FINAL
Site Inspection Report
Allendale Armory
Allendale, South Carolina

Site Inspection for Perfluorooctanoic acid (PFOA), Perfluorooctanesulfonic acid (PFOS), Perfluorohexanesulfonic acid (PFHxS), Perfluorononanoic acid (PFNA), Hexafluoropropylene oxide dimer acid (HFPO-DA), and Perfluorobutanesulfonic acid (PFBS) at ARNG Installations, Nationwide

August 2023

Prepared for:

Army National Guard Bureau
111 S. George Mason Drive
Arlington, VA 22204

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DoD	Department of Defense
DPT	direct push technology
DQO	data quality objective
DUA	data usability assessment
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FedEx	Federal Express
FEMA	Federal Emergency Management Agency
GPRS	Ground Penetrating Radar Systems
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
MIL-SPEC	military specification
MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride

QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
SCARNG	South Carolina Army National Guard
SCDHEC	South Carolina Department of Health and Environment Control
SCDNR	South Carolina Department of Natural Resources
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TOC	total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

Executive Summary

The Army National Guard (ARNG) G-9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS). These compounds are collectively referred to as "relevant compounds" throughout the document and the applicable screening levels (SLs) are provided in **Table ES-1**.

The PA identified one Area of Interest (AOI) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for the AOI location). The objective of the SI is to identify whether there has been a release to the environment from the AOI identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on SLs for relevant compounds. This SI was completed at the Allendale Armory in Allendale, South Carolina and determined further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for AOI 1: Maintenance Bay. Allendale Armory will also be referred to as the "facility" throughout this document.

Allendale Armory occupies approximately 3.8 acres in the City of Allendale, South Carolina. South Carolina ARNG (SCARNG) occupation of the facility's maintenance bay began in 1950, and the remaining property was purchased in 1957. The facility was previously home to the 264th and 268th Engineer Detachments (firefighting units), which moved around 2001 to 2003 from Allendale Armory to SCARNG's McCrady Training Center, where the units currently reside. The facility is currently used primarily as an armory but also for vehicle maintenance and administration.

The PA identified one AOI for investigation during the SI phase. SI sampling results from the AOI were compared to OSD SLs. **Table ES-2** summarizes the SI results for each AOI. Based on the results of this SI, further evaluation under CERCLA is warranted in a Remedial Investigation for AOI 1: Maintenance Bay.

[1] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table ES-1: Screening Levels (Soil and Groundwater)

Analyte[b]	Residential (Soil) (µg/kg)[a] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a]
PFOA	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter

a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.

b.) Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table ES-2: Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Maintenance Bay	◐	●	●	Proceed to RI

Legend:
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum will be referred to as "relevant compounds" throughout this document and include perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS) at ARNG facilities nationwide. The ARNG performed this SI at the Allendale Armory in Allendale, South Carolina. The Allendale Armory is also referred to as the "facility" throughout this document.

The SI project elements were performed in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; United States [US] Environmental Protection Agency [USEPA], 1980), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300; USEPA, 1994), and in compliance with US Department of the Army (DA) requirements and guidance for field investigations.

1.2 SI Purpose

A PA was performed at Allendale Armory (AECOM Technical Services, Inc. [AECOM], 2020) that identified one Area of Interest (AOI) where PFAS-containing materials may have been used, stored, disposed, or released historically. The objective of the SI is to identify whether there has been a release to the environment from the AOI identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

[1] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

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2. Facility Background

2.1 Facility Location and Description

The facility is a South Carolina ARNG (SCARNG) armory that occupies approximately 3.8 acres in the City of Allendale, South Carolina (**Figure 2-1**). The facility address is 368 Courthouse Square, Allendale, South Carolina 29810. SCARNG occupation of the facility's vehicle maintenance bay began in 1950 (Environmental Resources Center, 2009), and the remaining property was purchased in 1957 from Lucy Vance D. McCrady and Claudio D. Todd on behalf of Lucy O'H. Darlington.

The main armory building was constructed in 1959 (Environmental Resources Center, 2009). Renovations to expand the main armory building were completed in 2014; the Federal Emergency Management Agency (FEMA) and the Allendale County Fire and Rescue moved onto the property following completion of the renovations. According to SCARNG staff knowledge at the time of the PA, the FEMA and Allendale County Fire and Rescue properties are separately owned by Allendale County. However, a 2011 topographic map and boundary survey, provided by SCARNG, shows that portions of the Allendale County Fire and Rescue fire station falls within SCARNG property limits. The property boundary was subsequently updated after the PA report to include this area.

The facility was home to the 264th and 268th Engineer Detachments (firefighting units). According to interviewed SCARNG personnel, the two engineer detachments moved around 2001 to 2003 from Allendale Armory to SCARNG's McCrady Training Center, where the units currently reside. The facility is currently used by the SCARNG primarily as an armory but also for vehicle maintenance and administration.

2.2 Facility Environmental Setting

The facility lies near the Orangeburg Scarp, which marks the boundary between the Upper and Lower Coastal Plain and represents a paleoshoreline. The Lower Coastal Plain is characterized by flat topography and meandering streams, and the Upper Coastal Plain is characterized by hilly, dissected topography from stream erosion (Cain et al., 2000). The facility sits at an elevation of 189 feet above mean sea level along a north-south trending local topographic high, with gentle slopes to the east and west (**Figure 2-2**). Regionally, topography rises to the west of the facility and slopes gently to the east/northeast. The facility is primarily surrounded to the north and south by residential properties, with some commercial and light industrial areas. Light industrial areas are located to the west, and residential, commercial, and agricultural properties are located to the east.

2.2.1 Geology

The facility sits on the Atlantic Coastal Plain, a geologic province defined by passive continental margin Tertiary and Quaternary sedimentation. The coastal plain consists of a thick, eastward-dipping wedge of clastic and carbonate strata sourced from the Appalachian Mountains to the west (Katuna et al., 1997). These strata were deposited from the late Cretaceous to the present; with the type of coastal deposition being controlled by periodic sea level rise and fall over time (Cooke, 1936). Due to the facility's location along a paleoshoreline, deposits in the area are diverse, ranging from fine- to coarse-grained sands with lean clays and occasional limestone, all indicative of a lower delta plain to shallow marine shelf depositional environment (Denham, 1999) (**Figure 2-3**).

During the SI, silty sand and clayey sand were observed as the dominant lithology of the unconsolidated sediments below the Allendale Armory. The borings were completed at depths between 21 and 40 feet below ground surface (bgs). Isolated layers of sandy lean clay, lean clay, well-graded sand, and poorly-graded sand were also observed in the boring logs at thicknesses ranging from 1 to 9 feet. These facility observations are consistent with the reported lower delta plain to shallow marine shelf depositional environment of the region. Boring logs are presented in **Appendix E**. Samples for grain size analyses were collected at two locations, AOI01-03 and AA-02, and were analyzed via American Society for Testing and Materials (ASTM) Method D-422. Grain size results are pending from the laboratory and will be included in **Appendix F**, when received, in a later version of the SI Report.

2.2.2 Hydrogeology

The coastal plain has gently dipping layered aquifers separated by confining units. The water bearing units consist of unconsolidated sand and occasionally permeable limestone. The Floridan aquifer is the major aquifer under Allendale County. The Floridan aquifer is thick and made up of sands with small amounts of gravel and clay. The upper portion is the unconfined Upper Three Runs Aquifer, and the lower portion is the semi-confined to confined Gordon aquifer. These aquifers define up to 400 feet of the near-surface groundwater (Denham, 1999).

An Environmental Data Resources, Inc.™ report conducted a well search for a 1-mile radius surrounding the facility (AECOM, 2020). Using additional online resources, such as state and local Geographic Information System databases, wells were researched to a 4-mile radius of the facility. Numerous public water supply wells, domestic wells, and irrigation wells are located in the surrounding area within a 4-mile radius. The closest of each include a public supply well located approximately 0.25 miles northeast, a domestic well located 0.8 miles southeast, and an irrigation well located 0.3 miles south of the facility. The facility receives potable water from the Allendale Water Department. The Allendale Water Department sources its water from the public groundwater supply wells within four miles of the facility (South Carolina Department of Health and Environmental Control [SCDHEC] 2023, South Carolina Department of Natural Resources [SCDNR], 2023). According to information provided by SCDHEC, three public supply wells were sampled for PFAS in November 2022 and all samples were below the detection level of 2.0 ng/L. These wells are located upgradient and side-gradient of the facility and are therefore likely unaffected by potential contamination from the Allendale Armory. Additionally, the facility is connected to municipal sanitary sewer provided by the City of Allendale.

The facility is located near the convergence of three watersheds. The predominant topographic gradient of the larger area slopes from points of higher elevation west of the facility, down towards the east/northeast in the direction of Jackson Branch watershed. Groundwater features are presented on **Figure 2-3**.

Depths to water measured in March 2022 during the SI ranged from 5.33 to 8.21 feet bgs. Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate the groundwater flow direction at Allendale Armory is primarily to the northeast, with localized groundwater flow direction on the western side of the maintenance bay to the southwest. This groundwater flow divide is reflective of the facility's location near the convergence of three separate watersheds and the groundwater flow direction in the shallow surficial aquifer being influenced by the local topography.

The shallow, surficial aquifer at Allendale Armory appears to be semi-confined. The water table was encountered across a range of 17 to 35 ft bgs (17 to 22 ft bgs in the southeast portion of the facility; 27 to 35 ft bgs in the northern portion of the facility) during lithologic logging; however, as stated above, the depth to water measurements collected from the monitoring wells during the synoptic gauging ranged from 5.33 to 8.21 ft bgs. The difference between the potentiometric

surface elevation and the interpreted water table elevation ranged from approximately 11 to 28 ft indicating the wells are artesian. A clayey sand layer is consistently present above the water table in the northern area of the facility around AOI 1. The clayey sand unit ranges in thickness from approximately 15 ft to upwards of 20 ft and is interbedded with a silty sand layer typically 1 to 2-ft thick. The clayey sand transitions to a lean clay in the southeastern area of the facility near the Allendale County Fire and Rescue fire station and narrows in thickness and shallows in depth. It is likely the clay unit is acting as a semi-confining unit.

2.2.3 Hydrology

The facility is located primarily within the Duck Branch Watershed but is near the convergence of three watersheds: Duck Branch, Coosawhatchie River, and Jackson Branch. There is no ponding of water or wetlands present at the facility. The closest surface water feature to the facility is a small unnamed pond located 0.3 miles to the east. Stormwater drains surrounding the main armory building direct stormwater to an off-facility detention pond approximately 400 feet to the southeast. According to the 2011 topographic map and boundary survey, the detention pond outlet is directed to the east; however, it is unknown where the end discharge point is. The area surrounding the maintenance bay appears to be mostly unimproved. Stormwater may flow to a drainage ditch that runs the length of the western facility boundary along Old Barnwell Road. Surface water features are presented in **Figure 2-5**.

2.2.4 Climate

The facility is in a humid subtropical climate zone characterized by long, warm summers and short, mild winters. Rainfall is generally greater during the summer months but otherwise well-distributed year-round, with a normal annual precipitation of 46.3 inches. Summer temperatures peak in July, with an average high temperature of 93 degrees Fahrenheit (°F) and an average low temperature of 69 °F. Winter temperatures are lowest in January, with an average high temperature of 58 °F and an average low temperature of 33 °F (US Climate Data, 2020).

2.2.5 Current and Future Land Use

The facility is an SCARNG armory, occupying approximately 3.8 acres. Related infrastructure includes a vehicle maintenance bay, a main armory building, a motor pool, and general storage buildings. Daily operations include vehicle maintenance and administration. Both FEMA and Allendale County Fire and Rescue have an established presence on the property and occupy a portion of the main armory building. Reasonably anticipated future land use is not expected to change from the current land use.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

A Wildlife survey has not occurred at the facility, and the facility does not have any significant areas of habitat. The following species have not been identified at the facility but may be present in the surrounding area.

