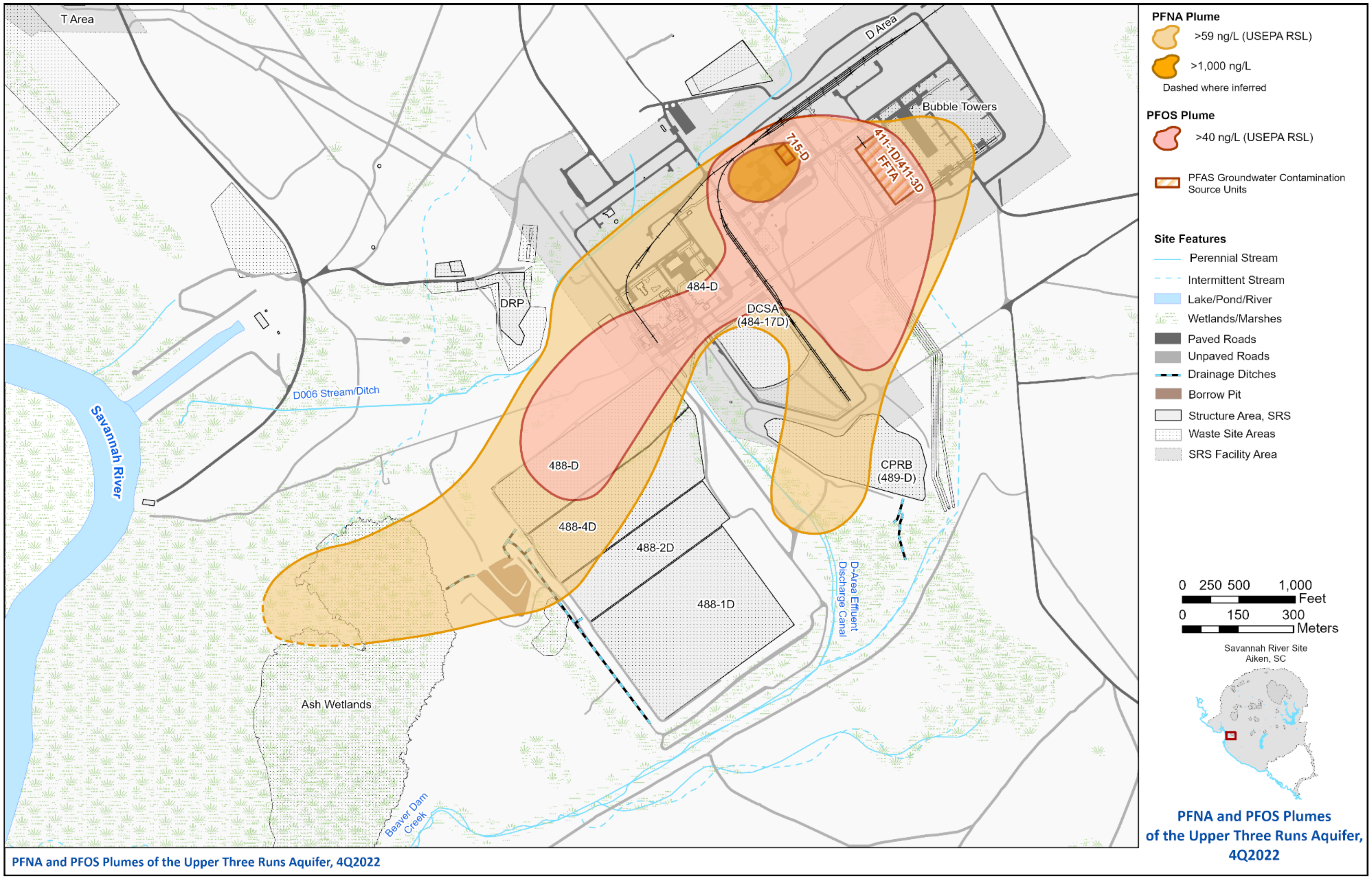

Figure 3. D-Area PFAS Plume (4Q2022)

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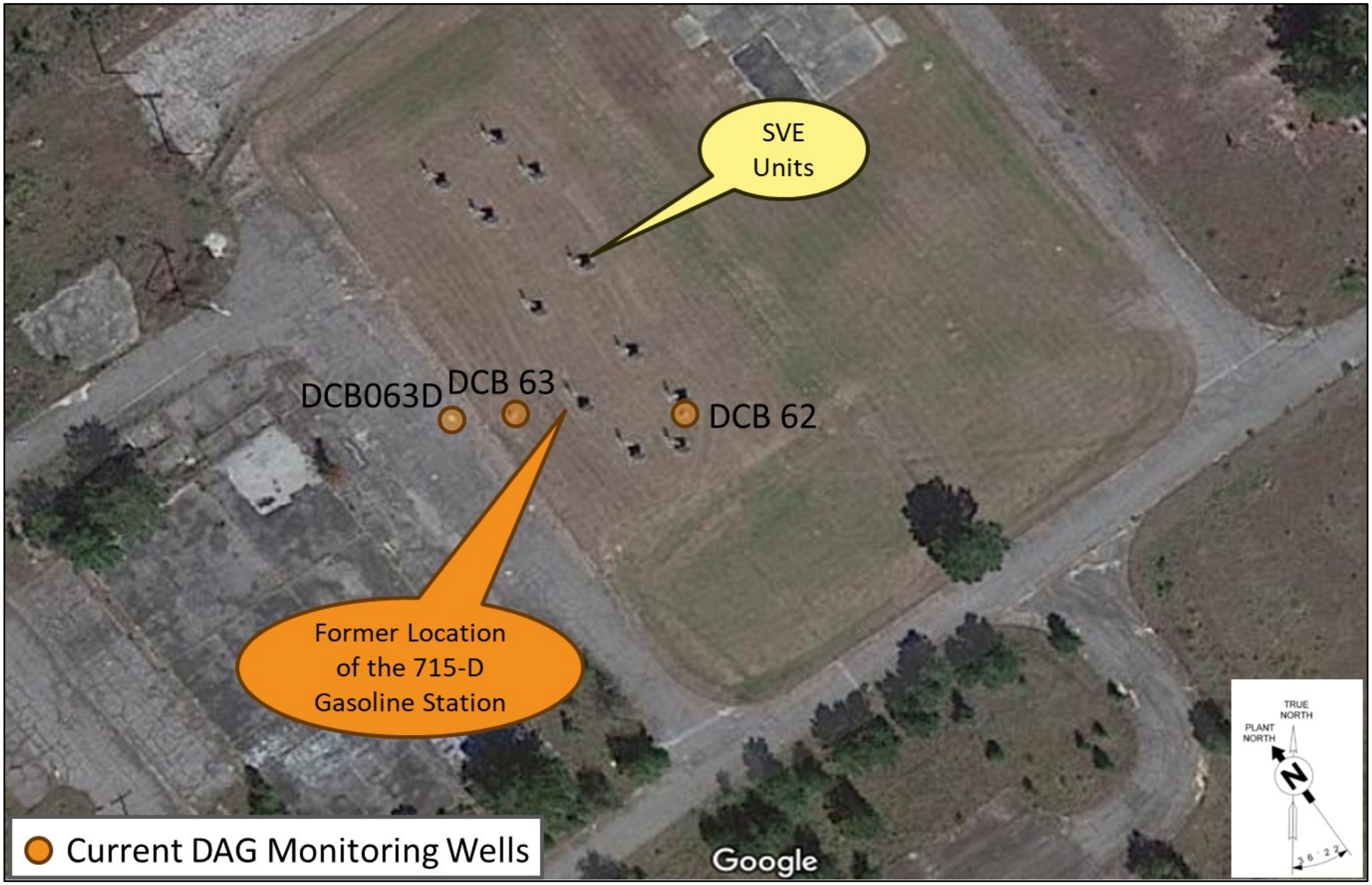

Figure 4. D-Area Bubble Tower Subunit SVE Units

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Figure 5. **D-Area FFTA 2022 Previous PFAS Soil Borings**

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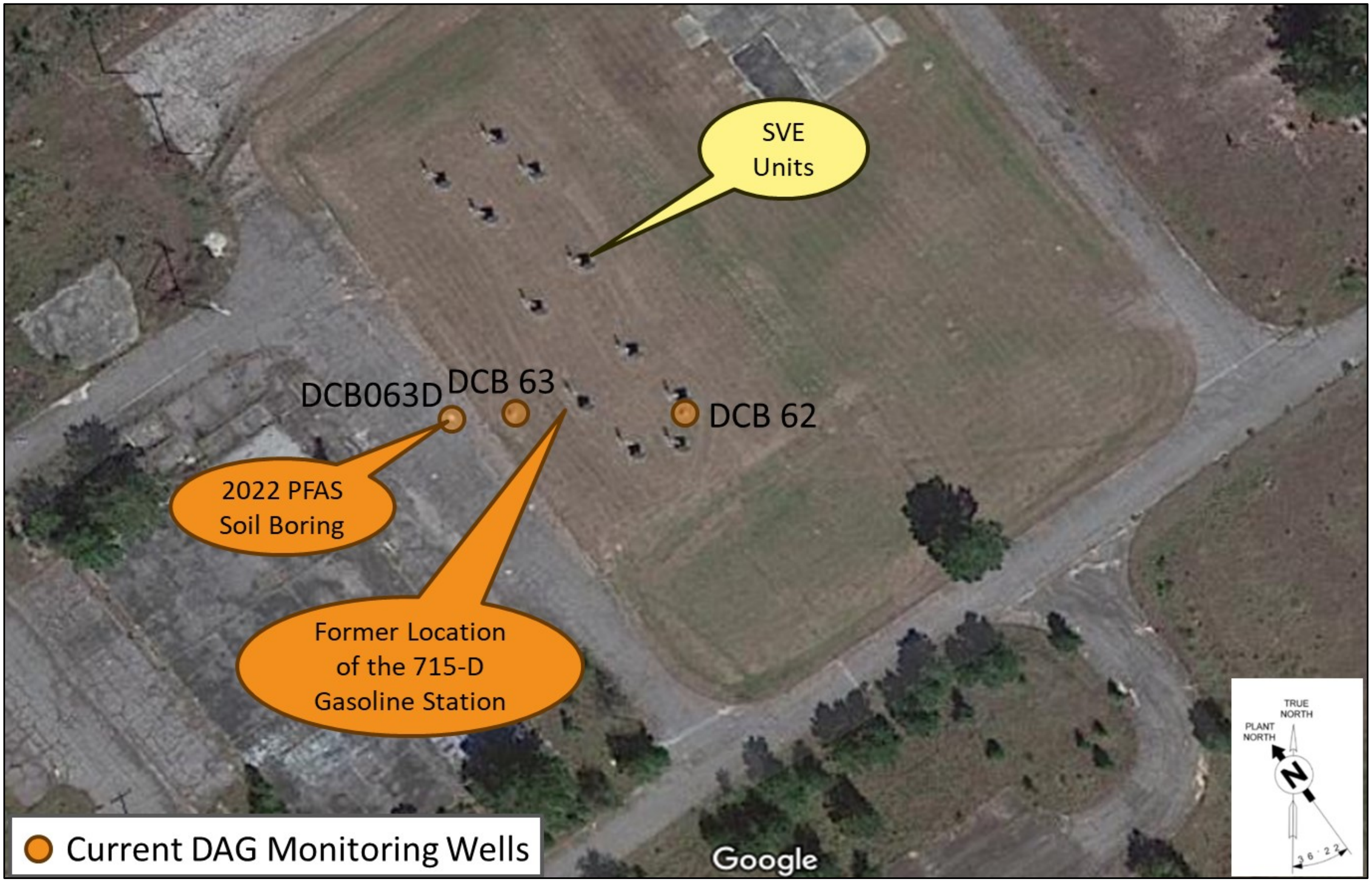