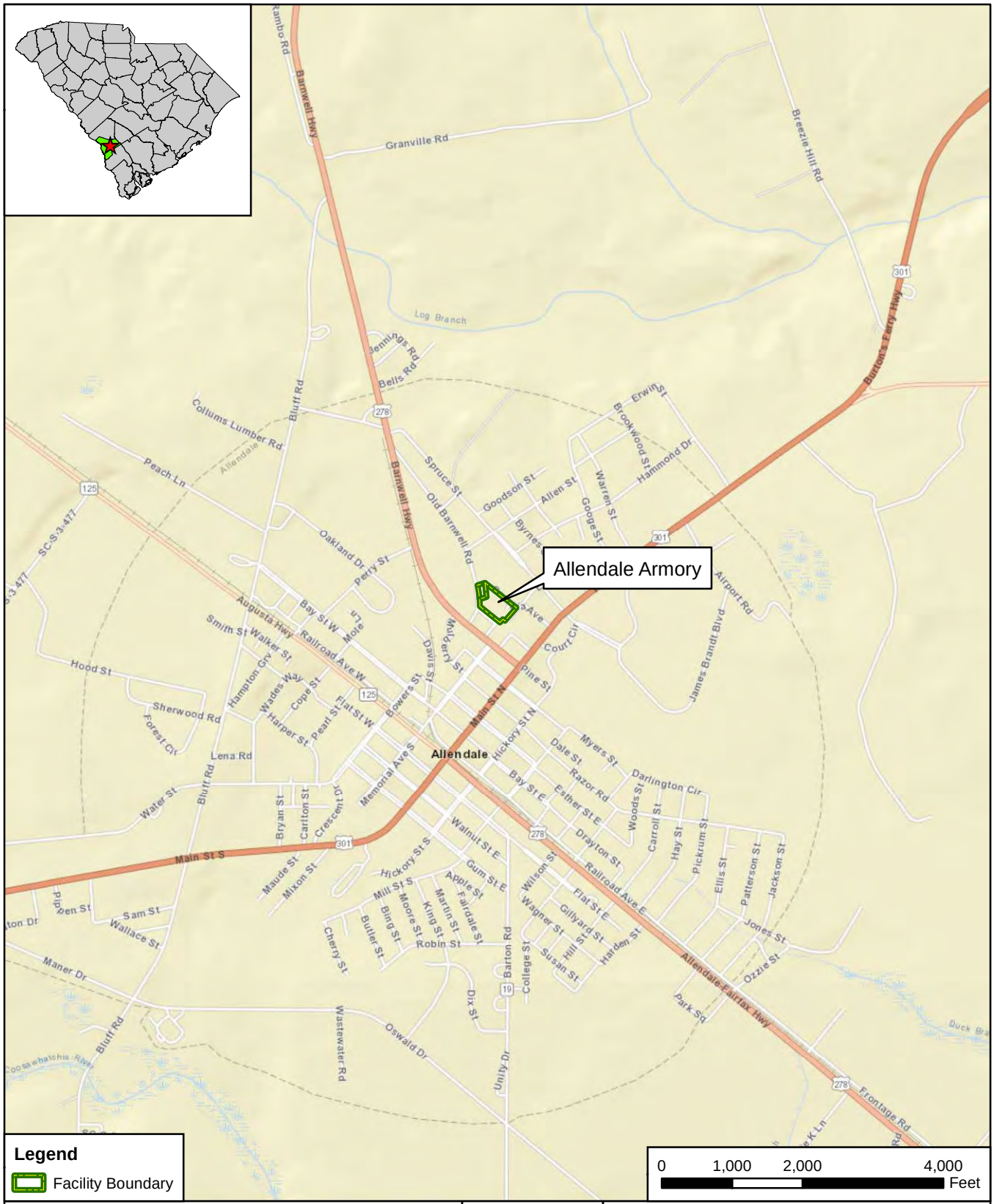
The following birds, plants, insects, mammals, and reptiles are federally endangered, threatened, proposed, and/ or are listed as candidate species in Allendale County, South Carolina (US Fish and Wildlife Service [USFWS], 2022).

- **Birds:** Red-cockaded woodpecker, *Picoides borealis* (endangered); Wood stork, *Mycteria americana* (threatened)
- **Flowering Plants:** Canby's dropwort, *Oxypolis canbyi* (endangered); Smooth coneflower, *Echinacea laevigata* (threatened)

- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Mammals**: Tricolored bat, *Perimyotis subflavus* (proposed endangered)
- **Reptiles**: Gopher tortoise, *Gopherus polyphemus* (candidate)

2.3 History of PFAS Use

One AOI was identified in the PA where AFFF may have been used, stored, disposed, or released historically at the Allendale Armory (AECOM, 2020). AFFF was historically stored at the vehicle maintenance bay. Although there are no known releases of AFFF at the facility, accidental AFFF releases from storage may have occurred. A description of the AOI is presented in **Section 3**.



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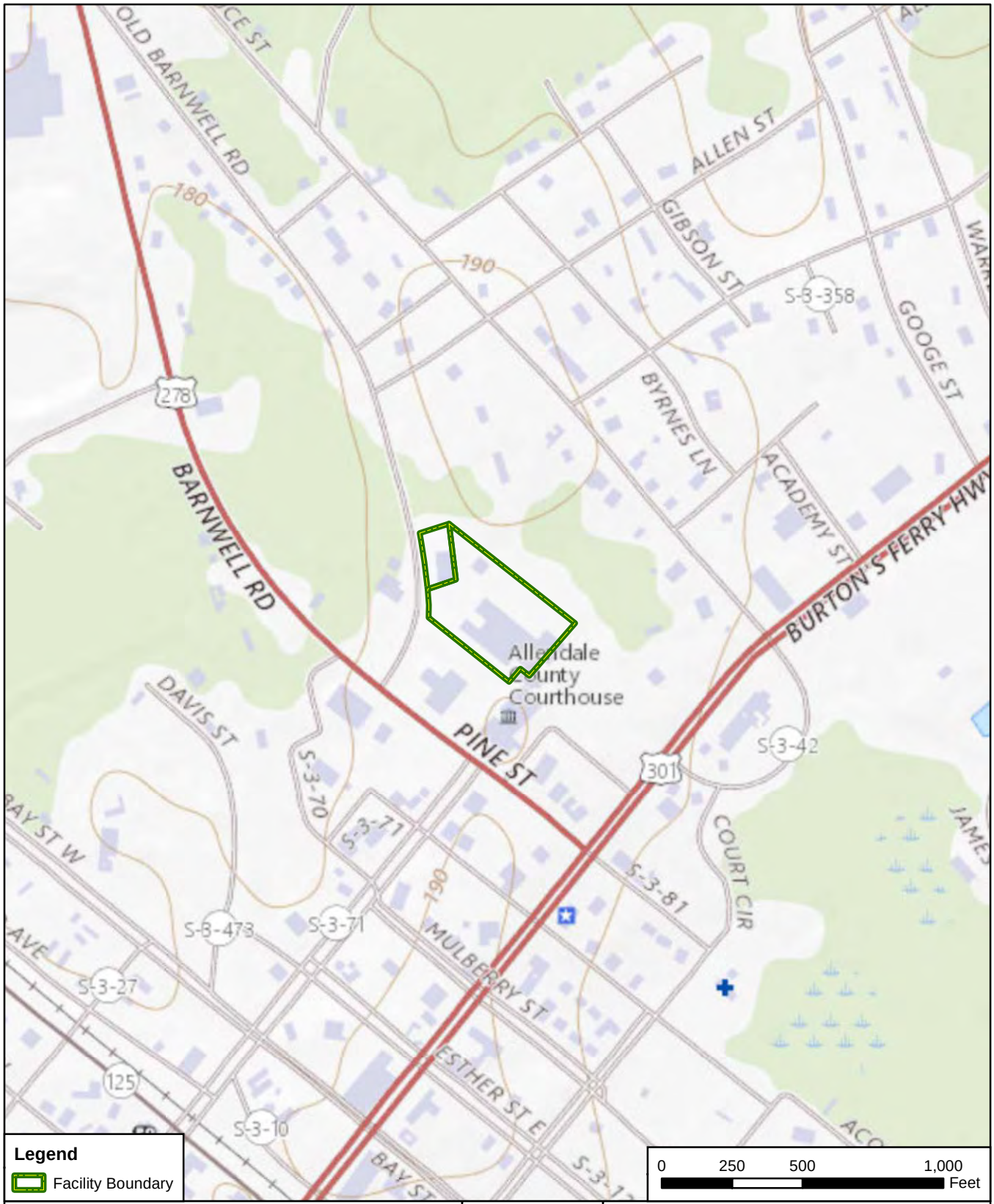
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	9/6/2022

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



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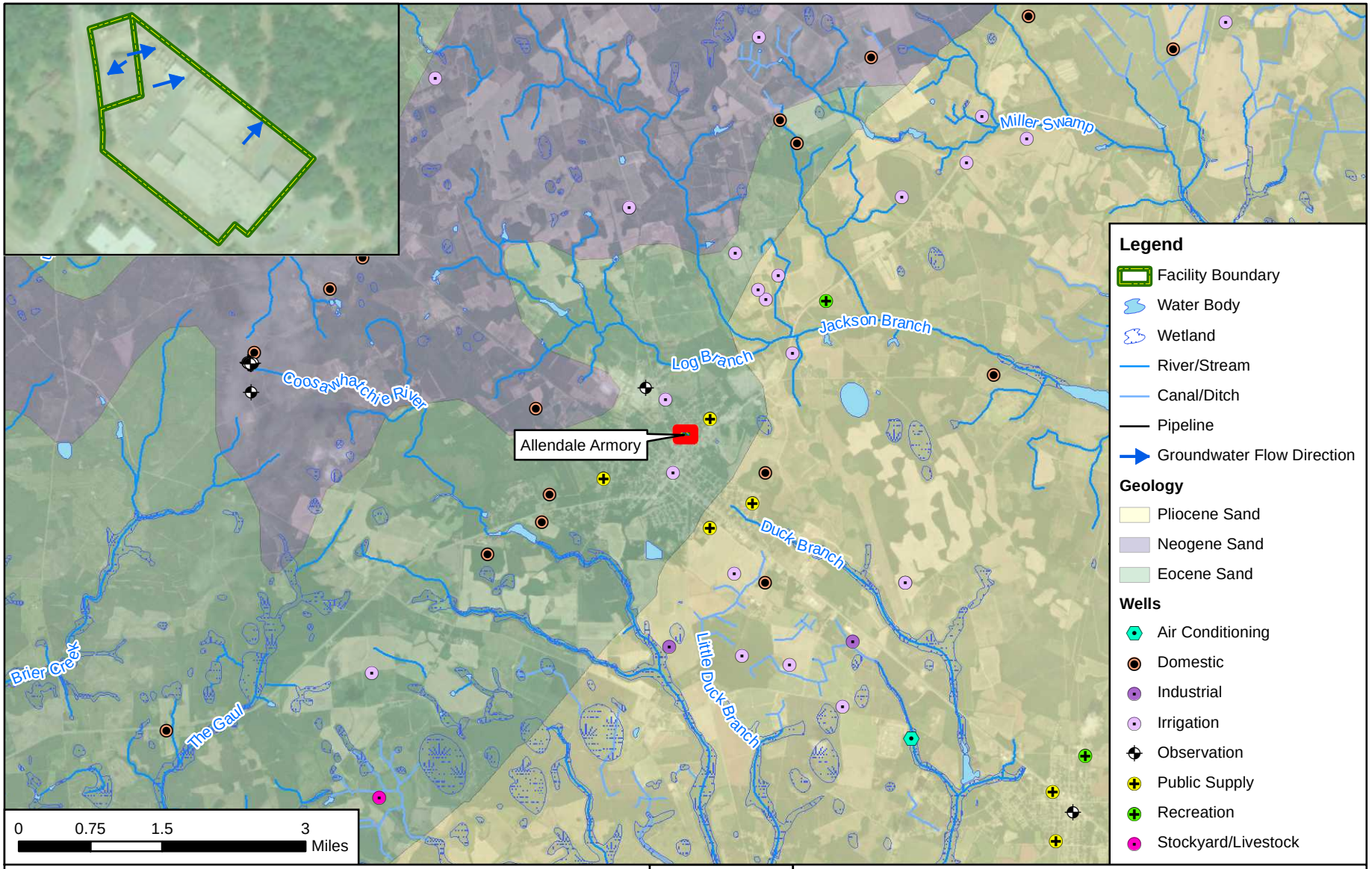
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	9/6/2022

Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



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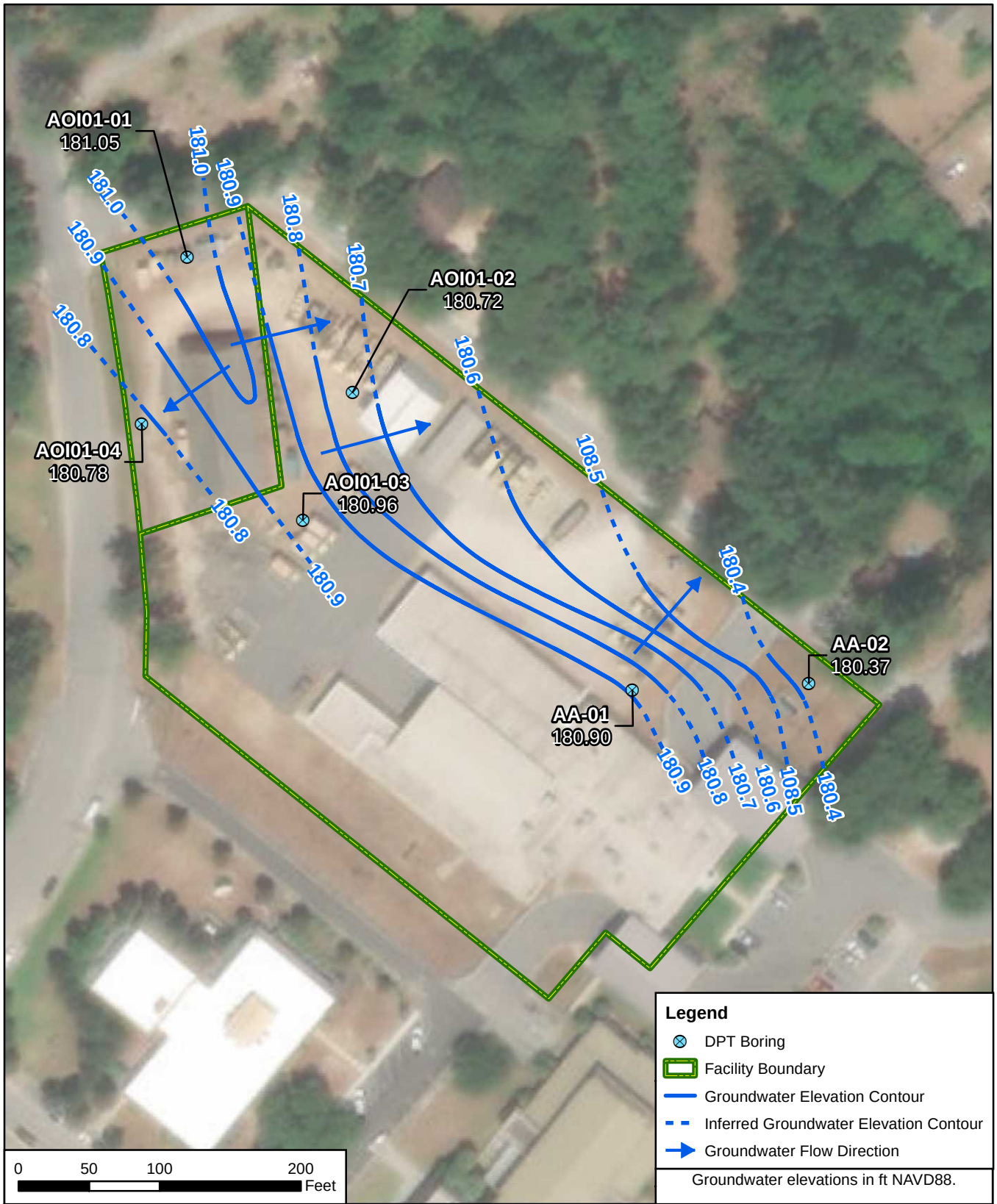
Groundwater Features

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3



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Groundwater Elevations, March 2022

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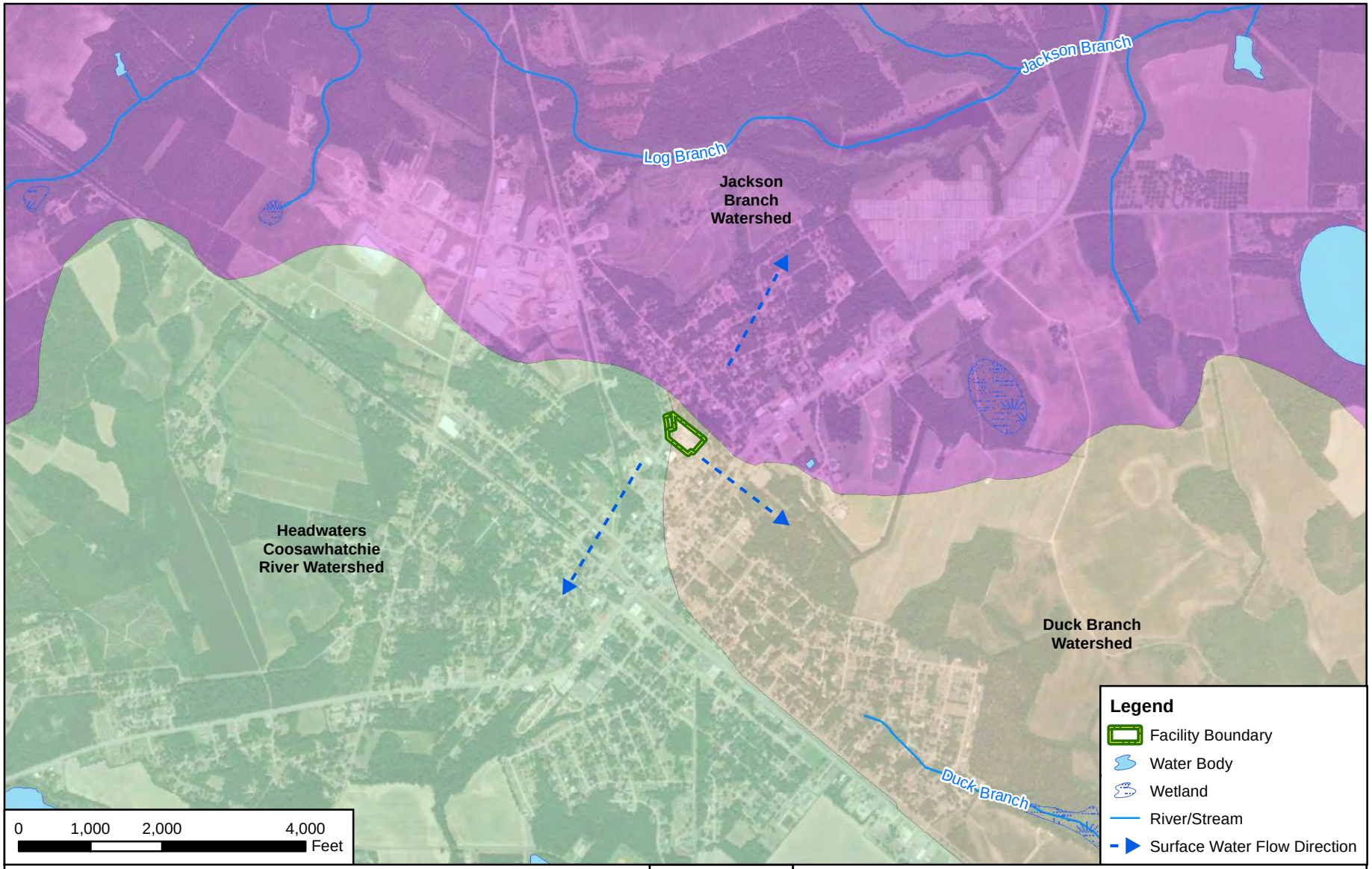
Figure 2-4



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Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	9/6/2022

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Surface Water Features

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-5

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3. Summary of Areas of Interest

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, one AOI was identified at Allendale Armory (AECOM, 2020). The potential release area is shown on **Figure 3-1**.

3.1 AOI 1 Maintenance Bay

AOI 1 comprises the facility maintenance bay. Although there are no known AFFF releases at the facility, AFFF was historically stored in 5-gallon buckets and in firetrucks located at the vehicle maintenance bay. The firetrucks were foam capable, but never leaked AFFF, and AFFF was never otherwise spilled to facility personnel's knowledge. Fire training and nozzle testing of the firetrucks were only conducted with water, although the exact location of these activities was not specified. Older firetrucks were historically present at the facility prior to 1990 but were not foam capable. Newer firetrucks with foam tanks were received around 1990 but were reportedly never used to expel AFFF. At the time of the PA, the only fire extinguishing agents located within the maintenance bay were portable ABC fire extinguishers (non-AFFF).

Accidental AFFF releases from storage would have occurred on either paved or unpaved surfaces. Releases carried by run-off into surface soil may have infiltrated to subsurface soil. Releases may have also infiltrated the subsurface soil via cracks in the pavement or in joints between areas that are paved with different materials. Since it is unknown where stormwater ultimately drains to, releases in stormwater run-off may be conveyed to either the Duck Branch Watershed or Headwaters Coosawhatchie River Watershed.

3.2 Adjacent Sources

A potential adjacent source was identified during the PA and is not associated with ARNG activities. The adjacent potential source is shown on **Figure 3-1** and described below.

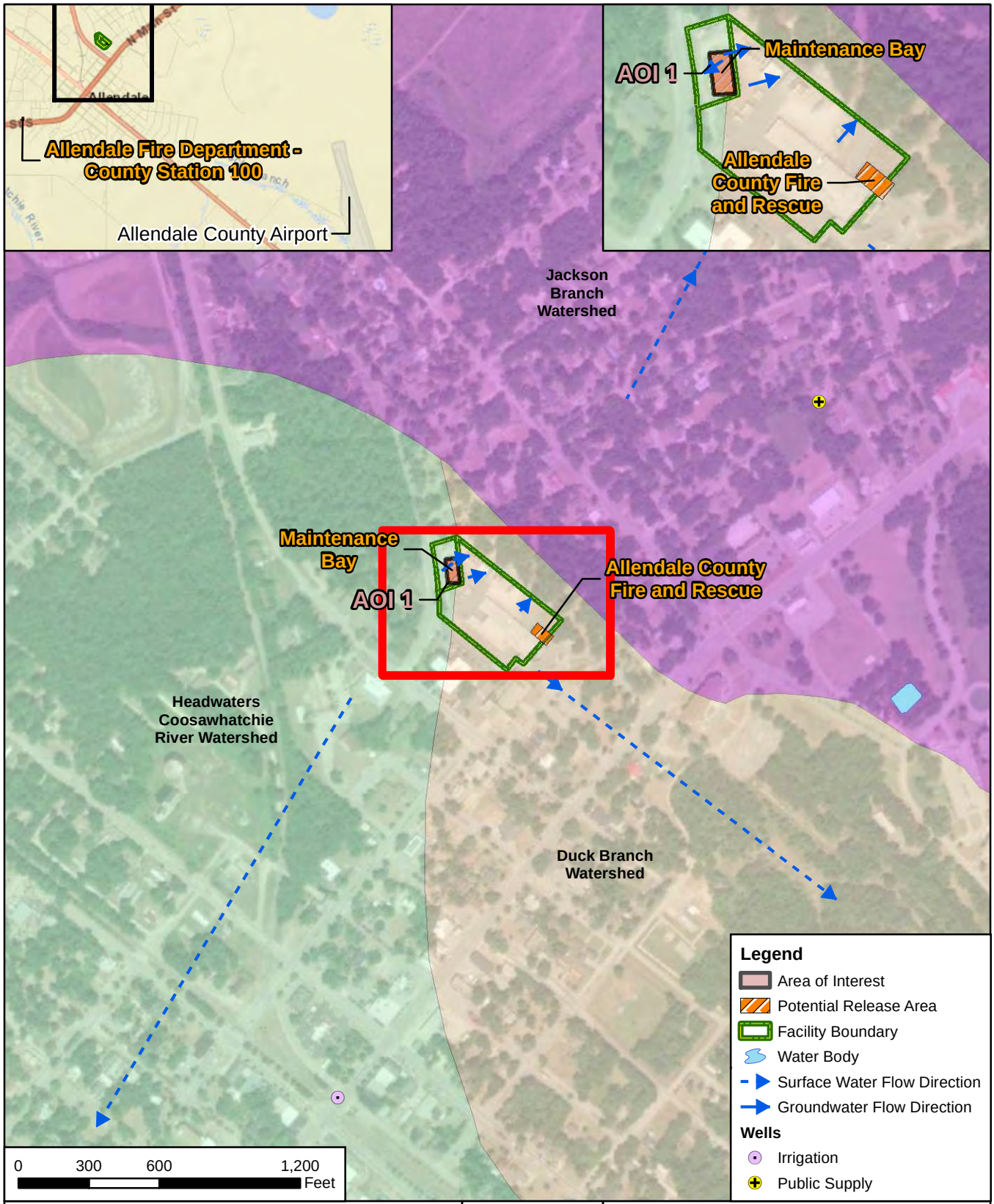
3.2.1 Allendale County Fire and Rescue

The Allendale County Fire and Rescue is located at two fire stations. One fire station (Allendale County Fire and Rescue) is located within facility boundaries. The other fire station (County Station 100) is located approximately 1 mile to the southwest of the facility. Allendale County Fire and Rescue was previously located within County Station 100 but moved to the armory building extension following the 2014 renovation of the facility. The Allendale Armory property boundary was revised since the PA report to extend further to the southeast. During the PA, four 5-gallon buckets of AFFF were found stored inside the fire station on the northern wall, near the northwest bay door. AFFF was reportedly never used or carried within firefighting vehicles, currently or historically. An unknown formulation of Flame Freeze™, a firefighting wetting agent, is stored within the firefighting vehicles and is used for vehicle washing. It is unclear if Flame Freeze™ contains PFAS compounds, as certain formulations of the product describe it as fluorine-free, while others describe it as a C6 Class B foam in compliance with 2010/2015 USEPA PFOA/PFOS Stewardship Requirements (Momar, Inc., 2020). Because the type of Flame Freeze™ used by the fire station is not known, it is possible that the C6 formulation of Flame Freeze™ has historically been used.

Any accidental release of AFFF from the buckets of AFFF stored within the fire station may have resulted in a release to the pavement or nearby grassy area immediately outside of the bay door. The drive located outside the northwestern bay door (where AFFF buckets were observed during the PA) is edged by 4-inch concrete curbing that would direct storm or wash water to stormwater grates located off-facility. Infiltration via cracks and/or seams in the pavement may allow storm or

wash water to enter the subsurface beneath the pavement prior to discharge off-facility. Firefighting vehicles are typically washed on a paved area in front of the fire station on the southeast side of the building, outside of the bay door, and wash water may contain PFAS compounds as the result of the use of the C6 formulation of Flame Freeze. Wash water reportedly travels southeast, down the driveway, to a curb inlet that discharges to an off-facility retention pond to the southeast. It is possible that wash water also incidentally discharges onto adjacent non-paved areas. While any release associated with Allendale County Fire and Rescue is not a result of ARNG activities, sample locations were positioned to investigate potential impact to ARNG property.

Although County Station 100 was not investigated during the SI, because the Allendale County Fire and Rescue was previously located with the station and has historically had AFFF, County Station 100 was also identified as a potential adjacent source of PFAS by association.



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Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	9/6/2022

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Area of Interest

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

As identified during the Data Quality Objective (DQO) process and outlined in the SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2021a), the objective of the SI is to identify whether there has been a release to the environment at the AOIs identified in the PA. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for presence or absence of relevant compounds at each of the sampled AOIs.

4.1 Problem Statement

ARNG will recommend an AOI for Remedial Investigation (RI) if related soil and groundwater samples have concentrations of the relevant compounds above the OSD risk-based SLs. The SLs are presented in **Section 6.1** of this report.

4.2 Information Inputs

Primary information inputs included:

- The PA for Allendale Armory (AECOM, 2020);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-QAPP Addendum (AECOM, 2022a); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s). The scope of the SI was vertically bounded by the shallow, surficial aquifer which was encountered at depths ranging from 17 to 35 feet bgs. The SI was not limited by any temporal boundaries.

4.4 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs within this document and decision rules as defined in the SI QAPP Addendum (AECOM, 2021a).

4.5 Data Usability Assessment

The Data Usability Assessment (DUA), which is provided in **Appendix A**, is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment determines whether project execution and the resulting data have met installation-specific DQOs. Both sampling and analytical activities are considered to assess

whether the collected data are of the right type, quality, and quantity to support the decision-making (DoD, 2019a; DoD, 2019b; USEPA, 2017).

Based on the DUA, the environmental data collected during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUA and its associated data validation reports. These data are of sufficient quality to meet the objectives and requirements of the SI QAPP Addendum (AECOM, 2022a).

5. Site Inspection Activities

This section describes the environmental investigation and sampling activities that occurred as part of the SI. The SI sampling approach was based on the findings of the PA and implemented in accordance with the following approved documents:

- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP)* dated March 2018 (AECOM, 2018a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b);
- *Final Preliminary Assessment Report, Allendale Armory, Allendale, South Carolina* dated October 2020 (AECOM, 2020);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Allendale Armory, Allendale, South Carolina* dated January 2022 (AECOM, 2022a); and
- *Final Site Safety and Health Plan, Allendale Armory, Allendale, South Carolina* dated January 2022 (AECOM, 2022b).

The SI field investigation activities were conducted from 25 March 2022 to 29 March 2022 and consisted of utility clearance, direct push boring, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022a).

The following samples were collected during the SI and analyzed for a subset of 18 compounds by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.3 Table B-15 to fulfill the project DQOs:

- Eighteen (18) soil samples from six boring locations;
- Six grab groundwater samples from six temporary wells;
- Thirteen (13) quality assurance (QA)/quality control (QC) samples.

Figure 5-1 provides the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**, land survey data are provided in **Appendix B3**, and water well records are provided in **Appendix B4**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

In preparation for the SI field activities, project team members participated in Technical Project Planning (TPP) meetings, performed utility clearance, and sampled decontamination source water. Details for each of these activities are presented below.

5.1.1 Technical Project Planning

The US Army Corps of Engineers (USACE) TPP Process, Engineer Manual (EM) 200-1-2 (USACE, 2016) defines four phases to project planning: 1.) defining the project phase; 2.) determining data needs; 3.) developing data collection strategies; and 4.) finalizing the data collection plan. The process encourages stakeholder involvement in the SI, beginning with defining overall project objectives, including DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 18 October 2021, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, SCARNG, USACE, and South Carolina Department of Health and Environment Control (SCDHEC). Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the SI QAPP Addendum (AECOM, 2022a).

A TPP Meeting 3 was held after the field event to discuss the results of the SI. Meeting minutes for TPP 3 are included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM's drilling subcontractor placed a ticket with the South Carolina 811, the local utility clearance provider to notify them of intrusive work on 17 March 2022. Additionally, AECOM contracted Ground Penetrating Radar Systems (GPRS), a private utility location service, to perform utility clearance. GPRS performed utility clearance of the proposed boring locations on 31 January 2022 with input from the AECOM field team and Allendale Armory facility staff. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared using a hand auger to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and Sampling Equipment Acceptability

A potable water source at Allendale Armory was sampled on 19 January 2022 to assess usability for decontamination of drilling equipment. Results of the sample collected at (AA-PW-01) confirmed this source to be acceptable for use in this investigation; therefore, it was used throughout the field activities. Specifically, the sample was analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water used during the SI are provided in **Appendix F**. A discussion of the results is presented in the DUA (**Appendix A**).

Materials that were used within the sampling zone were confirmed as acceptable for use in the sampling environment. The checklist of acceptable materials for use in the sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 2022a). Prior to the start of field work each day, a Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Borings were installed in grass areas where applicable, to avoid disturbing concrete or asphalt surfaces. Soil samples were collected via direct push technology (DPT), in accordance with the SI QAPP Addendum (AECOM, 2022a). A GeoProbe® 7822DT dual-tube sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top five feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1** and depths are provided **Table 5-1**.

In general, three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 1 foot above the groundwater table, and one subsurface soil sample at the mid-point between the surface and the groundwater table. Where depth to the water table was encountered greater than 30 feet deep, a mid-point sample was collected from 13-15 feet bgs. Soil sample collection depths may appear submerged below groundwater when compared to the

depth to groundwater measurements presented in **Table 5-2**; however, this is due to artesian conditions present within the temporary wells causing an elevated potentiometric surface higher than that of the water table.

The soil cores were continuously logged for lithological descriptions by an AECOM field geologist using the Unified Soil Classification System (USCS). A photoionization detector (PID) was used to screen the breathing zone during boring activities as part of personal safety requirements. Observations and measurements were recorded on sampling forms (**Appendix B2**) and in a non-treated field logbook (i.e., composition notebook). Depth interval, recovery thickness, PID concentrations, moisture, relative density, color (using a Munsell soil color chart), and texture (using the USCS) were recorded. The boring logs are provided in **Appendix E**.

Soil borings completed during the SI found silty sand and clayey sand as the dominant lithology of the unconsolidated sediments below the Allendale Armory. The borings were completed at depths between 21 and 40 feet bgs. Isolated layers of silty gravel with sand, sandy lean clay, lean clay, well-graded sand, and poorly graded sand were also observed in the boring logs at thicknesses ranging from 1 foot to 9 feet.

Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15, total organic carbon (TOC) (USEPA Method 9060A), and pH (USEPA Method 9045D) in accordance with the SI QAPP Addendum (AECOM, 2022a).

Field duplicate samples were collected at a rate of 10 percent (%) and analyzed for the same parameters as the accompanying samples. Matrix spike (MS)/MS duplicates (MSDs) were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. In instances when non-dedicated sampling equipment was used, such as a hand auger for the shallow soil samples, equipment rinsate blanks were collected at a rate of 5% and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6 degrees Celsius (°C) during shipment.

DPT borings were converted to temporary wells, which were subsequently abandoned in accordance with the SI QAPP Addendum (AECOM, 2022a) using neat cement grout at completion of sampling activities.

5.3 Temporary Well Installation and Groundwater Grab Sampling

Temporary wells were installed using a GeoProbe® 7822DT dual-tube sampling system. Once the borehole was advanced to the desired depth, a temporary well was constructed of a 5-foot section of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. New PVC pipe and screen were used to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

Groundwater samples were collected after a period of time following well installation to allow groundwater to infiltrate and recharge the temporary well screen intervals. After the recharge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. The temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) before each grab sample was collected. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2022a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. One field reagent blank was collected in accordance with the PQAPP (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6 °C during shipment.

Following well surveying (described below in **Section 5.5**), temporary wells were abandoned in accordance with the SI QAPP Addendum (AECOM, 2022a) by removing the PVC and backfilling the hole with neat cement grout. Upon completion of well abandonment, the ground surface at each location was patched to match existing surrounding conditions.

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 29 March 2022. Groundwater elevation measurements were collected from the six new temporary monitoring wells. Water level measurements were taken from the northern side of the well casing. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-2**. Depths to water measured in March 2022 during the SI ranged from 5.33 to 8.21 feet bgs, and the groundwater flow direction at the facility is primarily to the northeast, with localized groundwater flow direction on the western side of the maintenance bay to the southwest.

5.5 Surveying

The northern side of each well casing was surveyed by South Carolina-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2022a). Survey data from the newly installed wells on the facility were collected on 29 March 2022 in the applicable Universal Transverse Mercator zone projection with North American Datum 1983 (2011) datum (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B3**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of investigation-derived waste (IDW) is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the SI QAPP Addendum (AECOM, 2022a) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) generated during SI activities were containerized in properly labeled 55-gallon drums and stored at the facility in a location designated by the Allendale Armory Environmental Manager and SCARNG. This IDW was not sampled and assumes the characteristics of the associated soil samples collected from that source location. A final decision of whether the soil can be returned to the ground surface or otherwise disposed will be determined by ARNG G9, SCARNG, USACE, and SCDHEC after a review of the soil analytical results.

Liquid IDW generated during SI activities (i.e., purge water and decontamination fluids) was containerized in properly labeled 55-gallon drums and stored at the facility in a location designated by the Allendale Armory Environmental Manager and SCARNG. This IDW was not sampled and will assume the characteristics of the associated groundwater samples collected from that source location. A final decision regarding whether the liquid can be returned to the ground surface will

be determined by ARNG G9, SCARNG, USACE, and SCDHEC after a review of the groundwater analytical results. Liquid IDW with concentrations that exceed the SLs will be managed in accordance with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018). ARNG will coordinate waste profiling, transportation, and disposal of the liquid IDW.

Other solids such as spent personal protective equipment, plastic sheeting, tubing, rope, unused monitoring well construction materials, and other environmental media generated during the field activities were disposed of at a licensed solid waste landfill.

5.7 Laboratory Analytical Methods

Samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 at Pace Analytical Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP certified laboratory. Soil samples were also analyzed for TOC using USEPA Method 9060A and pH by USEPA Method 9045D.

5.8 Deviations from SI QAPP Addendum

No deviations from the SI QAPP Addendum were identified during review of the field documentation.