Figure 6. D-Area 715-D Gasoline Station Area 2022 Previous PFAS Soil Borings

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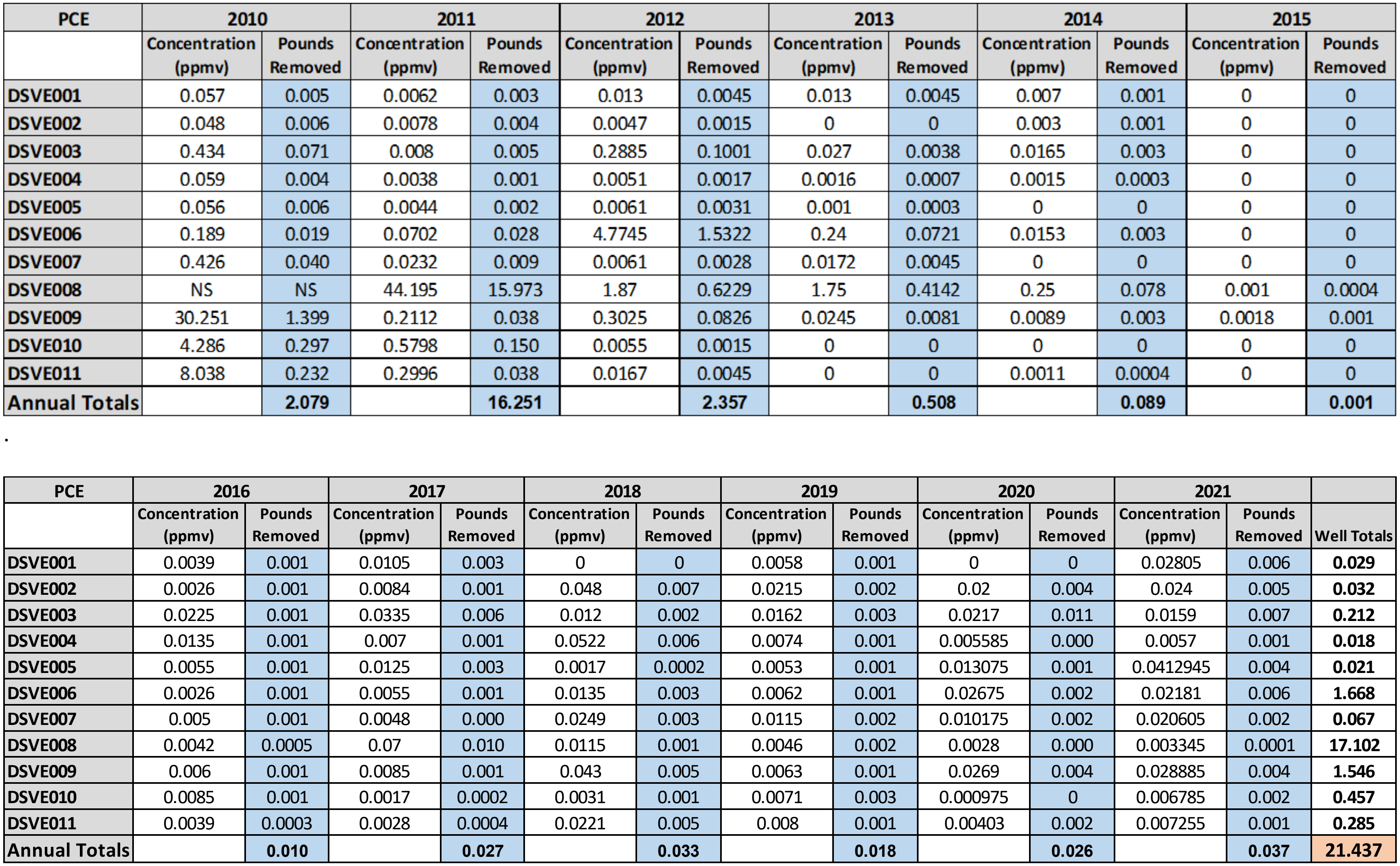

PCE	2010		2011		2012		2013		2014		2015	
	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed
DSVE001	0.057	0.005	0.0062	0.003	0.013	0.0045	0.013	0.0045	0.007	0.001	0	0
DSVE002	0.048	0.006	0.0078	0.004	0.0047	0.0015	0	0	0.003	0.001	0	0
DSVE003	0.434	0.071	0.008	0.005	0.2885	0.1001	0.027	0.0038	0.0165	0.003	0	0
DSVE004	0.059	0.004	0.0038	0.001	0.0051	0.0017	0.0016	0.0007	0.0015	0.0003	0	0
DSVE005	0.056	0.006	0.0044	0.002	0.0061	0.0031	0.001	0.0003	0	0	0	0
DSVE006	0.189	0.019	0.0702	0.028	4.7745	1.5322	0.24	0.0721	0.0153	0.003	0	0
DSVE007	0.426	0.040	0.0232	0.009	0.0061	0.0028	0.0172	0.0045	0	0	0	0
DSVE008	NS	NS	44.195	15.973	1.87	0.6229	1.75	0.4142	0.25	0.078	0.001	0.0004
DSVE009	30.251	1.399	0.2112	0.038	0.3025	0.0826	0.0245	0.0081	0.0089	0.003	0.0018	0.001
DSVE010	4.286	0.297	0.5798	0.150	0.0055	0.0015	0	0	0	0	0	0
DSVE011	8.038	0.232	0.2996	0.038	0.0167	0.0045	0	0	0.0011	0.0004	0	0
Annual Totals		**2.079**		**16.251**		**2.357**		**0.508**		**0.089**		**0.001**

.

PCE	2016		2017		2018		2019		2020		2021		
	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Well Totals
DSVE001	0.0039	0.001	0.0105	0.003	0	0	0.0058	0.001	0	0	0.02805	0.006	**0.029**
DSVE002	0.0026	0.001	0.0084	0.001	0.048	0.007	0.0215	0.002	0.02	0.004	0.024	0.005	**0.032**
DSVE003	0.0225	0.001	0.0335	0.006	0.012	0.002	0.0162	0.003	0.0217	0.011	0.0159	0.007	**0.212**
DSVE004	0.0135	0.001	0.007	0.001	0.0522	0.006	0.0074	0.001	0.005585	0.000	0.0057	0.001	**0.018**
DSVE005	0.0055	0.001	0.0125	0.003	0.0017	0.0002	0.0053	0.001	0.013075	0.001	0.0412945	0.004	**0.021**
DSVE006	0.0026	0.001	0.0055	0.001	0.0135	0.003	0.0062	0.001	0.02675	0.002	0.02181	0.006	**1.668**
DSVE007	0.005	0.001	0.0048	0.000	0.0249	0.003	0.0115	0.002	0.010175	0.002	0.020605	0.002	**0.067**
DSVE008	0.0042	0.0005	0.07	0.010	0.0115	0.001	0.0046	0.002	0.0028	0.000	0.003345	0.0001	**17.102**
DSVE009	0.006	0.001	0.0085	0.001	0.043	0.005	0.0063	0.001	0.0269	0.004	0.028885	0.004	**1.546**
DSVE010	0.0085	0.001	0.0017	0.0002	0.0031	0.001	0.0071	0.003	0.000975	0	0.006785	0.002	**0.457**
DSVE011	0.0039	0.0003	0.0028	0.0004	0.0221	0.005	0.008	0.001	0.00403	0.002	0.007255	0.001	**0.285**
Annual Totals		**0.010**		**0.027**		**0.033**		**0.018**		**0.026**		**0.037**	**21.437**

NS – Not sampled; 0 Concentration – Not Detected.

Figure 7. **D-Area SVE PCE Vapor Results per Well per Year**

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TCE	2010		2011		2012		2013		2014		2015	
	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed
DSVE001	0.041	0.003	0.0028	0.001	0.0012	0.0003	0	0	0	0	0	0
DSVE002	0.035	0.004	0.0022	0.001	0	0	0	0	0	0	0	0
DSVE003	1.846	0.240	0.0024	0.001	0.0145	0.004	0	0	0	0	0.001	0.0001
DSVE004	0.043	0.002	0.0026	0.001	0	0	0	0	0	0	0	0
DSVE005	0.047	0.004	0.0022	0.001	0	0	0	0	0	0	0.0015	0.0005
DSVE006	0.203	0.016	0.0112	0.004	0.1123	0.029	0	0	0.0038	0.001	0.0013	0.0004
DSVE007	0.224	0.017	0.0148	0.005	0.0014	0.001	0.0185	0.004	0.0013	0.000	0.001	0.0003
DSVE008	27.088	0.149	3.091	0.885	0.35	0.092	0.15	0.028	0.0395	0.010	0	0
DSVE009	4.37	0.160	0.0284	0.004	0.057	0.012	0	0	0.0021	0.001	0.0013	0.0004
DSVE010	0.448	0.025	0.04	0.008	0	0	0	0	0	0	0	0
DSVE011	0.792	0.018	0.0184	0.002	0.0019	0.0004	0	0	0	0	0	0
Yearly Totals		**0.637**		**0.912**		**0.139**		**0.032**		**0.011**		**0.002**

TCE	2016		2017		2018		2019		2020		2021		
	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Concentration (ppmv)	Pounds Removed	Well Totals
DSVE001	0	0	0	0	0	0	0.0009	0.0001	0	0	0.00059	0.0001	**0.004**
DSVE002	0	0	0	0	0	0	0.0017	0.0001	0.00095	0.0002	0.0014	0.0002	**0.005**
DSVE003	0.0014	0.0001	0.0029	0.0004	0	0	0.0009	0.0001	0.003275	0.0013	0.003505	0.0013	**0.249**
DSVE004	0.0015	0.0001	0.0012	0.0001	0	0	0.0016	0.0002	0.000422	0.00003	0.00175	0.0002	**0.003**
DSVE005	0.0013	0.0002	0.0034	0.001	0	0	0.0017	0.0003	0.00124	0.0001	0.007375	0.0006	**0.007**
DSVE006	0	0	0.0016	0.0003	0	0	0.0015	0.0003	0.00253	0.0001	0.00391	0.0008	**0.051**
DSVE007	0.0055	0.001	0	0	0	0	0.0012	0.0001	0.00074	0.0001	0.00681	0.0006	**0.028**
DSVE008	0.001	0.0001	0.0335	0.004	0	0	0.001	0.0003	0.000482	0.00002	0.00194	0.00004	**1.169**
DSVE009	0.0021	0.0002	0.0048	0.0003	0.0029	0.0003	0.001	0.0001	0.0143	0.0015	0.00961	0.0010	**0.181**
DSVE010	0	0	0	0	0	0	0.0014	0.0005	0	0	0.00138	0.0003	**0.034**
DSVE011	0.0011	0.0001	0	0	0	0	0.0014	0.0002	0	0	0.002255	0.0002	**0.021**
Yearly Totals		**0.001**		**0.006**		**0.0003**		**0.002**		**0.003**		**0.005**	**1.751**

0 Concentration – Not Detected.

Figure 8. **D-Area SVE TCE Vapor Results per Well per Year**

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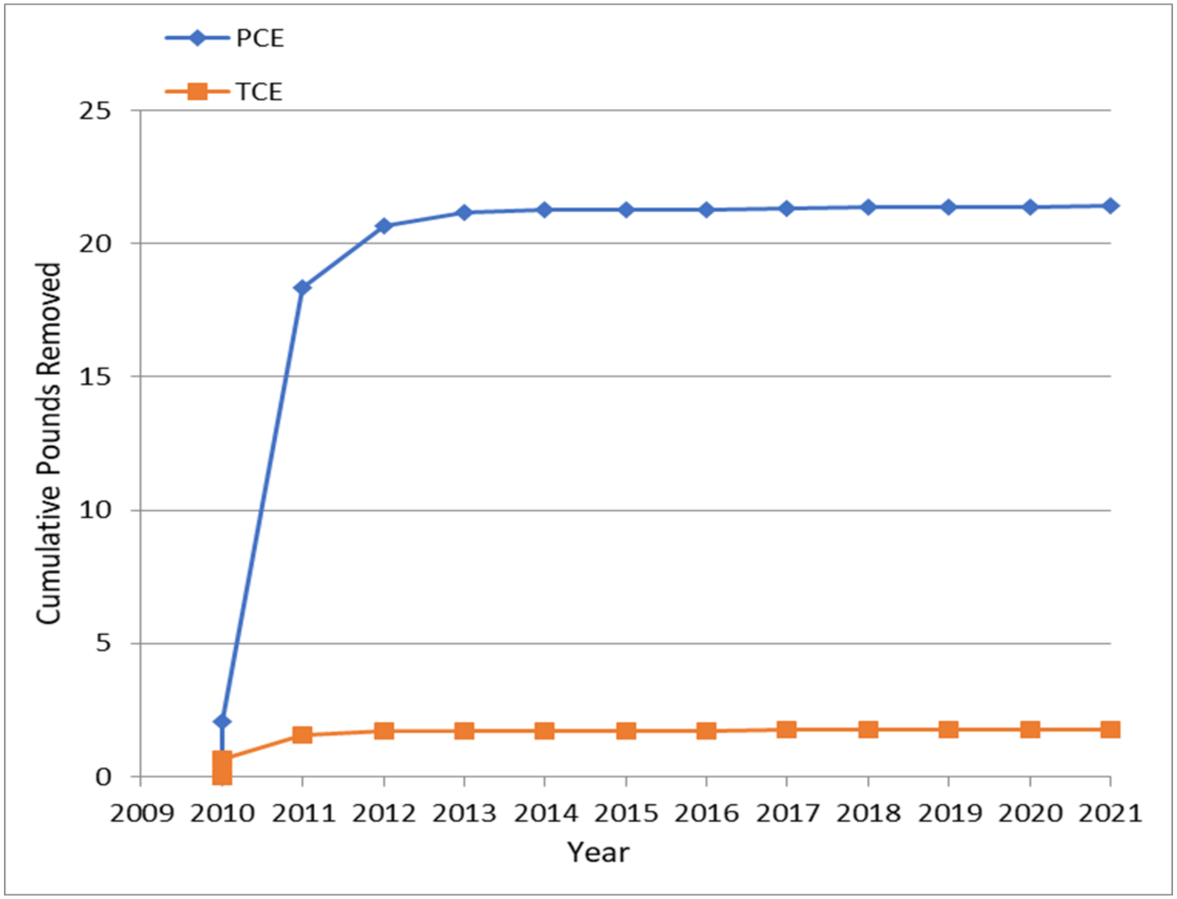

Figure 9. D-Area SVE Annual PCE and TCE Mass Removed 2010 through 2021

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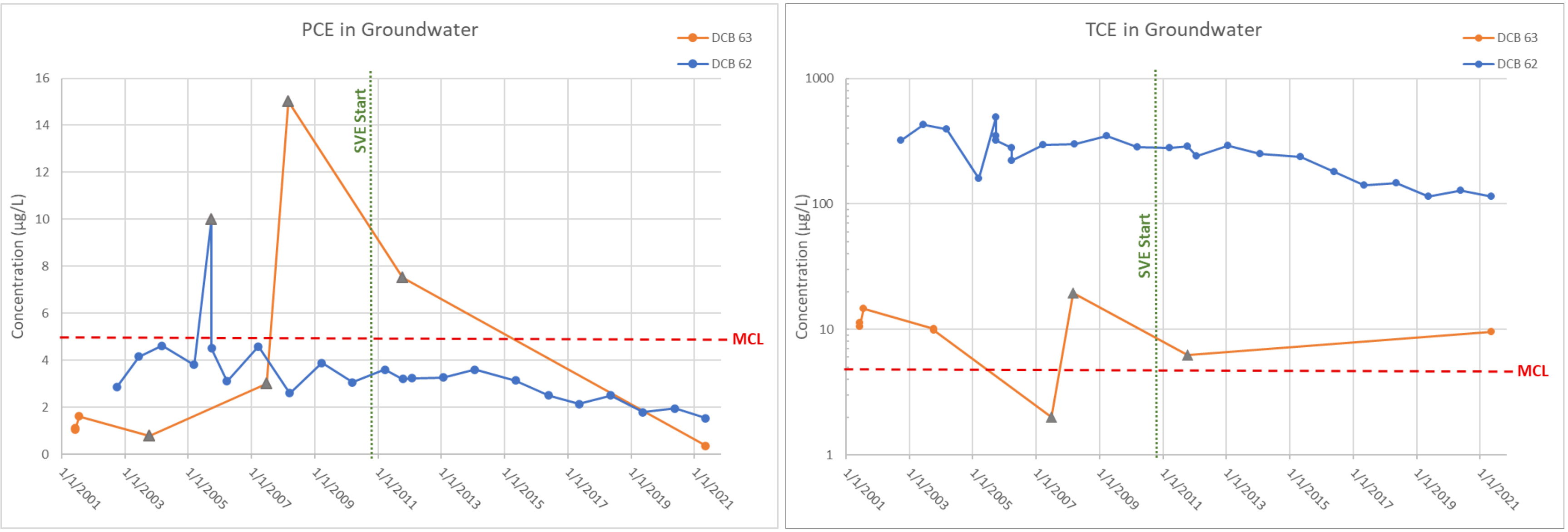

Figure 10. **Groundwater Trends for PCE and TCE Near the DAOU SVE Units**

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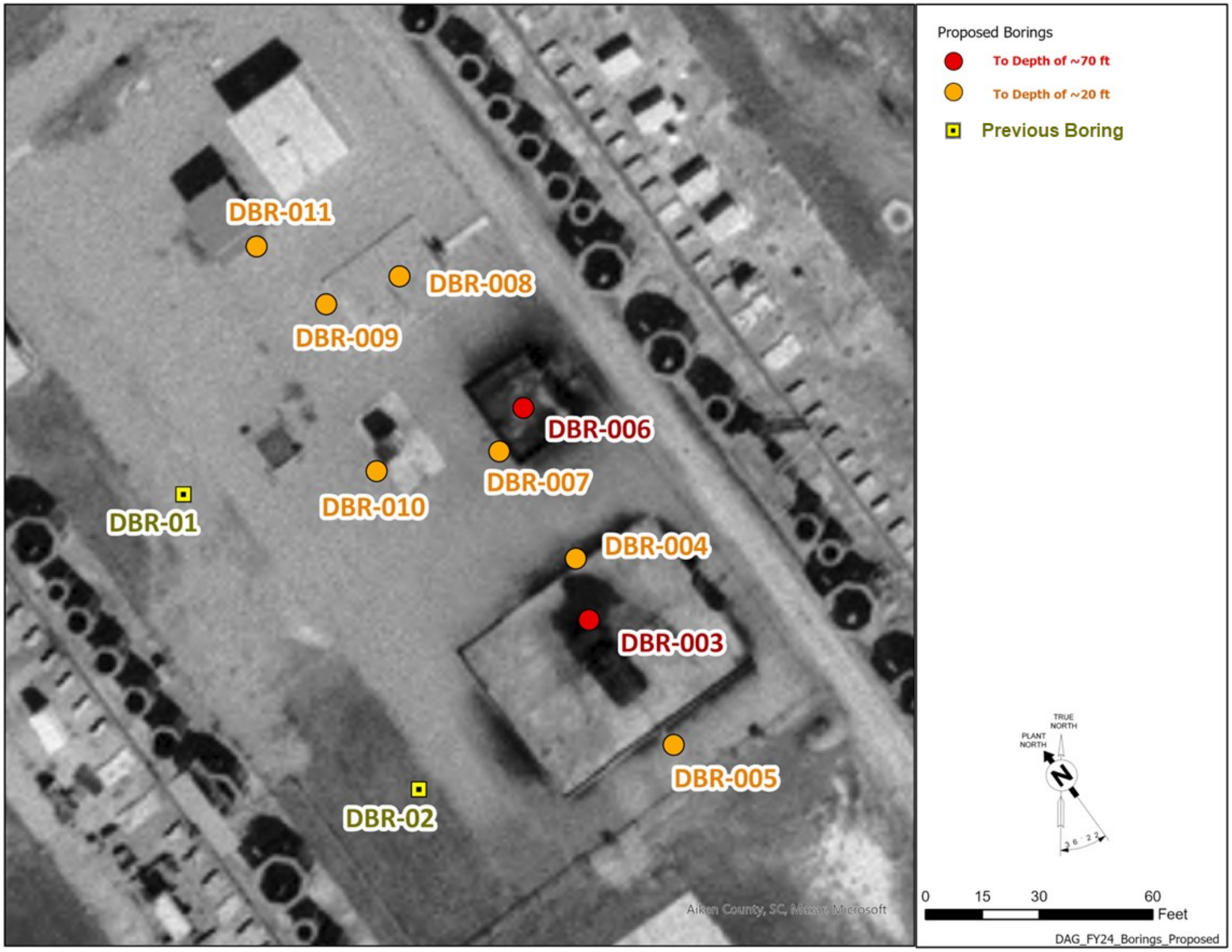

Figure 11. Proposed FFTA Sample Locations

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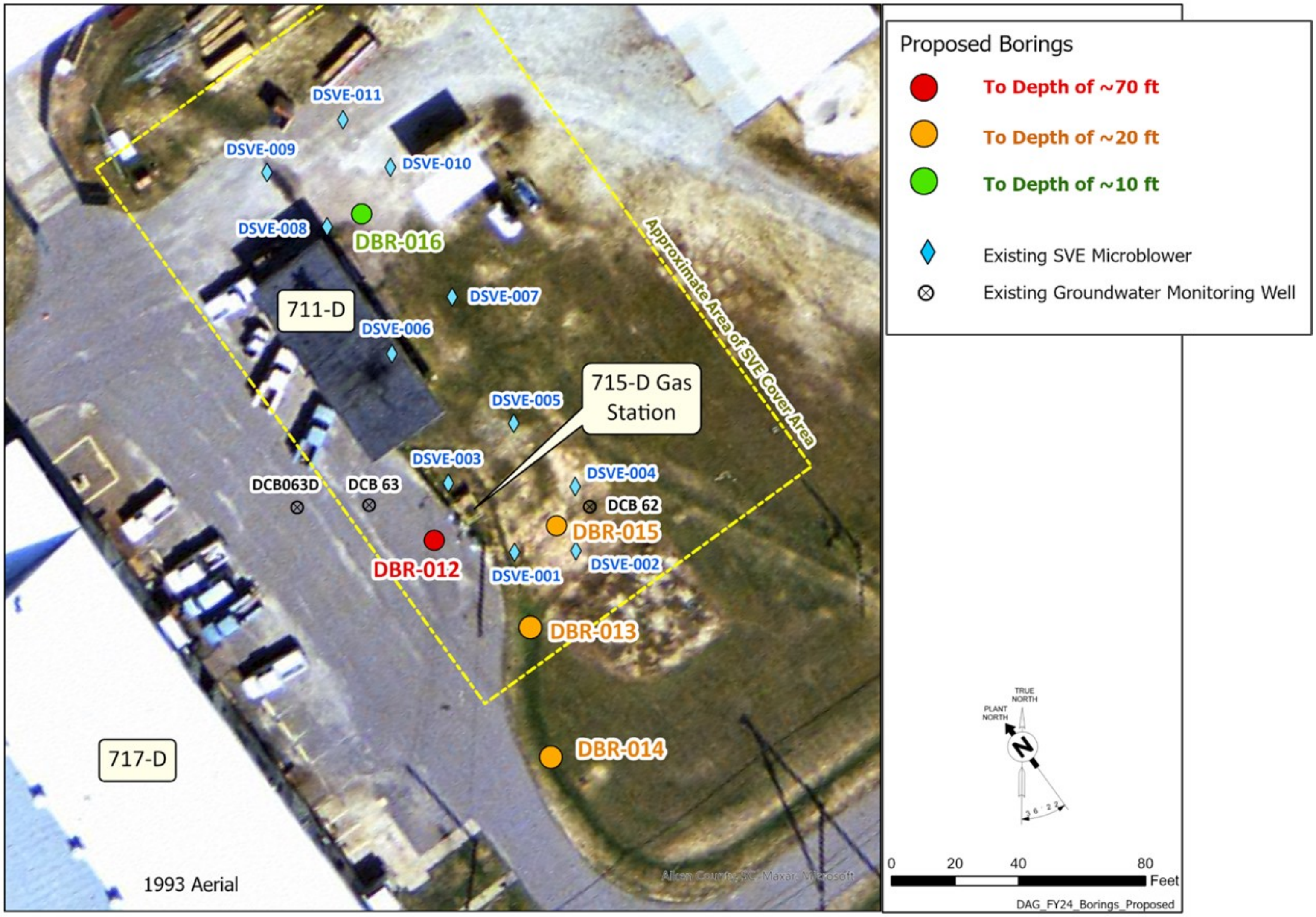