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Allendale Armory, South Carolina

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-00-02	3/28/2022 11:20	0 - 2	x				
AOI01-01-SB-00-02-D	3/28/2022 11:20	0 - 2	x				FD
AOI01-01-SB-12-14	3/28/2022 11:40	12 - 14	x				
AOI01-01-SB-24-26	3/28/2022 11:50	24 - 26	x				
AOI01-02-SB-00-02	3/25/2022 9:05	0 - 2	x	x	x		
AOI01-02-SB-00-02-D	3/25/2022 9:05	0 - 2		x			FD
AOI01-02-SB-13-15	3/25/2022 9:45	13 - 15	x				
AOI01-02-SB-32-34	3/25/2022 9:55	32 - 34	x				
AOI01-03-SB-00-02	3/28/2022 13:15	0 - 2	x				
AOI01-03-SB-00-02-MS	3/28/2022 13:15	0 - 2	x				MS
AOI01-03-SB-00-02-MSD	3/28/2022 13:15	0 - 2	x				MSD
AOI01-03-SB-13-15	3/28/2022 13:35	13 - 15	x				
AOI01-03-SB-25-27	3/28/2022 13:50	25 - 27	x				
AOI01-03-GS	3/28/2022 13:25	11 - 13				x	
AOI01-04-SB-00-02	3/25/2022 14:05	0 - 2	x				
AOI01-04-SB-13-15	3/25/2022 15:25	13 - 15	x				
AOI01-04-SB-27-29	3/25/2022 15:45	27 - 29	x				
AA-01-SB-00-02	3/28/2022 15:10	0 - 2	x				
AA-01-SB-09-11	3/28/2022 15:35	9 - 11	x	x	x		
AA-01-SB-09-11-MS	3/28/2022 15:35	9 - 11		x			MS
AA-01-SB-09-11-MSD	3/28/2022 15:35	9 - 11		x			MSD
AA-01-SB-19-21	3/28/2022 15:50	19 - 21	x				
AA-02-SB-00-02	3/29/2022 8:30	0 - 2	x				
AA-02-SB-07-09	3/29/2022 9:00	7 - 9	x				
AA-02-SB-07-09-D	3/29/2022 9:00	7 - 9	x				FD
AA-02-SB-14-16	3/29/2022 9:20	14 - 16	x				
AA-02-GS	3/29/2022 9:45	11 - 13				x	
Groundwater Samples							
AOI01-01-GW	3/28/2022 15:40	NA	x				
AOI01-01-GW-D	3/28/2022 15:40	NA	x				FD
AOI01-02-GW	3/28/2022 13:10	NA	x				
AOI01-03-GW	3/29/2022 11:55	NA	x				
AOI01-04-GW	3/28/2022 14:25	NA	x				
AA-01-GW	3/29/2022 10:20	NA	x				
AA-01-GW-MS	3/29/2022 10:20	NA	x				MS
AA-01-GW-MSD	3/29/2022 10:20	NA	x				MSD
AA-02-GW	3/29/2022 13:00	NA	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Allendale Armory, South Carolina

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Quality Control Samples							
AA-PW-01	1/19/2022 9:40	NA	x				Decon water source
AA-ERB-01	3/25/2022 16:30	NA	x				DPT shoe
AA-ERB-02	3/28/2022 13:30	NA	x				water level meter
AA-ERB-03	3/28/2022 14:45	NA	x				hand auger tooth
AA-ERB-04	3/28/2022 16:50	NA	x				pressure washer wand
AA-FRB-01	3/29/2022 11:00	NA	x				

Notes:
AA = Allendale Armory
AOI = area of interst
bgs = below ground surface
Decon = decontamination
DPT = direct push technology
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
GW = groundwater
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
PW = potable water
QSM = Quality Systems Manual
SB = soil boring
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths, Temporary Well Screen Intervals, and Groundwater Elevations
Site Inspection Report, Allendale Armory, South Carolina

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Depth to Water (feet btoc)	Depth to Water (feet bgs)[2]	Groundwater Elevation (feet NAVD88)
1	AOI01-01	32	24 - 29[1]	188.13	187.00	7.08	5.96	181.05
	AOI01-02	40	33 - 38[1]	190.89	188.68	10.17	7.96	180.72
	AOI01-03	35	25 - 30[1]	189.00	188.26	8.04	7.30	180.96
	AOI01-04	33	28 - 33	188.21	186.11	7.43	5.33	180.78
	AA-01	40	20 - 25[1]	190.21	189.10	9.31	8.21	180.90
	AA-02	21	16 - 21	188.27	187.46	7.90	7.09	180.37

Notes:

[1] Temporary well screen set above total depth to capture groundwater interface

[2] Artesian conditions present within surficial aquifer creating potentiometric surface higher than the bracketed water table.

AOI = area of interest

bgs = below ground surface

btoc = below top of casing

NA = not applicable

NAVD88 = North American Vertical Datum 1988

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CLIENT	ARNG			
PROJECT	Site Inspection at Allendale Armory, SC			
REVISED	3/16/2023	GIS BY	MS	3/16/2023
SCALE	1:1,200	CHK BY	JL	3/16/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/16/2023

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Site Inspection Results

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for AOI 1 is provided in **Section 6.3**. **Table 6-2** through **Table 6-5** present results in soil or groundwater for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the OSD dated 6 July 2022 (Assistant Secretary of Defense, 2022). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to the five compounds presented on **Table 6-1** below.

Table 6-1: Screening Levels (Soil and Groundwater)

Analyte[b]	Residential (Soil) (µg/kg)[a] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a]
PFOA	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter

a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.

b.) Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

The data in the subsequent sections are compared to the SLs presented in **Table 6-1**. The SLs for groundwater are based on direct ingestion. The SLs for soil are based on incidental ingestion and are applied to the depth intervals reasonably anticipated to be encountered by the receptors identified at the facility: the residential scenario is applied to surface soil results (0 to 2 feet bgs) and the industrial/commercial worker scenario is applied to shallow subsurface soil results (2 to 15 feet bgs). The SLs are not applied to deep subsurface soil results (>15 feet bgs) because 15 feet is the anticipated limit of construction activities.

6.2 Soil Physicochemical Analyses

To provide basic soil parameter information, soil samples were analyzed for TOC and pH which are important for evaluating transport through the soil medium. **Appendix F** contains the results of the TOC and pH sampling.

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport. According to the Interstate Technology Regulatory Council (ITRC), several important partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions and are therefore relatively mobile in groundwater (Xiao et al., 2015), but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy, 2006; Guelfo and Higgins, 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (K_{oc} values) can help in evaluating transport potential, though other geochemical factors (for example, pH and presence of polyvalent cations) may also affect PFAS sorption to solid phases (ITRC, 2018).

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1: Maintenance Bay. The soil and groundwater results are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

Soil was sampled from surface soil (0 to 2 feet bgs), shallow subsurface soil (between 7 to 16 feet bgs), and deep subsurface soil (between 19 and 34 feet bgs) from boring locations AOI01-01 through AOI01-04, AA-01, and AA-02. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results.

PFOA, PFOS, PFHxS, PFNA, and PFBS were detected below the SLs in surface soil in at least one boring location, with the following maximum concentrations: PFOA at 0.262 J micrograms per kilogram (µg/kg) at AA-01; PFOS at 2.97 µg/kg; PFHxS at 0.272 J µg/kg at AOI01-04; PFNA at 0.181 J µg/kg at AOI01-04; and PFBS at 0.049 J µg/kg at AOI01-04.

PFOS and PFHxS were detected below the SLs in shallow subsurface soil in at least two boring locations, with maximum concentrations of 0.149 J µg/kg at AA-01 and 0.055 J µg/kg at AOI01-02, respectively. PFOA, PFNA, and PFBS were not detected in shallow subsurface soil. PFOS and PFHxS were detected in deep subsurface soil at AOI01-03, with concentrations of 0.252 J µg/kg and 0.145 J µg/kg, respectively. PFOA, PFNA, and PFBS were not detected in deep subsurface soil.

6.3.2 AOI 1 Groundwater Analytical Results

Figure 6-6 and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

Groundwater was sampled from temporary monitoring wells AOI01-01 through AOI01-04, AA-01, and AA-02. The following maximum concentrations were measured:

- PFOA was detected above the SL of 6 nanograms per liter (ng/L) in three of the six wells, with a maximum concentration of 17.8 ng/L at AOI01-03.
- PFOS was detected above the SL of 4 ng/L at all six wells, with a maximum concentration of 345 ng/L at AOI01-03.

- PFHxS was detected above the SL of 39 ng/L at AOI01-03, with a concentration of 322 ng/L.
- PFNA was detected below the SL of 6 ng/L at two of the six wells, with a maximum concentration of 1.56 J ng/L at AOI01-03.
- PFBS was detected below the SL of 601 ng/L at all six wells, with a maximum concentration of 21.5 ng/L at AOI01-03.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in soil below their SLs. PFOA, PFOS, and PFHxS were detected in groundwater at concentrations above their SLs. Based on the exceedances of the SLs in groundwater, further evaluation at AOI 1 is warranted.

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Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Allendale Armory

Area of Interest		AOI01										Facility Wide			
Sample ID		AOI01-01-SB-0-2		AOI01-01-SB-0-2-D		AOI01-02-SB-0-2		AOI01-03-SB-0-2		AOI01-04-SB-0-2		AA-01-SB-0-2		AA-02-SB-0-2	
Sample Date		03/28/2022		03/28/2022		03/25/2022		03/28/2022		03/25/2022		03/28/2022		03/29/2022	
Depth		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)															
PFBS	1900	ND	U	ND	U	ND	U	ND	U	0.049	J	ND	U	ND	U
PFHxS	130	ND	U	ND	U	0.039	J	ND	U	0.272	J	0.046	J	ND	U
PFNA	19	0.026	J	0.029	J	ND	U	ND	U	0.181	J	0.089	J	0.020	J
PFOA	19	ND	U	ND	U	ND	U	ND	U	0.184	J	0.262	J	ND	U
PFOS	13	0.136	J	0.126	J	0.278	J	0.152	J	2.97		0.662	J	0.107	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for direct ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AA	Allendale Armory
AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Allendale Armory

Area of Interest		AOI01										Facility Wide					
Sample ID		AOI01-01-SB-12-14		AOI01-02-SB-13-15		AOI01-03-SB-13-15		AOI01-04-SB-13-15		AA-01-SB-9-11		AA-02-SB-7-9		AA-02-SB-7-9-D		AA-02-SB-14-16	
Sample Date		03/28/2022		03/25/2022		03/28/2022		03/25/2022		03/28/2022		03/29/2022		03/29/2022		03/29/2022	
Depth		12-14 ft		13-15 ft		13-15 ft		13-15 ft		9-11 ft		7-9 ft		7-9 ft		14-16 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																	
PFBS	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	1600	ND	U	0.055	J	ND	U	0.035	J	ND	U	ND	U	ND	U	ND	U
PFNA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	160	ND	U	0.127	J	ND	U	0.107	J	0.149	J	ND	U	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AA	Allendale Armory
AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Allendale Armory

Area of Interest	AOI01								Facility Wide	
Sample ID	AOI01-01-SB-24-26		AOI01-02-SB-32-34		AOI01-03-SB-25-27		AOI01-04-SB-27-29		AA-01-SB-19-21	
Sample Date	03/28/2022		03/25/2022		03/28/2022		03/25/2022		03/28/2022	
Depth	24-26 ft		32-34 ft		25-27 ft		27-29 ft		19-21 ft	
Analyte	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)										
PFBS	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	ND	U	ND	U	0.145	J	ND	U	ND	U
PFNA	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	ND	U	ND	U	0.252	J	ND	U	ND	U

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AA	Allendale Armory
AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
µg/kg	micrograms per kilogram

Table 6-5
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Allendale Armory

Area of Interest		AOI01										Facility Wide			
Sample ID		AOI01-01-GW		AOI01-01-GW-D		AOI01-02-GW		AOI01-03-GW		AOI01-04-GW		AA-01-GW		AA-02-GW	
Sample Date		03/28/2022		03/28/2022		03/28/2022		03/29/2022		03/28/2022		03/29/2022		03/29/2022	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)															
PFBS	601	1.65	J	1.34	J	2.50	J	21.5		5.29		1.89	J	2.22	J
PFHxS	39	10.9		8.45	J+	21.9		322		33.7		7.34	J+	10.9	
PFNA	6	ND	U	ND	U	ND	U	1.56	J	1.21	J	ND	U	ND	U
PFOA	6	ND	U	ND	U	ND	U	17.8		13.6		4.52		15.4	
PFOS	4	4.19	J	3.12	J	12.9		345		24.1		15.2		41.6	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022 Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

J+ = Estimated concentration, biased high

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

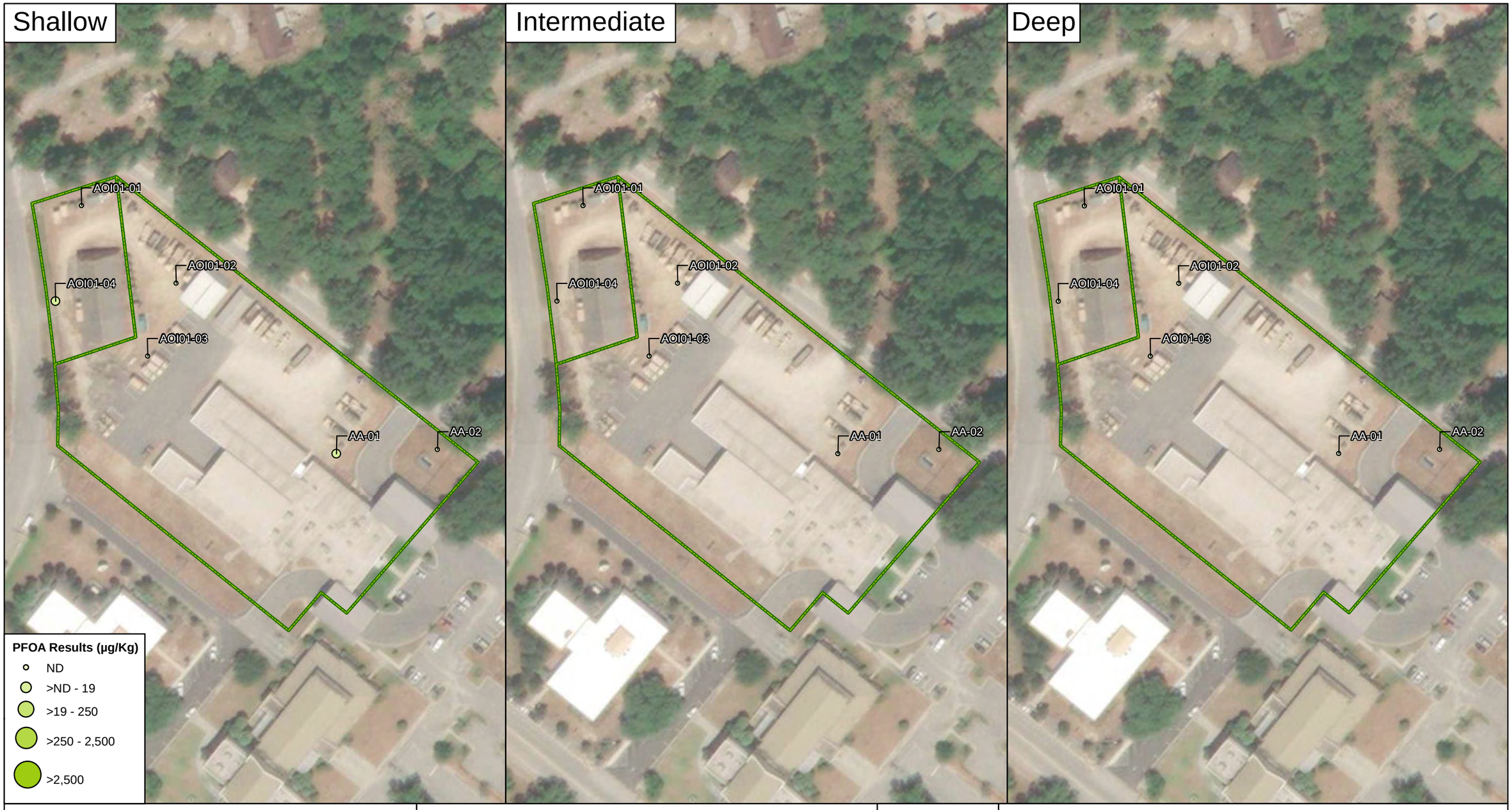
ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AA	Allendale Armory
AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
GW	groundwater
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
USEPA	United States Environmental Protection Agency
ng/l	nanogram per liter



CLIENT	ARNG			
PROJECT	Site Inspection at Allendale Armory, SC			
REVISED	9/6/2022	GIS BY	MS	9/6/2022
SCALE	1:1,440	CHK BY	JL	9/6/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	9/6/2022

Legend

Facility Boundary

0 60 120 240 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOA Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-1

Shallow

Intermediate

Deep

AOI01-01
AOI01-02
AOI01-03
AOI01-04
AA-01
AA-02

PFOS Results (µg/Kg)

- ND
- >ND - 13
- >13 - 160
- >160 - 1,600
- >1,600

CLIENT	ARNG			
PROJECT	Site Inspection at Allendale Armory, SC			
REVISED	9/6/2022	GIS BY	MS	9/6/2022
SCALE	1:1,440	CHK BY	JL	9/6/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	9/6/2022

Legend

Facility Boundary

0 60 120 240 Feet

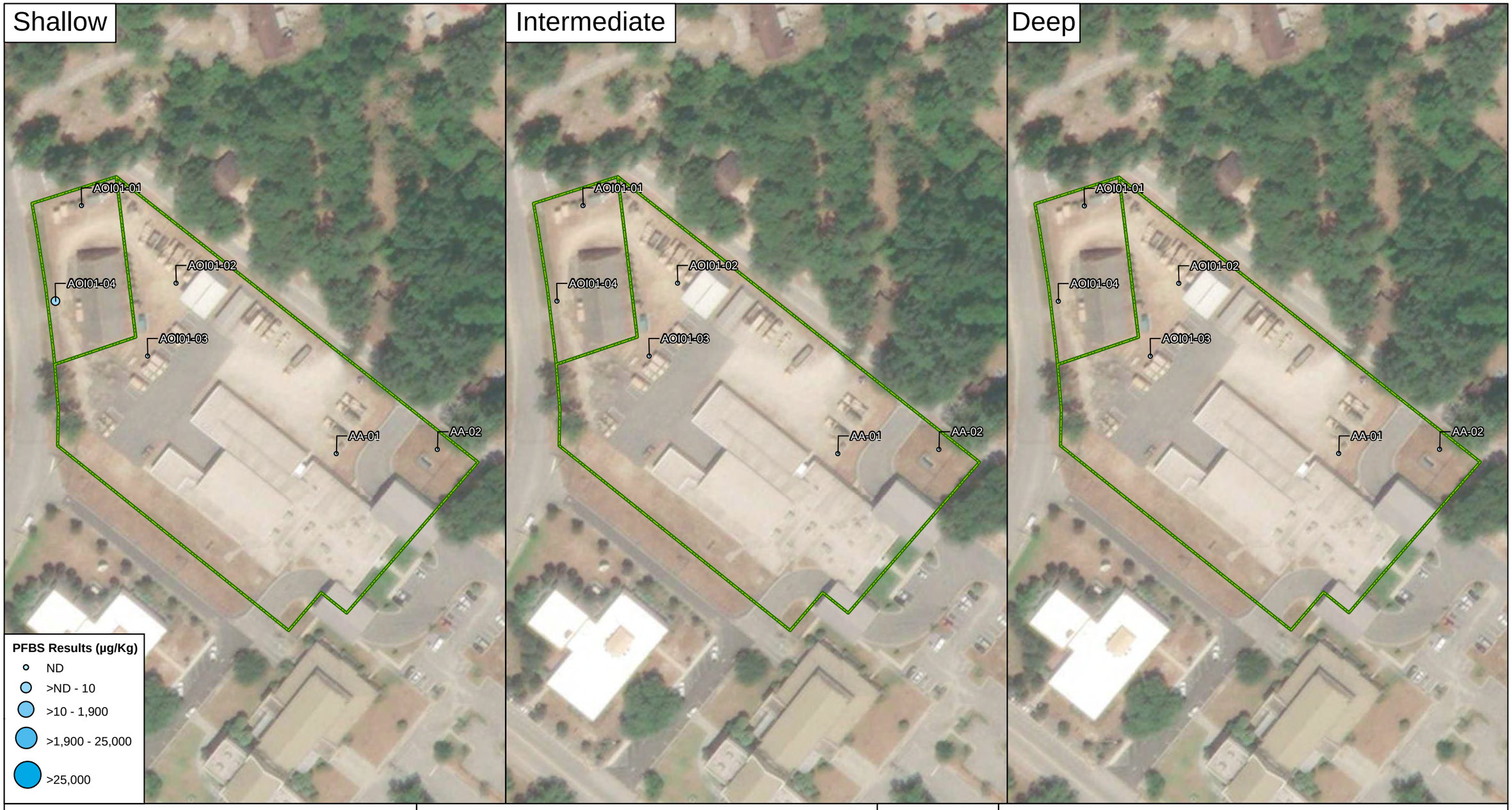
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOS Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-2



CLIENT	ARNG			
PROJECT	Site Inspection at Allendale Armory, SC			
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SCALE	1:1,440	CHK BY	JL	9/6/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	9/6/2022

Legend

Facility Boundary

0 60 120 240 Feet

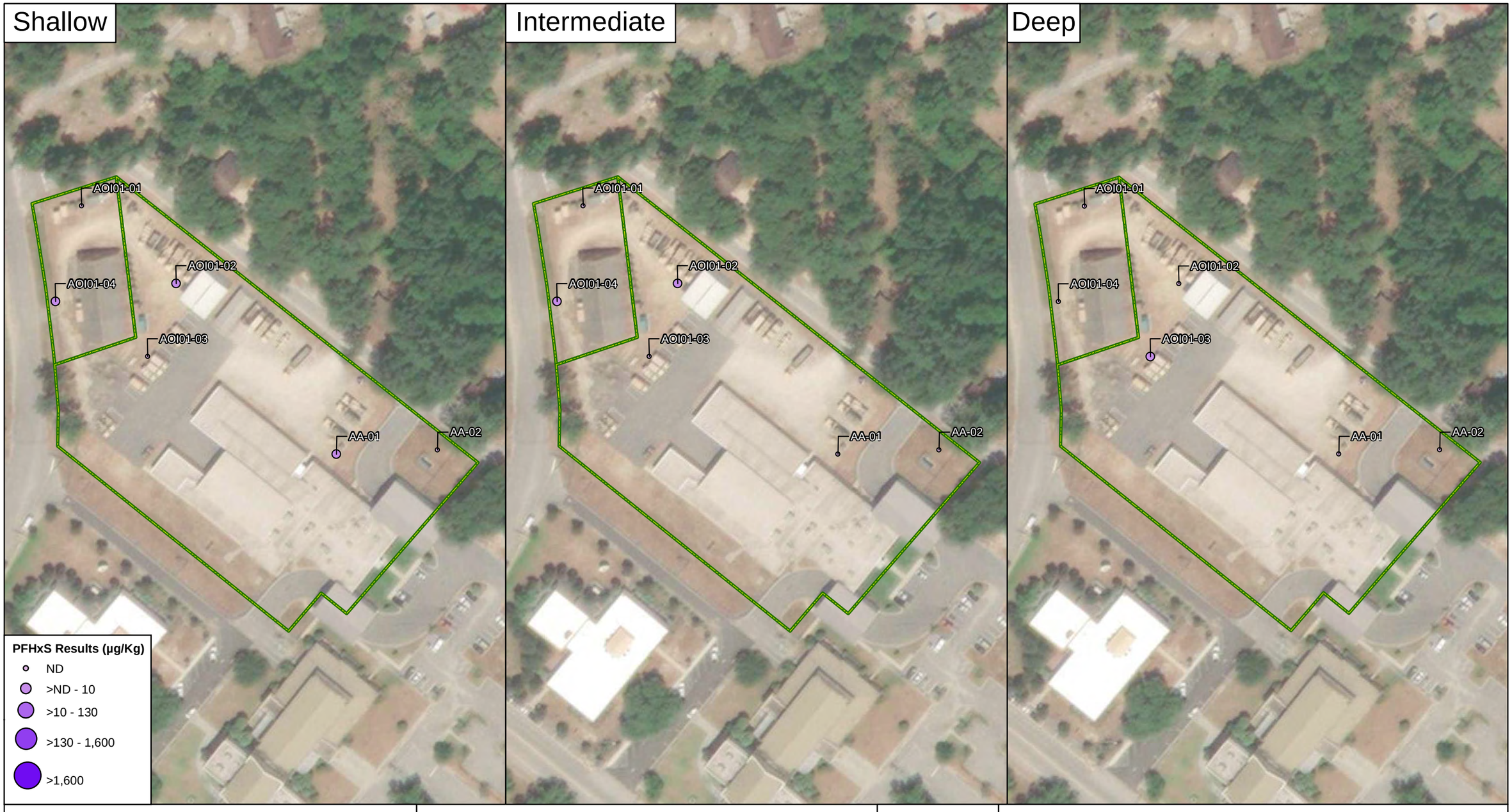
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFBS Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-3



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PROJECT	Site Inspection at Allendale Armory, SC			
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SCALE	1:1,440	CHK BY	JL	9/6/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	9/6/2022