Figure 12. Proposed 715-D Gasoline Station Area Sample Locations

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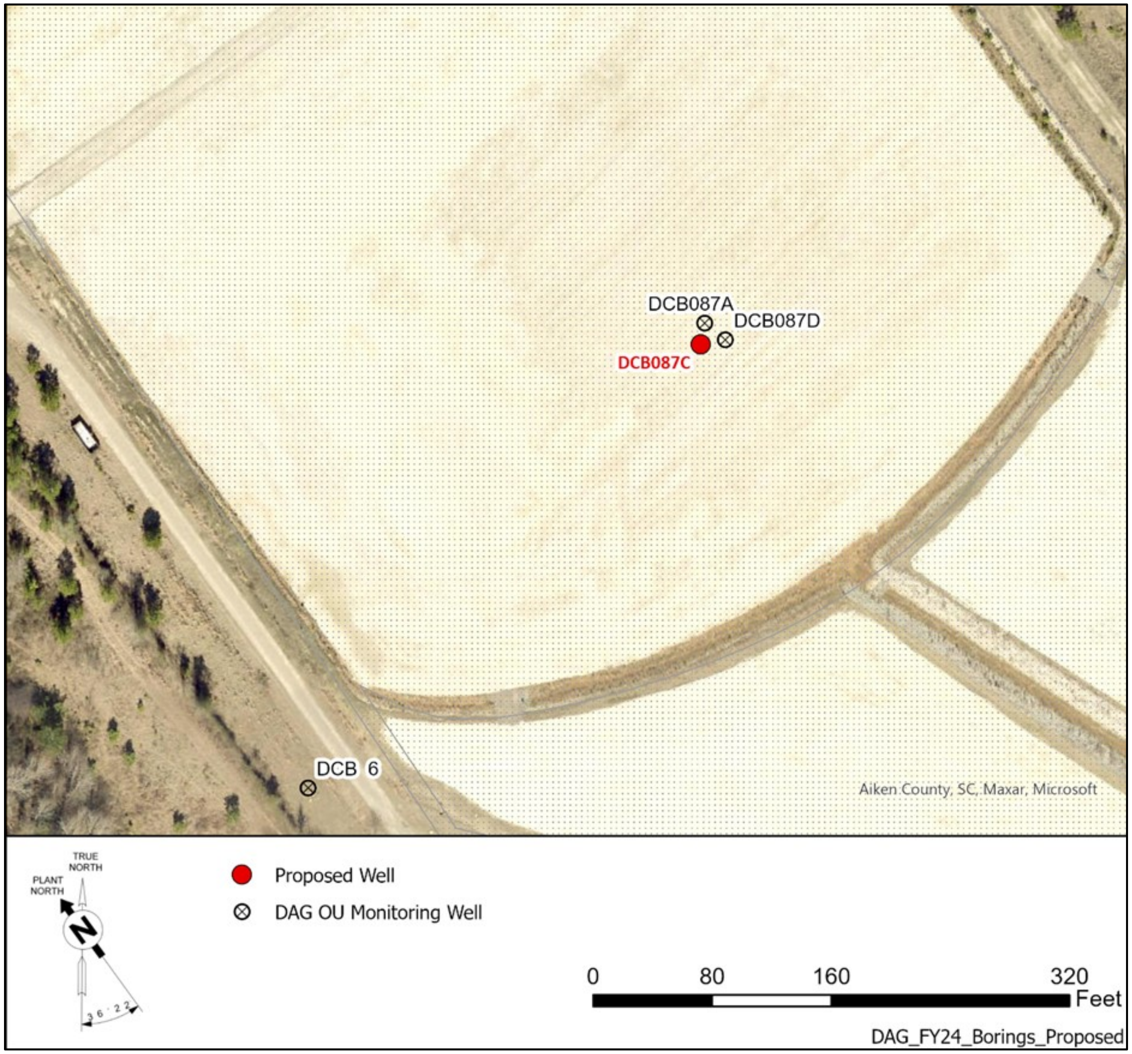

Figure 13. **Proposed 484-17D DCSA Groundwater Monitoring Well Location**

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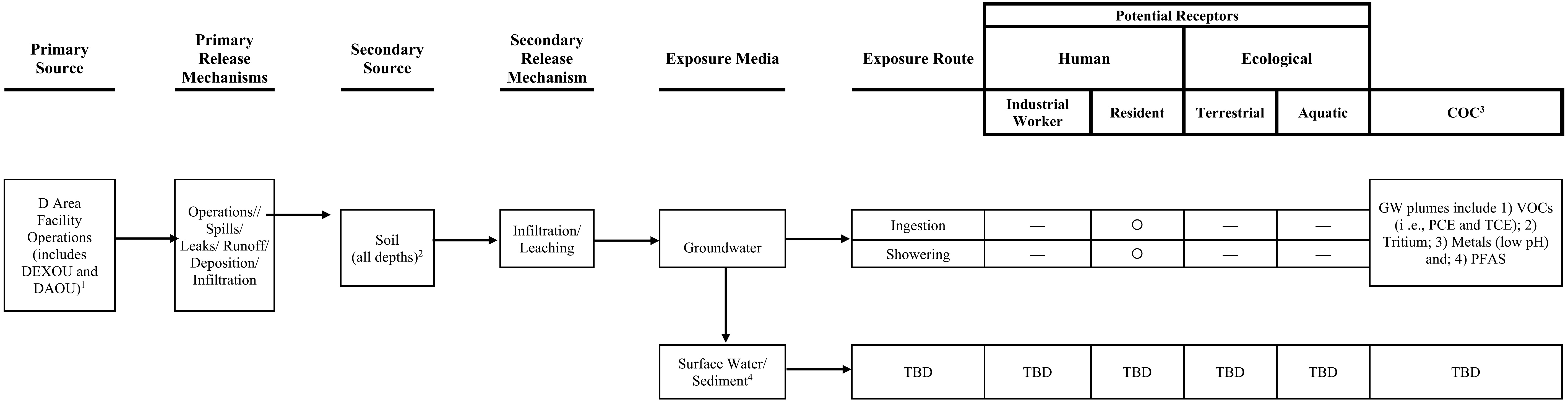
Preliminary Conceptual Site Model for the D-Area Groundwater Operable Unit



Exposure Media	Exposure Route	Industrial Worker	Resident	Terrestrial	Aquatic	COC[3]
Groundwater	Ingestion	—	○	—	—	GW plumes include 1) VOCs (i .e., PCE and TCE); 2) Tritium; 3) Metals (low pH) and; 4) PFAS
	Showering	—	○	—	—	
Surface Water/ Sediment[4]	TBD	TBD	TBD	TBD	TBD	TBD

→	Pathways: current, historic, and/or future.
○	Complete exposure pathway for qualitative evaluation, (i.e., comparison to MCLs).
—	Incomplete exposure pathway.
1	Groundwater has been impacted by multiple sources within D Area, including subunits associated with the D-Area Expanded Operable Unit (DEXOU) and the D-Area Operable Unit (DAOU). Primary sources include 488-D Ash Basin, D-Area Coal Storage Area (484-17D), D- Area Coal Pile Runoff Basin (489-D), D-Area Rubble Pit (431-2D), D-Area Heavy Water Facility (411-D, 412-D and 413-D), 420-2D Heavy Water Rework Facility, 421-2D Moderator Handling and Storage Building, Fire Training Area (411-1D/411-3D) and the Gasoline Station (715-D).
2	Surface, subsurface and deep soils either have been or will be addressed as subunits of the DEXOU and/or the DAOU and are not part of the DAG OU. Detailed CSMs are provided in the appropriate OU documentation.
3	Although a formal RFI/RI/BRA has not been performed, four distinct groundwater plumes have been identified for the DAG OU.
4	Surface water and/or sediment data to be formally evaluated in the Savannah River and Floodplain Swamp IOU.
TBD	To Be Determined

Figure 14. Conceptual Site Model

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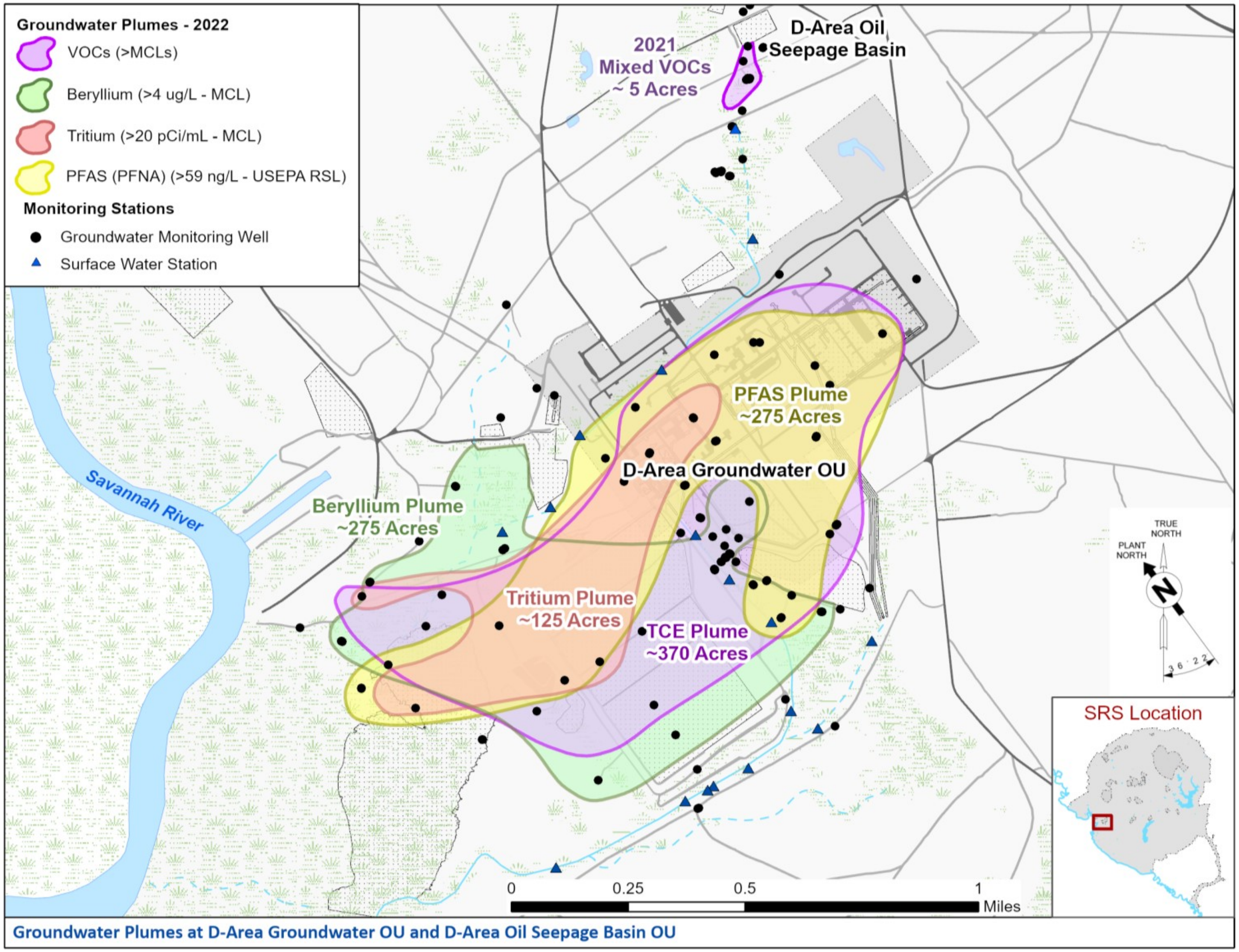

Figure 15. D-Area Groundwater Plumes (2022)

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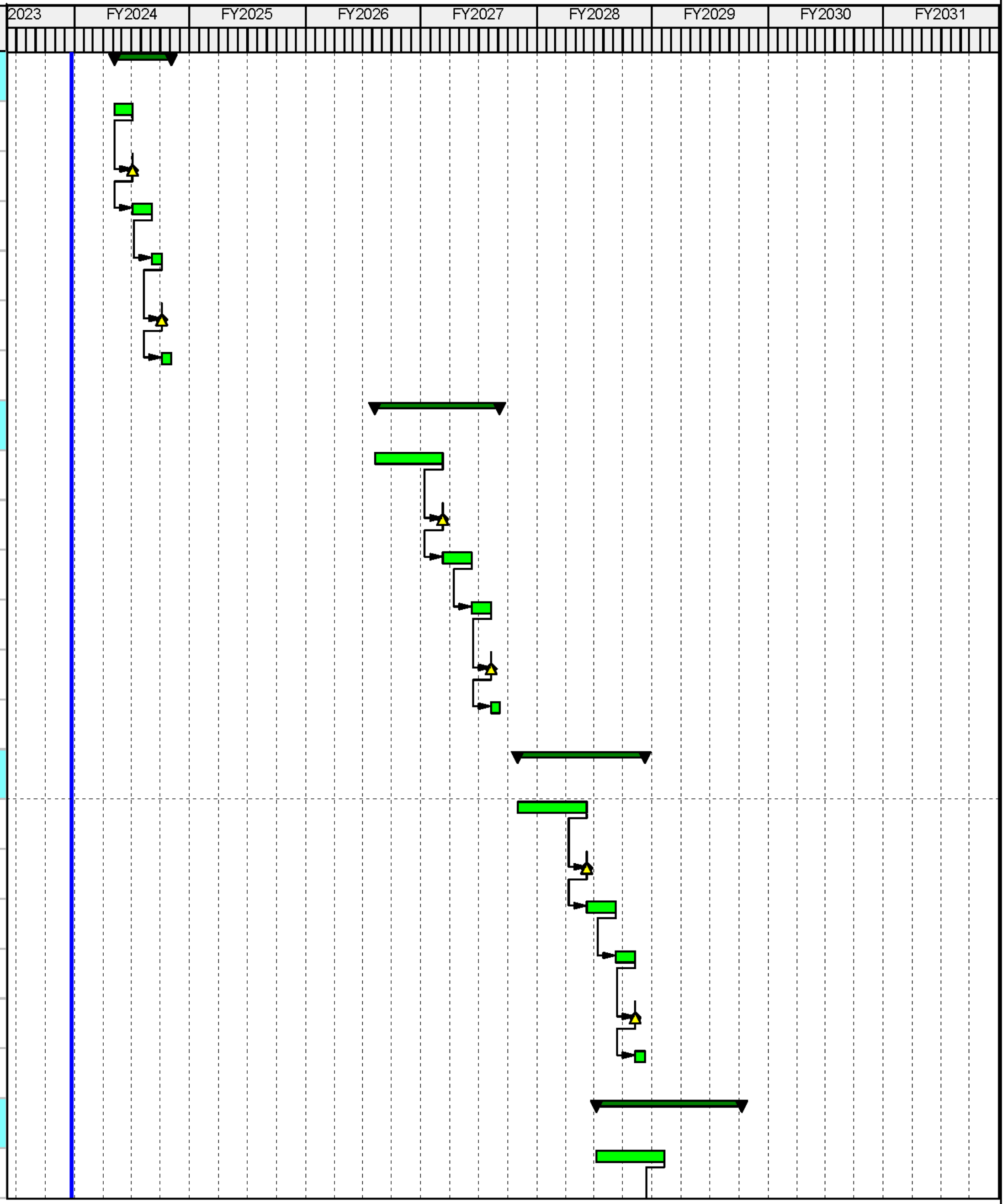
#	Activity ID	Activity Name	Original Duration	Start	Finish
1	**1- Workplan Addendum**		100d	5-Feb-2024	2-Aug-2024
2	WRKPLNA10	Develop D-Area Groundwater OU Revision 0 SAP / RFI / RI Work Plan Addendum	34d	5-Feb-2024*	4-Apr-2024
3	WRKPLNA20	D-Area Groundwater OU Revision 0 SAP / RFI / RI Work Plan Addendum Submittal	0d		4-Apr-2024
4	WRKPLNA30	EPA/SCDHEC Review Revision 0 SAP / RFI / RI Work Plan Addendum	60d	5-Apr-2024	3-Jun-2024
5	WRKPLNA40	SRS Incorporate EPA/SCDHEC Comments	30d	4-Jun-2024	3-Jul-2024
6	WRKPLNA50	SRS Submit Rev. 1 SAP / RFI / RI Work Plan Addendum	0d		3-Jul-2024
7	WRKPLNA60	EPA/SCDHEC Final Review & Approval of Rev. 1 SAP / RFI / RI Work Plan Addendum	30d	4-Jul-2024	2-Aug-2024
8	**3 - RFI / RI / BRA Report**		215d	7-May-2026	8-Jun-2027
9	DAGWOU07190	Develop D-Area Groundwater OU Revision 0 RFI/RI / BRA	120d	7-May-2026*	10-Dec-2026
10	DAGWOU07200	D-Area Groundwater OU Revision 0 RFI / RI / BRA Submittal	0d		10-Dec-2026
11	DAGWOU07210	EPA/SCDHEC Review Revision 0 RFI / RI / BRA	90d	11-Dec-2026	10-Mar-2027
12	DAGWOU07220	SRS Incorporate EPA/SCDHEC Comments	60d	11-Mar-2027	9-May-2027
13	DAGWOU07230	SRS Submit Rev. 1 RFI / RI / BRA	0d		9-May-2027
14	DAGWOU07240	EPA/SCDHEC Final Review & Approval of Rev. 1 RFI / RI / BRA	30d	10-May-2027	8-Jun-2027
15	**4- CMS / FS Report**		220d	2-Aug-2027	7-Sep-2028
16	DAGWOU07260	Develop D-Area Groundwater OU Revision 0 CMS/FS	120d	2-Aug-2027*	9-Mar-2028
17	DAGWOU07280	D-Area Groundwater OU Revision 0 CMS/FS Submittal	0d		9-Mar-2028
18	DAGWOU07290	EPA/SCDHEC Review Revision 0 CMS/FS	90d	10-Mar-2028	7-Jun-2028
19	DAGWOU07300	SRS Incorporate EPA/SCDHEC Comments	60d	8-Jun-2028	6-Aug-2028
20	DAGWOU07310	SRS Submit Rev. 1 CMS/FS	0d		6-Aug-2028
21	DAGWOU07320	EPA/SCDHEC Final Review & Approval of Rev. 1 CMS/FS	30d	9-Aug-2028	7-Sep-2028
22	**5 - Statement of Basis/Proposed Plan (SB/PP)**		248d	10-Apr-2028	10-Jul-2029
23	DAGWOU07340	Develop D-Area Groundwater OU Revision 0 SB/PP	120d	10-Apr-2028*	9-Nov-2028



▬ Remaining Level of Effort	◆ Milestone	▼▬▼ Summary
▬ Actual Level of Effort	🟩 Remaining Work	
🟩 Actual Work	■ % Complete	
■ Actual Work Crit	△ Baseline Milestone	