Legend

Facility Boundary

0 60 120 240 Feet

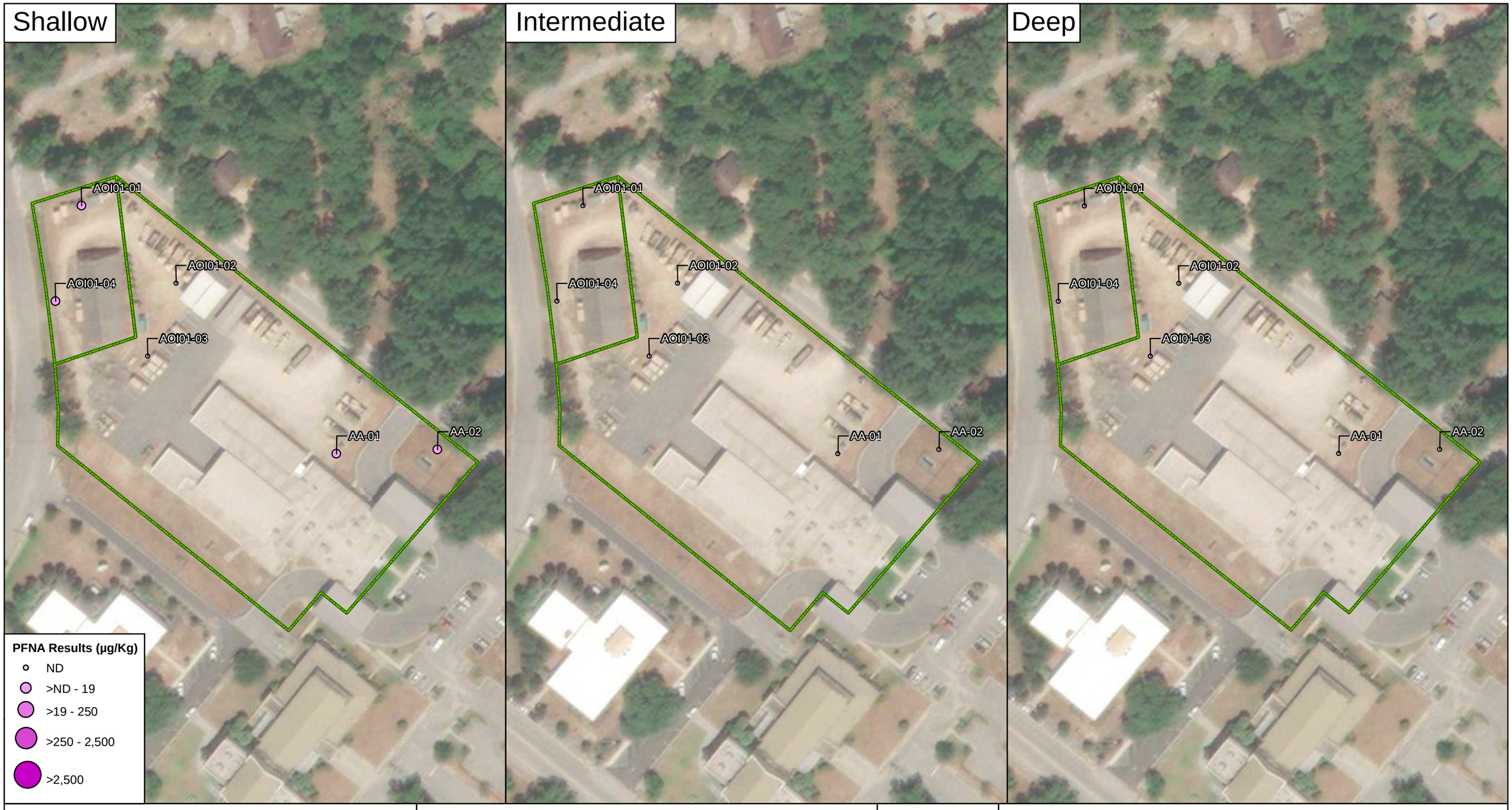
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFHxS Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-4



CLIENT	ARNG			
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SCALE	1:1,440	CHK BY	JL	9/6/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	9/6/2022

Legend

Facility Boundary

0 60 120 240 Feet

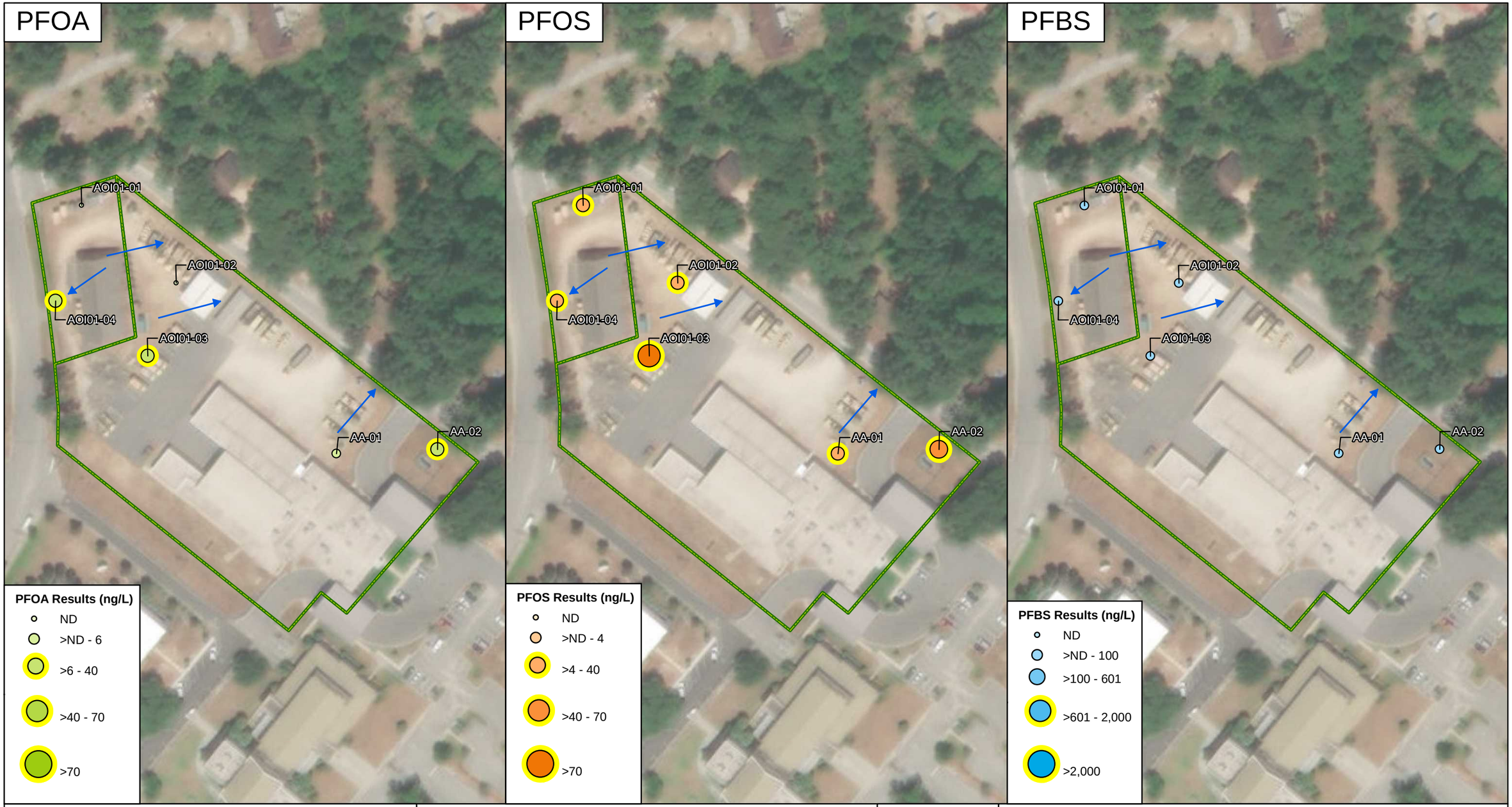
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFNA Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-5



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SCALE	1:1,440	CHK BY	JL	11/8/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	11/8/2022

Legend

Facility Boundary

Groundwater Flow Direction

0 60 120 240 Feet

Exceedances of the OSD SL are depicted with a yellow halo.

N

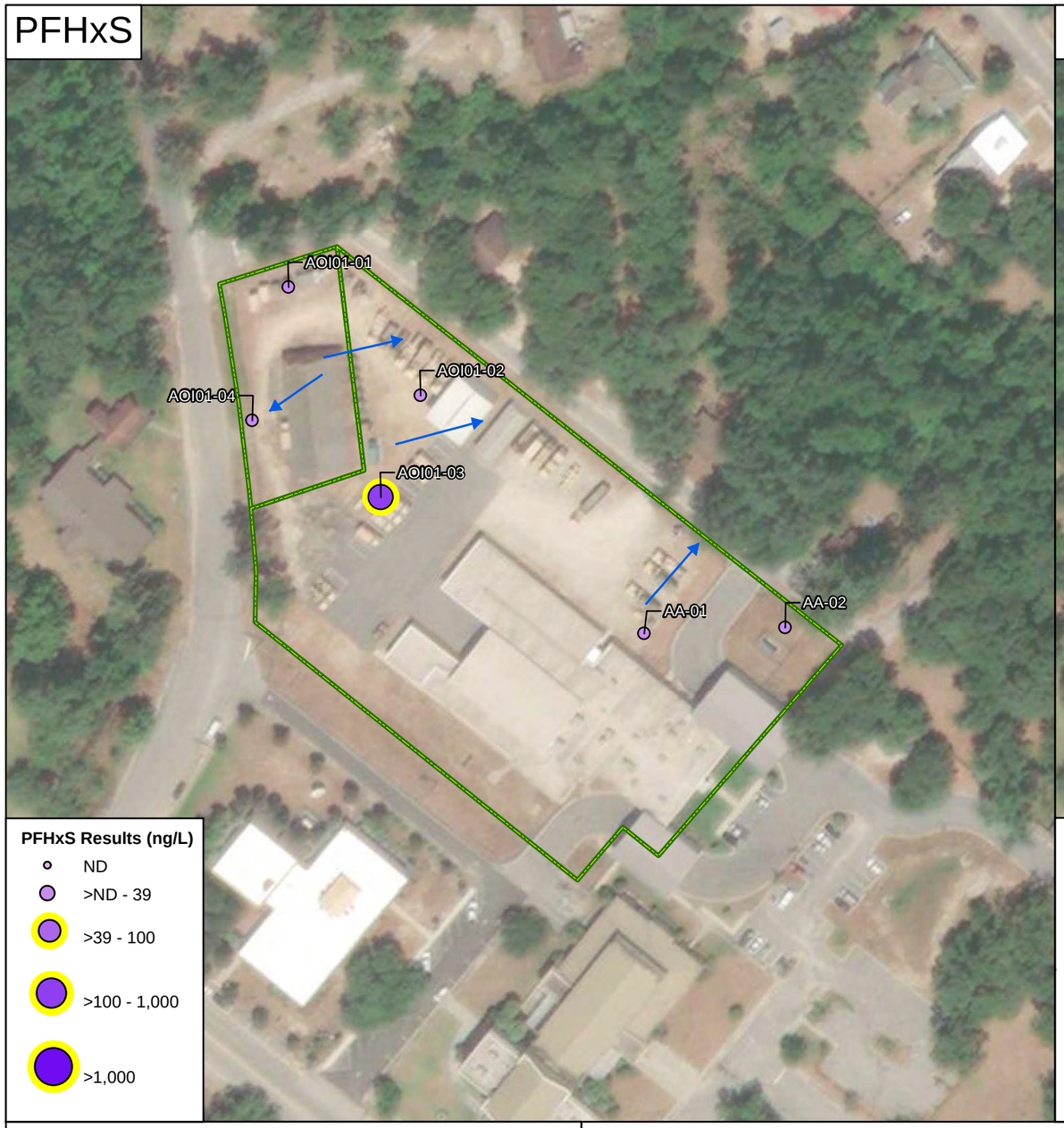
PFOA, PFOS, and PFBS Detections in Groundwater

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-6

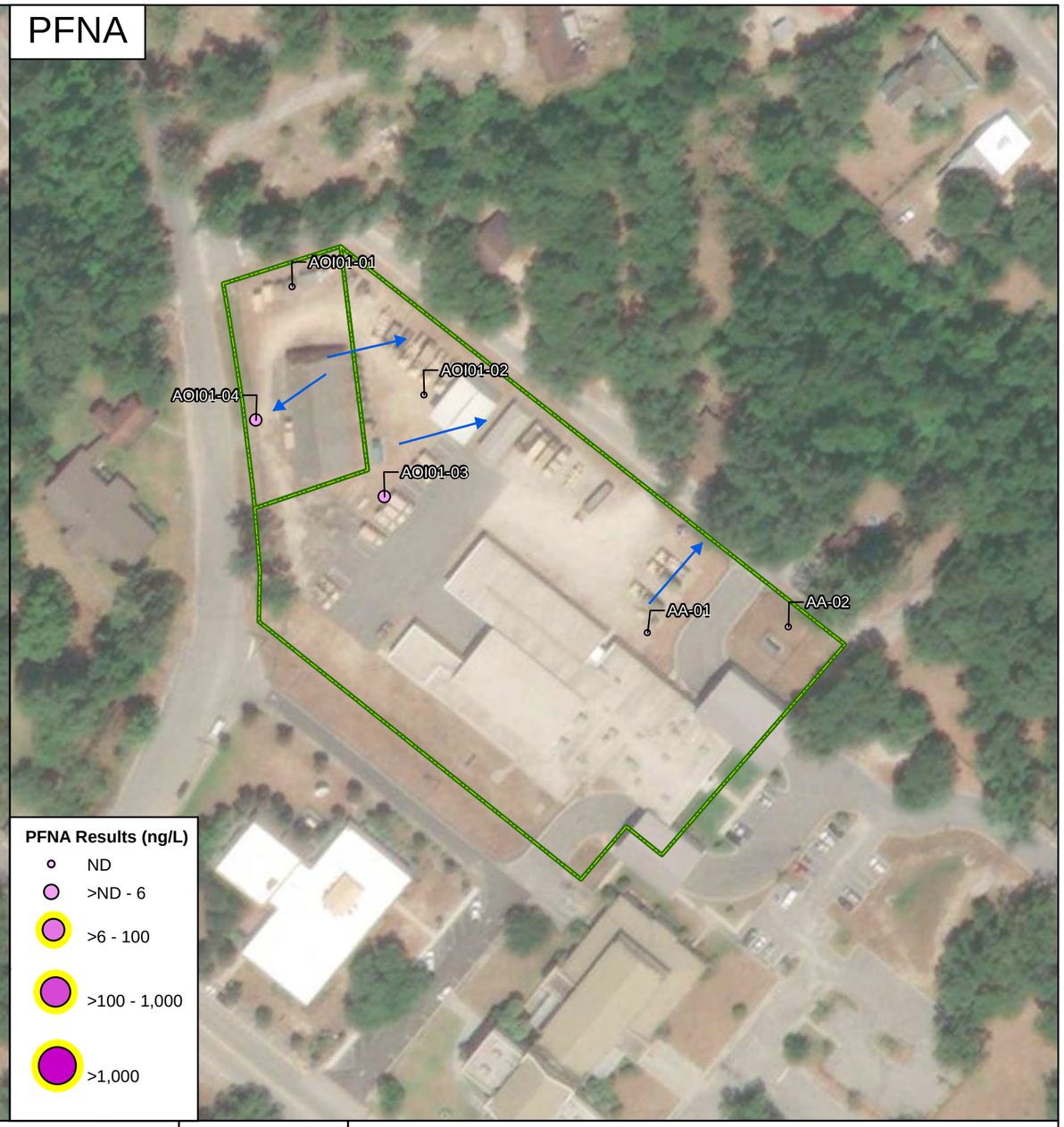
PFHxS



PFHxS Results (ng/L)