D - Area Groundwater OU Implementation Schedule 1_24_2024

Page 1 of 2 6-Feb-2024

Figure 16. Implementation Schedule for the DAG OU

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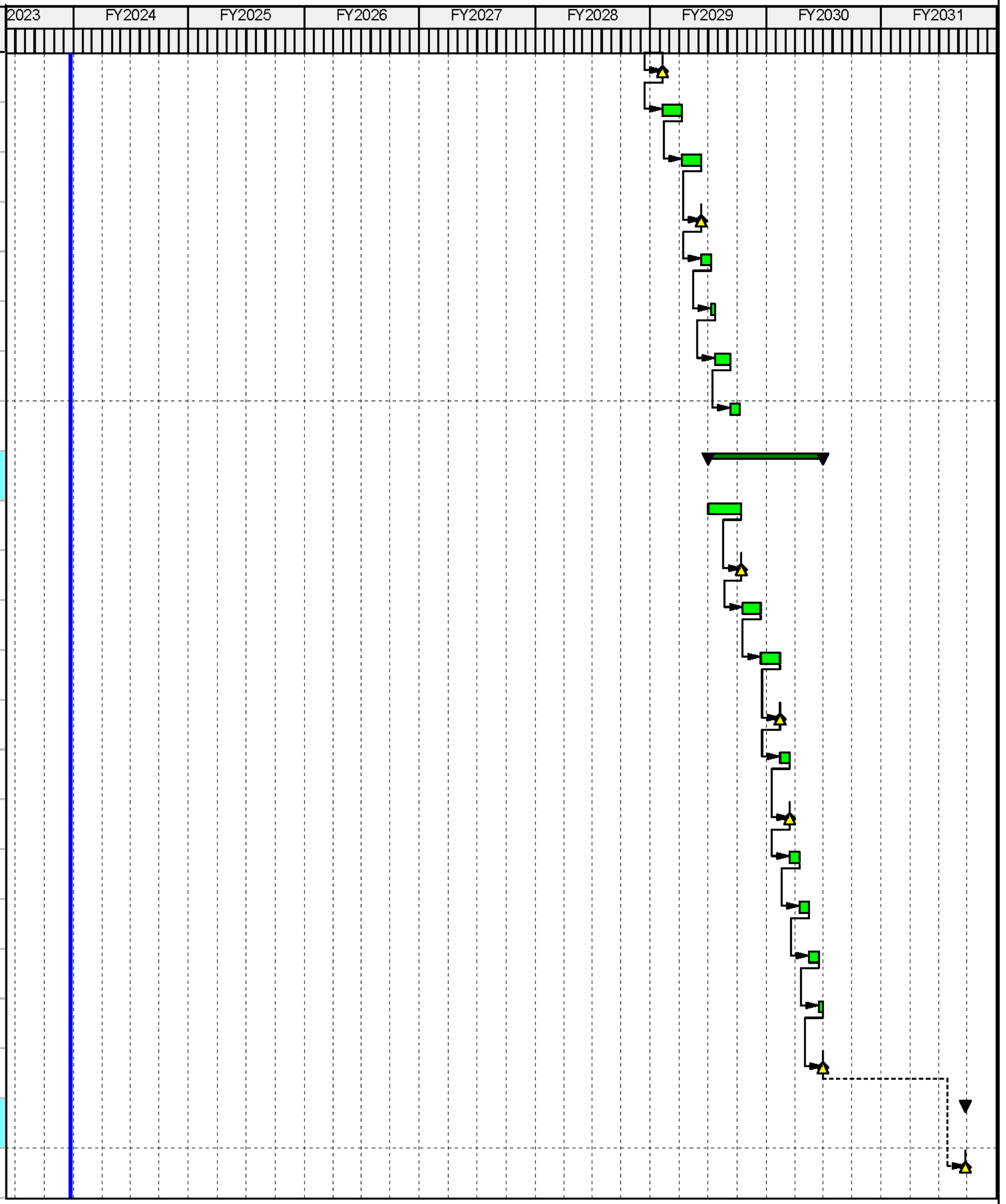
#	Activity ID	Activity Name	Original Duration	Start	Finish
24	DAGWOU07360	D-Area Groundwater OU Revision 0 SB/PP Submittal	0d		9-Nov-2028
25	DAGWOU07370	EPA/SCDHEC Review Revision 0 SB/PP	60d	10-Nov-2028	8-Jan-2029
26	DAGWOU07380	SRS Incorporate EPA/SCDHEC Comments	60d	9-Jan-2029	9-Mar-2029
27	DAGWOU07390	SRS Submit Rev. 1 SB/PP	0d		9-Mar-2029
28	DAGWOU07400	EPA/SCDHEC Final Review & Approval of Rev. 1 SB/PP	30d	10-Mar-2029*	8-Apr-2029
29	DAGWOU07410	Notification of Public Comment Proposed Plan	14d	9-Apr-2029	22-Apr-2029
30	DAGWOU07420	Public Comment Period	48d	23-Apr-2029	9-Jun-2029
31	DAGWOU07430	Develop Responsiveness Summary	29d	12-Jun-2029	10-Jul-2029
32	**6- ROD**		198d	2-Apr-2029	29-Mar-2030
33	DAGWOU07440	Develop D-Area Groundwater OU Revision 0 ROD	60d	2-Apr-2029*	17-Jul-2029
34	DAGWOU07450	D-Area Groundwater OU Revision 0 ROD Submittal	0d		17-Jul-2029
35	DAGWOU07460	EPA/SCDHEC Review of ROD (Rev.0)	60d	18-Jul-2029	15-Sep-2029
36	DAGWOU07470	SRS Incorporate EPA/SCDHEC Comments	60d	16-Sep-2029	14-Nov-2029
37	DAGWOU07480	Submit ROD (Rev.1) to EPA/SCDHEC	0d		14-Nov-2029
38	DAGWOU07490	EPA/SCDHEC Final Review/Approval	30d	15-Nov-2029	14-Dec-2029
39	DAGWOU07500	Approval of ROD	0d		14-Dec-2029
40	DAGWOU07510	DOE Obtain Signature on ROD	30d	16-Dec-2029	14-Jan-2030
41	DAGWOU07520	SCDHEC obtain Signature on ROD	30d	15-Jan-2030	13-Feb-2030
42	DAGWOU07530	EPA obtain Signature on ROD	30d	14-Feb-2030	15-Mar-2030
43	DAGWOU07540	Prepare Public Notice	14d	16-Mar-2030	29-Mar-2030
44	DAGWOU07550	Issue ROD	0d		29-Mar-2030
45	**7 - RA Start**		0d	22-Jun-2031	22-Jun-2031
46	RASTART20	D-Area Groundwater OU Remedial Action Start	0d		22-Jun-2031*



Remaining Level of Effort ◆ ◆ Milestone
Actual Level of Effort 🟩 Remaining Work
Actual Work ▬ % Complete
Actual Work Crit △ △ Baseline Milestone
Summary

D - Area Groundwater OU Implementation Schedule 1_24_2024

Page 2 of 2 6-Feb-2024

Figure 16. Implementation Schedule for the DAG OU *(Continued/End)*

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Table 1. DAG OU Boring and Monitoring Well Proposed Sample Stations and Samples

Station ID	Station Type	Aquifer	Longitude (UTM Zone 17 - NAD 27)	Latitude (UTM Zone 17 - NAD 27)	Screen Zone *(ft bgs)*		Ground Elevation	Reference Elevation	Total Depth *(f bgst)*	VOCs		Tritium	Metals	Sulfate	PFAS	
					Top Depth	Bottom Depth				GW	Soil				GW	Soil
DBR-003	Boring	UTRA	-81°44'5.33"	33°12'21.45"	--	--	147.31	--	70							X
DBR-004	Boring	UTRA	-81°44'5.34"	33°12'21.65"	--	--	147.59	--	20							X
DBR-005	Boring	UTRA	-81°44'5.17"	33°12'21.11"	--	--	147.44	--	20							X
DBR-006	Boring	UTRA	-81°44'5.58"	33°12'22.02"	--	--	147.48	--	70							X
DBR-007	Boring	UTRA	-81°44'5.61"	33°12'21.88"	--	--	147.48	--	20							X
DBR-008	Boring	UTRA	-81°44'5.98"	33°12'22.32"	--	--	148.31	--	20							X
DBR-009	Boring	UTRA	-81°44'6.19"	33°12'22.30"	--	--	147.47	--	20							X
DBR-010	Boring	UTRA	-81°44'6.01"	33°12'21.85"	--	--	147.63	--	20							X
DBR-011	Boring	UTRA	-81°44'6.48"	33°12'22.43"	--	--	146.22	--	20							X
DBR-012	Boring	UTRA	-81°44'15.85"	33°12'21.86"	--	--	144.01	--	70		X					X
DBR-013	Boring	UTRA	-81°44'15.62"	33°12'21.61"	--	--	143.82	--	20							X
DBR-014	Boring	UTRA	-81°44'15.51"	33°12'21.25"	--	--	140.26	--	20							X
DBR-015	Boring	UTRA	-81°44'15.43"	33°12'21.93"	--	--	144.81	--	20		X					X
DBR-016	Boring	UTRA	-81°44'16.08"	33°12'22.90"	--	--	145.39	--	10		X					X
DCB087C	Monitoring Well	UTRA	-81°44'16.47"	33°12'3.94"	58	68	131.07	TBD	70	X		X	X	X	X	

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Table 2. Potential ARARs and TBC Criteria for the DAG OU

ARAR/TBC	Type	Applicability
Federal		
Atomic Energy Act	Action/chemical-specific	Radioactive Waste
Resource Conservation and Recovery Act	Action/chemical-specific	Treatment, storage, and disposal of hazardous waste
Clean Air Act	Action/chemical-specific	Potential releases to air from units
Safe Drinking Water Act	Chemical-specific	MCLs and MCL goals
Clean Water Act	Action/chemical-specific	Discharge limitations
Toxic Substances Control Act	Action/chemical-specific	Potentially applicable if specific constituents are determined to be present
Federal Insecticide, Fungicide, and Rodenticide Control Act	Chemical-specific	Potentially applicable if specific pesticides are determined to be present
USDOE Orders	Action-specific	Treatment, storage, and disposal of hazardous and radioactive wastes
State		
SC Pollution Control Act	Action -specific	Potential releases to surface water, groundwater, air, or soil
SC Wastewater Regulations	Chemical-specific	Discharge limitations
SC Drinking Water Regulations	Chemical-specific	MCLs and MCL goals
SC Hazardous Waste Management Regulations	Action -specific	Treatment, storage, and disposal of hazardous and radioactive wastes
SC Air Pollution Control Regulations	Action-specific	Potential releases to air
SC Water Classification Standards	Chemical/location-specific	Surface water and groundwater classification
SC Well Standards	Action-specific	Well construction requirements

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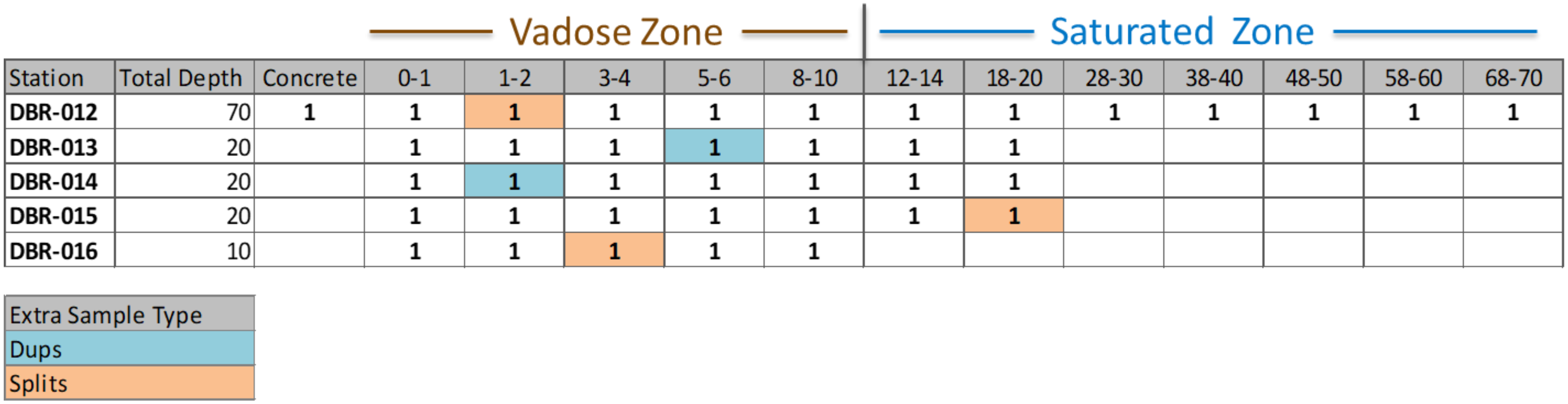
Table 3. Proposed FFTA PFAS Soil Samples

			Vadose Zone					Saturated Zone						
Station	Total Depth	Concrete	0-1	1-2	3-4	5-6	8-10	12-14	18-20	28-30	38-40	48-50	58-60	68-70
DBR-003	70	🟦 **1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
DBR-004	20		**1**	**1**	**1**	🟦 **1**	**1**	**1**	**1**					
DBR-005	20		**1**	**1**	**1**	**1**	**1**	🟧 **1**	**1**					
DBR-006	70	🟧 **1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
DBR-007	20		**1**	**1**	🟦 **1**	**1**	**1**	**1**	**1**					
DBR-008	20	**1**	🟦 **1**	**1**	**1**	**1**	**1**	**1**	**1**					
DBR-009	20		**1**	**1**	**1**	**1**	🟧 **1**	**1**	**1**					
DBR-010	20		**1**	**1**	**1**	**1**	**1**	🟧 **1**	**1**					
DBR-011	20		**1**	**1**	**1**	**1**	**1**	**1**	🟦 **1**					

Extra Sample Type
🟦 Dups
🟧 Splits

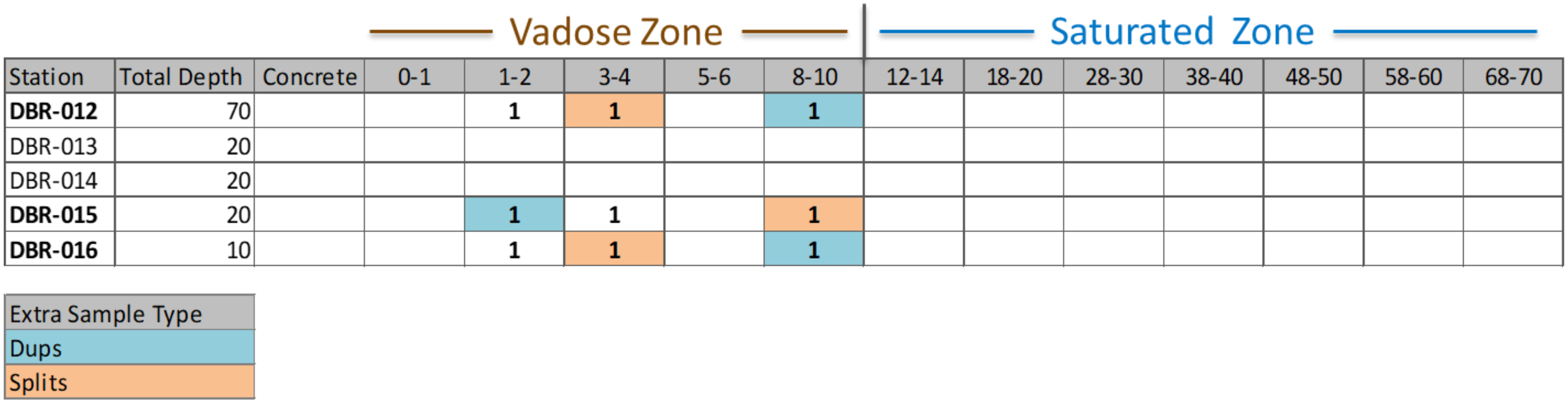
Table 4. Proposed 715-D Gasoline Station PFAS Soil Samples



			Vadose Zone					Saturated Zone						
Station	Total Depth	Concrete	0-1	1-2	3-4	5-6	8-10	12-14	18-20	28-30	38-40	48-50	58-60	68-70
DBR-012	70	**1**	**1**	**1** 🟧	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
DBR-013	20		**1**	**1**	**1**	**1** 🟦	**1**	**1**	**1**					
DBR-014	20		**1**	**1** 🟦	**1**	**1**	**1**	**1**	**1**					
DBR-015	20		**1**	**1**	**1**	**1**	**1**	**1**	**1** 🟧					
DBR-016	10		**1**	**1**	**1** 🟧	**1**	**1**							

Extra Sample Type
🟦 Dups
🟧 Splits

Table 5. Proposed DSVE VOC Soil Samples



			Vadose Zone					Saturated Zone						
Station	Total Depth	Concrete	0-1	1-2	3-4	5-6	8-10	12-14	18-20	28-30	38-40	48-50	58-60	68-70
DBR-012	70			**1**	**1**		**1**							
DBR-013	20													
DBR-014	20													
DBR-015	20			**1**	**1**		**1**							
DBR-016	10			**1**	**1**		**1**							

Extra Sample Type
Dups
Splits

Table 6. Data Quality Objectives Worksheet for D-Area Groundwater Operable Unit - Primary Source Material

Primary Sources	Probable Condition	Exposure Pathway and/or Release Mechanism	Data Needs and DQOs Including Engineering/Physical Processes	Field Activities including Removal and Characterization	Parameters	Potential Remedial Action Alternative
• Gasoline Station (715-D) • Fire Training Area (411-1D/411-3D)	Existing data show PFAS contamination in groundwater. Concrete could be contaminated at levels that pose a CM risk to soil and groundwater.	Exposure pathways within these source areas have been or will be addressed independently. PFAS has not yet been fully investigated. PFAS and VOCs may still pose a CM risk to groundwater.	Provide data on the amount of concrete contamination to determine if CM risks to soil and groundwater exist.	Concrete sampling.	Definitive-level PFAS suite (method EPA 1633).	Potential DAOU Removal Action or Final Action for PFAS.

Table 7. Data Quality Objectives Worksheet for D-Area Groundwater Operable Unit - Secondary Source Material

Secondary Sources	Probable Condition	Exposure Pathway and/or Release Mechanism	Data Needs and DQOs including Engineering/Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternative
• Soils within and adjacent to the: • Gasoline Station (715-D) • Fire Training Area (411-1D/411-3D)	Based on existing data, VOCs and PFAS have migrated into the subsurface from multiple source areas.	Exposure pathways within these source areas for VOCs were addressed independently under separate remedial investigations. PFAS has not yet been fully investigated. PFAS and VOCs may still pose a CM risk to groundwater.	Provide data on the amount of soil contamination to determine if CM risks to groundwater exist.	Soil cores	Definitive-level soil VOC suite, PFAS suite.	Ongoing SVE Operation for VOCs Potential DAOU Removal Action or Final Action for PFAS

Table 8. Data Quality Objectives Worksheet for D-Area Groundwater Operable Unit – Groundwater Pathway (Media)

Primary Sources	Probable Condition	Exposure Pathway and/or Release Mechanism	Data Needs and DQOs including Engineering/Physical Processes	Field Activities including Removal and Characterization	Parameters	Potential Remedial Action Alternative
• Groundwater	Contamination of groundwater from leaching and spills from primary sources. Contaminated groundwater exists. Plume commingled. Slow groundwater flow rates. Varying subsurface groundwater flow resulting in multiple plumes. Contaminated groundwater discharging into Beaver Creek and D-Area Discharge Canal.	Release mechanism is infiltration/leaching from soil	Primary sources inside D Area facilities that have contributed to tritium, TCE, pH/metals, and PFAS plumes have been identified and have been or will be addressed under separate actions. Provide data on extent of tritium, TCE, pH/metals, and PFAS contamination. Groundwater analyses to determine location, concentration, and plume geometry.	Install new monitoring well. Collect groundwater samples and analyze for VOCs, metals, tritium, and PFAS.	VOC suite, pH, metals, sulfate, tritium, and PFAS data for water samples collected from new monitoring well.	Alternatives include: monitored natural attenuation with LUCs, phytoremediation (tritium), targeted bioremediation (VOCs), and pH adjustment (pH/metals), PFAS reduction by carbon treatment; resin capsulation, etc (or other emerging remediation technologies), and groundwater and surface water monitoring

Table 9. Laboratory Analytical Specifications Table for Analytes for Groundwater Media

Analyte	Analyte ID	Preparation Method [B]	Analytical Method [B]	CRDL [A] *(µg/L)*
Metals				
ALUMINUM	7429-90-5	3005A	EPA6020B	20
ANTIMONY	7440-36-0	3005A	EPA6020B	6
ARSENIC	7440-38-2	3005A	EPA6020B	50
BARIUM	7440-39-3	3005A	EPA6020B	4
BERYLLIUM	7440-41-7	3005A	EPA6020B	0.6
CADMIUM	7440-43-9	3005A	EPA6020B	8
CALCIUM	7440-70-2	3005A	EPA6020B	10
CHROMIUM	7440-47-3	3005A	EPA6020B	14
COBALT	7440-48-4	3005A	EPA6020B	14
COPPER	7440-50-8	3005A	EPA6020B	12
IRON	7439-89-6	3005A	EPA6020B	4
LEAD	7439-92-1	3005A	EPA6020B	8
MAGNESIUM	7439-95-4	3005A	EPA6020B	2
MANGANESE	7439-96-5	3005A	EPA6020B	2
NICKEL	7440-02-0	3005A	EPA6020B	10
POTASSIUM	7440-09-7	3005A	EPA6020B	86.5
SELENIUM	7782-49-2	3005A	EPA6020B	150
SILVER	7440-22-4	3005A	EPA6020B	10
SODIUM	7440-23-5	3005A	EPA6020B	10
THALLIUM	7440-28-0	3005A	EPA6020B	2
VANADIUM	7440-62-2	3005A	EPA6020B	16
ZINC	7440-66-6	3005A	EPA6020B	4
URANIUM	7440-61-1	3005A	EPA6020B	30
TOTAL MERCURY	7439-97-6	7470A	EPA7470A	0.4
SULFATE	14808-79-8	NA	EPA9056A	1,000
Volatiles				
TETRACHLOROETHYLENE (PCE)	127-18-4	NA	EPA8260D	1
TRICHLOROETHYLENE (TCE)	79-01-6	NA	EPA8260D	1
1,1-DICHLOROETHYLENE	75-35-4	NA	EPA8260D	1
CIS-1,2-DICHLOROETHYLENE	156-59-2	NA	EPA8260D	1
TRANS-1,2-DICHLOROETHYLENE	156-60-5	NA	EPA8260D	1
CHLOROETHENE (VINYL CHLORIDE)	75-01-4	NA	EPA8260D	2
Radionuclides				
Tritium	10028-17-8	EPA900.0MOD	EPA900.0MOD	15 (pCi/mL)

A) CRDL is the Contract Required Detection Limit and is not always attainable.
B) Extraction and preparation methods differ depending upon media, concentration, instrument, laboratory, and analytical method. Preparation methods will also influence detection limits.
C) Laboratory instructed to obtain the lowest possible method detection limit.

Table 9. Laboratory Analytical Specifications Table for Analytes for Groundwater Media *(Continued)*

Analyte	Analyte ID	Preparation Method B	Analytical Method^B	CRDL *(ng/L)*^{A}
PFAS				
PERFLUOROOCTANOIC ACID (PFOA)	335-67-1	1633	EPA1633	0.21
PERFLUOROOCTANE SULFONATE (PFOS)	1763-23-1	1633	EPA1633	0.25
11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID	763051-92-9	1633	EPA1633	0.87
4,8-DIOXA-3H-PERFLUORONONANOIC ACID	919005-14-4	1633	EPA1633	0.66
9-CHLOROHEXADECAFLUORO-3-OXANONE-1-SULFONIC ACID	756426-58-1	1633	EPA1633	0.67
HEXAFLUOROPROPYLENE OXIDE DIMER ACID	13252-13-6	1633	EPA1633	0.99
N-ETHYLPERFLUORO-1-OCTANESULFONAMIDOACETIC ACID	2991-50-6	1633	EPA1633	0.29
N-METHYLPERFLUORO-1-OCTANESULFONAMIDOACETIC ACID	2355-31-9	1633	EPA1633	0.29
PERFLUOROBUTANESULFONIC ACID	375-73-5	1633	EPA1633	0.09
Perfluorodecanoic acid	335-76-2	1633	EPA1633	0.14
Perfluorododecanoic acid	307-55-1	1633	EPA1633	0.11
PERFLUOROHEPTANOIC ACID	375-85-9	1633	EPA1633	0.21
PERFLUOROHEXANESULFONIC ACID	355-46-4	1633	EPA1633	0.18
PERFLUOROHEXANOIC ACID	307-24-4	1633	EPA1633	0.14
PERFLUORONONANOIC ACID	375-95-1	1633	EPA1633	0.10
PERFLUOROTETRADECANOIC ACID	376-06-7	1633	EPA1633	0.27
PERFLUOROTRIDECANOIC ACID	72629-94-8	1633	EPA1633	0.19
Perfluoroundecanoic acid	2058-94-8	1633	EPA1633	0.25
PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID	113507-82-7	1633	EPA1633	0.36
NONAFLUORO-3,6-DIOXAHEPTANOIC ACID	151772-58-6	1633	EPA1633	0.58
PERFLUORO-N-PENTANOIC ACID	2706-90-3	1633	EPA1633	0.18
PERFLUORO-1-PENTANESULFONIC ACID	2706-91-4	1633	EPA1633	0.26
1H, 1H, 2H, 2H-PERFLUOROOCTANE SULFONIC ACID	27619-97-2	1633	EPA1633	2.02

A) CRDL is the Contract Required Detection Limit and is not always attainable.
B) Extraction and preparation methods differ depending upon media, concentration, instrument, laboratory, and analytical method. Preparation methods will also influence detection limits.
C) Laboratory instructed to obtain the lowest possible method detection limit.

Table 9. Laboratory Analytical Specifications Table for Analytes for Groundwater Media *(Continued; End)*

Analyte	Analyte ID	Preparation Method [B]	Analytical Method[B]	CRDL *(ng/L)*[A]
PFAS (continued; end)				
PERFLUORO-N-BUTANOIC ACID	375-22-4	1633	EPA1633	0.51
PERFLUORO-1-HEPTANESULFONIC ACID	375-92-8	1633	EPA1633	0.19
PERFLUORO-3-METHOXYPROPANOIC ACID	377-73-1	1633	EPA1633	0.18
1H, 1H, 2H, 2H-PERFLUORODECANE SULFONIC ACID	39108-34-4	1633	EPA1633	0.61
1H,1H,2H,2H-PERFLUOROHEXANE SULFONIC ACID	757124-72-4	1633	EPA1633	0.40
PERFLUORO-4-METHOXYBUTANOIC ACID	863090-89-5	1633	EPA1633	0.39
N-ETHYL PERFLUOROOCTANE SULFONAMIDOETHANOL	1691-99-2	1633	EPA1633	0.61
N-METHYL PERFLUOROOCTANE SULFONAMIDOETHANOL	24448-09-7	1633	EPA1633	0.63
N-METHYLPERFLUORO-1-OCTANESULFONAMIDE	31506-32-8	1633	EPA1633	0.22
PERFLUORO-1-DECANESULFONIC ACID	335-77-3	1633	EPA1633	0.16
3-PERFLUOROPROPYL PROPANOIC ACID	356-02-5	1633	EPA1633	0.60
N-ETHYL PERFLUOROOCTANE SULFONAMIDE	4151-50-2	1633	EPA1633	0.13
PERFLUORO-1-NONANESULFONIC ACID	68259-12-1	1633	EPA1633	0.15
PERFLUORO-1-OCTANESULFONAMIDE	754-91-6	1633	EPA1633	0.20
PERFLUORODODECANESULFONIC ACID	79780-39-5	1633	EPA1633	0.15
3-PERFLUOROHEPTYL PROPANOIC ACID	812-70-4	1633	EPA1633	4.18
2H,2H,3H,3H-PERFLUOROOCTANOIC ACID	914637-49-3	1633	EPA1633	4.30

A) CRDL is the Contract Required Detection Limit and is not always attainable.
B) Extraction and preparation methods differ depending upon media, concentration, instrument, laboratory, and analytical method. Preparation methods will also influence detection limits.
C) Laboratory instructed to obtain the lowest possible method detection limit.

Table 10. Laboratory Analytical Specifications Table for Analytes for Soil Media

Analyte	Analyte ID	Preparation Method B	Analytical Method B	CRDL (μg/kg) A
PFAS				
PERFLUOROOCTANOIC ACID (PFOA)	335-67-1	1633	EPA1633	0.03
PERFLUOROOCTANE SULFONATE (PFOS)	1763-23-1	1633	EPA1633	0.02
11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID	763051-92-9	1633	EPA1633	0.23
4,8-DIOXA-3H-PERFLUORONONANOIC ACID	919005-14-4	1633	EPA1633	0.25
9-CHLOROHEXADECAFLUORO-3-OXANONE-1-SULFONIC ACID	756426-58-1	1633	EPA1633	0.33
HEXAFLUOROPROPYLENE OXIDE DIMER ACID	13252-13-6	1633	EPA1633	0.32
N-ETHYLPERFLUORO-1-OCTANESULFONAMIDOACETIC ACID	2991-50-6	1633	EPA1633	0.04
N-METHYLPERFLUORO-1-OCTANESULFONAMIDOACETIC ACID	2355-31-9	1633	EPA1633	0.04
PERFLUOROBUTANESULFONIC ACID	375-73-5	1633	EPA1633	0.02
Perfluorodecanoic acid	335-76-2	1633	EPA1633	0.03
Perfluorododecanoic acid	307-55-1	1633	EPA1633	0.03
PERFLUOROHEPTANOIC ACID	375-85-9	1633	EPA1633	0.03
PERFLUOROHEXANESULFONIC ACID	355-46-4	1633	EPA1633	0.02
PERFLUOROHEXANOIC ACID	307-24-4	1633	EPA1633	0.02
PERFLUORONONANOIC ACID	375-95-1	1633	EPA1633	0.03
PERFLUOROTETRADECANOIC ACID	376-06-7	1633	EPA1633	0.03
PERFLUOROTRIDECANOIC ACID	72629-94-8	1633	EPA1633	0.04
Perfluoroundecanoic acid	2058-94-8	1633	EPA1633	0.03
PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID	113507-82-7	1633	EPA1633	0.12
NONAFLUORO-3,6-DIOXAHEPTANOIC ACID	151772-58-6	1633	EPA1633	0.35
PERFLUORO-N-PENTANOIC ACID	2706-90-3	1633	EPA1633	0.04
PERFLUORO-1-PENTANESULFONIC ACID	2706-91-4	1633	EPA1633	0.02
1H, 1H, 2H, 2H-PERFLUOROOCTANE SULFONIC ACID	27619-97-2	1633	EPA1633	0.17

A) CRDL is the Contract Required Detection Limit and is not always attainable.
B) Extraction and preparation methods differ depending upon media, concentration, instrument, laboratory, and analytical method. Preparation methods will also influence detection limits.
C) Laboratory instructed to obtain the lowest possible method detection limit.

Table 10. Laboratory Analytical Specifications Table for Analytes for Soil Media *(Continued)*

Analyte	Analyte ID	Preparation Method B	Analytical Method^B	CRDL *(µg/kg)*^{A}
PFAS (Continued; End)				
PERFLUORO-N-BUTANOIC ACID	375-22-4	1633	EPA1633	0.10
PERFLUORO-1-HEPTANESULFONIC ACID	375-92-8	1633	EPA1633	0.03
PERFLUORO-3-METHOXYPROPANOIC ACID	377-73-1	1633	EPA1633	0.12
1H, 1H, 2H, 2H-PERFLUORODECANE SULFONIC ACID	39108-34-4	1633	EPA1633	0.08
1H,1H,2H,2H-PERFLUOROHEXANE SULFONIC ACID	757124-72-4	1633	EPA1633	0.10
PERFLUORO-4-METHOXYBUTANOIC ACID	863090-89-5	1633	EPA1633	0.11
N-ETHYL PERFLUOROOCTANE SULFONAMIDOETHANOL	1691-99-2	1633	EPA1633	0.29
N-METHYL PERFLUOROOCTANE SULFONAMIDOETHANOL	24448-09-7	1633	EPA1633	0.21
N-METHYLPERFLUORO-1-OCTANESULFONAMIDE	31506-32-8	1633	EPA1633	0.02
PERFLUORO-1-DECANESULFONIC ACID	335-77-3	1633	EPA1633	0.03
3-PERFLUOROPROPYL PROPANOIC ACID	356-02-5	1633	EPA1633	0.21
N-ETHYL PERFLUOROOCTANE SULFONAMIDE	4151-50-2	1633	EPA1633	0.03
PERFLUORO-1-NONANESULFONIC ACID	68259-12-1	1633	EPA1633	0.02
PERFLUORO-1-OCTANESULFONAMIDE	754-91-6	1633	EPA1633	0.01
PERFLUORODODECANESULFONIC ACID	79780-39-5	1633	EPA1633	0.02
3-PERFLUOROHEPTYL PROPANOIC ACID	812-70-4	1633	EPA1633	1.73
2H,2H,3H,3H-PERFLUOROOCTANOIC ACID	914637-49-3	1633	EPA1633	1.41

A) CRDL is the Contract Required Detection Limit and is not always attainable.
B) Extraction and preparation methods differ depending upon media, concentration, instrument, laboratory, and analytical method. Preparation methods will also influence detection limits.
C) Laboratory instructed to obtain the lowest possible method detection limit.

Table 10. Laboratory Analytical Specifications Table for Analytes for Soil Media *(Continued; End)*

Analyte	Analyte ID	Preparation Method [B]	Analytical Method[B]	CRDL *(µg/kg)*[A]
VOCs				
TETRACHLOROETHYLENE (PCE)	127-18-4	5035A	EPA8260B	1.42
TRICHLOROETHYLENE (TCE)	79-01-6	5035A	EPA8260B	1.37
1,1-DICHLOROETHYLENE	75-35-4	5035A	EPA8260B	0.05
CIS-1,2-DICHLOROETHYLENE	156-59-2	5035A	EPA8260B	4
TRANS-1,2-DICHLOROETHYLENE	156-60-5	5035A	EPA8260B	2
CHLOROETHENE (VINYL CHLORIDE)	75-01-4	5035A	EPA8260B	0.15

A) CRDL is the Contract Required Detection Limit and is not always attainable.
B) Extraction and preparation methods differ depending upon media, concentration, instrument, laboratory, and analytical method. Preparation methods will also influence detection limits.
C) Laboratory instructed to obtain the lowest possible method detection limit.

Table 11. Minimum Field Quality Control/Quality Assurance Sampling Requirements

Data Quality Level	Field Quality Control/Quality Assurance Samples	Frequency of Field Quality Control/ Quality Assurance Sample
UU	None	
VU	None	
VV	Co-located Field Duplicate	Minimum 5%[1]
	Trip Blank	Minimum 1 per cooler
	Equipment Blank	1 per 40 samples[2]
	Field Blank	Optional; 1 per 40 samples[3]
	Split Sample	Minimum 5%
SD	Co-located Field Duplicate	Minimum 5%[1]
	Trip Blank	1 per cooler
	Equipment Blank	1 per 40 samples[2]
	Field Blank	Optional; 1 per 40 samples[3]
	Split Sample	Minimum 5%
D	Co-located Field Duplicate	Minimum 5%[1]
	Trip Blank	1 per cooler
	Equipment Blank	1 per 40 samples[2]
	Field Blank	Optional; 1 per 40 samples[3]
	Split Sample	Minimum 5%

Data Quality Levels

UU Data	Unverified and Unvalidated Data (no errors from ERDMs database loading screens)
VU Data	Verified and Unvalidated Data (includes missing data checks)
VV Data	Verified and Validated Data (validated to automated criteria; equivalent to USEPA Screening Level Data)
SD Data	USEPA Screening Level Data with 10% Definitive Confirmation
D Data	USEPA Definitive Level Data

Footnotes:

[1] Minimum frequency established per ER-SOP-043
[2] Typical frequency
[3] Recommended based on project needs; typical frequency

Table 12. Preservatives, Holding Times, and Sample Containers

Parameter	Preservatives	Hold Times	Containers
Volatiles Method (Water)	Cool 6°C to 0°C, no chemical preservative, without headspace, 40-mL septum cap vial, G	7 Days	3 X 40 mL Vial, Zero headspace/COLD
ICP-MS Metals (Water)	HNO3 to pH < 2, G (not for boron or silica), P	180 Days	1 X 500 mL HDPE, HNO3
Tritium	G	180 Days	1 X 250 mL amber glass, NONE
Mercury, total recoverable (Water)	HNO3 to pH < 2, P, G	28 Days	1 X 125 mL HDPE, HNO3
Sulfate (Water)	Cool 6°C to 0°C, P, G	28 Days	1 X 125 mL HDPE, COLD
PFAS (Water)	Cool 0-6°C OR ≤ -20°C	28 Days	2 X 500 ML & 1 X 125 ML HDPE, NONE
Volatiles Method (Soil)	5 mL reagent water + freeze to <0°C within 48 hours, G. High level samples may use only methanol with cooling	14 Days	4 X 40 mL VOA Vials; 3Clear/1EMPTY, 2 (Water)/ 1(MeOH)/Frozen
PFAS (Soil)	Cool 0-6°C OR ≤ -20°C	90 Days	1 X 125 ml HDPE, COLD

P = Polyethylene, G = Glass, NDM = Not determined for this matrix, NR = None required