- ND
- >ND - 39
- >39 - 100
- >100 - 1,000
- >1,000

PFNA



PFNA Results (ng/L)

- ND
- >ND - 6
- >6 - 100
- >100 - 1,000
- >1,000

CLIENT	ARNG			
PROJECT	Site Inspection at Allendale Armory, SC			
REVISED	9/6/2022	GIS BY	MS	9/6/2022
SCALE	1:1,440	CHK BY	JL	9/6/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	9/6/2022

Legend

- Facility Boundary
- Groundwater Flow Direction

0 60 120 240 Feet

Exceedances of the OSD SL are depicted with a yellow halo.

N

PFHxS and PFNA Detections in Groundwater

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-7

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7. Exposure Pathways

The CSM for AOI 1, revised based on the SI findings, is presented on **Figure 7-1**. Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to Remedial Investigation (RI) or interim action is determined based upon exceedances of the SLs for the relevant compounds and whether the release is more than likely attributable to the DoD. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

1. Contaminant source;
2. Environmental fate and transport;
3. Exposure point;
4. Exposure route; and
5. Potentially exposed populations.

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with an incomplete pathway generally warrant no further action. However, the pathway is considered potentially complete if the relevant compounds are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of relevant compounds above the SLs. Areas with an identified potentially complete pathway that have detections of the relevant compounds above the SLs may warrant further investigation. Although the CSMs indicate whether potentially complete exposure pathways may exist, the recommendation for future study in a RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

In general, the potential routes of exposure to the relevant compounds are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2001). Receptors at the facility include site workers (e.g., facility staff and visiting soldiers), construction workers, trespassers, residents outside the facility boundary, and recreational users outside of the facility boundary.

7.1 Soil Exposure Pathway

The SI results in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 1 based on the aforementioned criteria.

7.1.1 AOI 1

AOI 1 is the Maintenance Bay, where AFFF was historically stored in 5-gallon buckets and in firetrucks located at the vehicle maintenance bay. Fire training and nozzle testing with the firetrucks was reportedly only conducted with water, although the exact location of these activities is unknown.

PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in surface soil at AOI 1. Facility access is restricted; therefore, trespasser exposure is unlikely. No active construction was ongoing during site activities, but site workers and future construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathways for site workers and future construction workers are potentially complete. Residential areas surround the facility, so residents and/or trespassers may be potentially exposed via inhalation of dust. PFOS and PFHxS were detected in subsurface soil at AOI 1. Construction workers could contact constituents in subsurface soil via incidental ingestion, and therefore, the subsurface soil exposure pathway for future construction workers is potentially complete. All other soil exposure pathways for site workers, residents, trespassers, and recreational users are considered incomplete, as the receptors are unlikely to encounter the media under current and/or future scenarios. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2 Groundwater Exposure Pathway

The SI results in groundwater were used to determine whether a potentially complete pathway exists between the source and potential receptors based on the aforementioned criteria.

7.2.1 AOI 1

PFOA, PFOS, and PFHxS were detected above their SLs in groundwater samples collected at AOI 1. Due to the presence of domestic and public water system wells within a 4-mile radius of the facility, the pathway for exposure to off-facility residents via ingestion of groundwater is considered potentially complete. The facility receives potable water from the Allendale Water Department. The primary source of Allendale Water Department is groundwater; however, the on-facility potable water source used for equipment decontamination during the SI was non detect for all relevant compounds. Therefore, the ingestion exposure pathway for site workers is considered incomplete. Depths to water measured at AOI 1 in March 2022 during the SI ranged from 5.33 to 8.21 feet bgs. Therefore, construction workers could reasonably come in contact with groundwater and the ingestion exposure pathway for future construction workers is considered potentially complete. The difference in groundwater elevations between observations made during lithologic logging and groundwater gauging suggests that a semi-confining unit may be present, and the depth to the shallow, surficial aquifer is deeper than 15 ft bgs. Construction activities that extend into the semi-confining layer could expose future construction workers to deeper groundwater. The CSM for AOI 1 is presented on **Figure 7-1**.

PFOA and PFOS were detected above their SLs in groundwater samples collected on the facility near the Allendale County Fire and Rescue potential release area. These sample locations are cross-gradient to AOI 1. Therefore, any releases associated with the fire station are not resultant of DoD activities.

7.3 Surface Water and Sediment Exposure Pathway

The SI results in soil and groundwater, in combination with knowledge of the fate and transport properties of PFAS, were used to determine whether a potentially complete pathway exists between the source and potential receptors. Surface water and sediment samples were not collected as part of the SI.

7.3.1 AOI 1

PFAS are water soluble and can migrate readily from soil to surface water via leaching and run-off. Because PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in soil and groundwater at

AOI 1, it is possible that those compounds may have migrated from soil and groundwater to the stormwater drainages and the off-facility detention pond.

Stormwater from the area surrounding the maintenance bay may flow to a drainage ditch that runs the length of the western facility boundary along Old Barnwell Road. The drainage ditch does not hold water outside of rain events. Therefore, the surface water sediment ingestion exposure pathway for future site workers and future construction workers is potentially complete. There is also a stormwater catch basin at the northwest corner of the facility on the corner of Old Barnwell and Georgia Avenue that connects to a sewer line which drains off-facility. The closest surface water feature to the facility is a small unnamed pond located 0.3 miles to the east. Stormwater drains surrounding the main armory building direct stormwater to an off-facility detention pond approximately 400 feet to the southeast and the end discharge point is unknown. Therefore, conservatively, the surface water sediment ingestion exposure pathway for off-facility recreational users is potentially complete.

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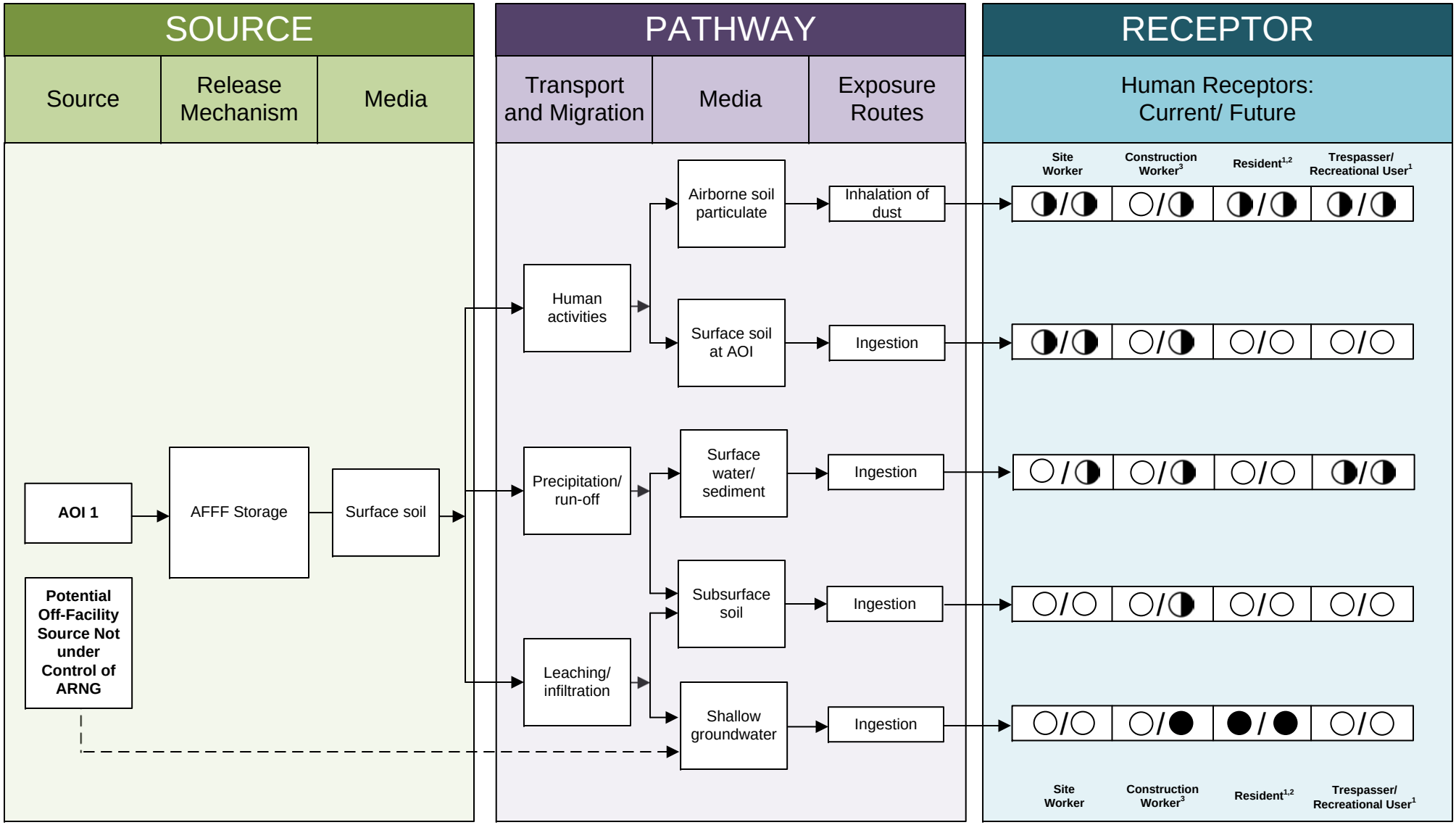

LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

Notes:

1. The resident and recreational users refer to off-site receptors.
2. No current active construction at the facility.

Figure 7-1
Conceptual Site Model, AOI 1
Allendale Armory

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8. Summary and Outcome

This section summarizes SI activities and findings. The most significant findings are summarized in this section and are reproduced directly or abstracted from information contained in this report. The outcome provides general and comparative interpretations of the findings relative to the SLs.

8.1 SI Activities

The SI field activities were conducted from 25 March 2022 to 29 March 2022 and consisted of utility clearance, direct push boring, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022a).

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2021a), samples were collected and analyzed for a subset of 18 compounds by LC/MS/MS compliant with QSM 5.3 Table B-15 as follows.

- Eighteen (18) soil samples from six boring locations;
- Six grab groundwater samples from six temporary wells;
- Thirteen (13) QA/QC samples

An SI is conducted when the PA determines an AOI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at the AOI to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. Additionally, the CSM was refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure at the AOI, which are described in **Section 7**.

8.2 Outcome

Based on the results of this SI, further evaluation is warranted in an RI for AOI 1: Maintenance Bay. Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to drinking water receptors from sources that may originate on the facility as a result of historical DoD activities. Sample analytical concentrations collected during the SI were compared to the project SLs in soil and groundwater, as described in **Table 6-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1:
    - The detected concentrations of the relevant compounds in soil at AOI 1 were below their SLs.
    - PFOA, PFOS, and PFHxS in groundwater exceeded their SLs, with maximum concentrations detected at AOI01-03. PFOA exceeded the SL of 6 ng/L, with a maximum concentration of 17.8 ng/L. PFOS exceeded the SL of 4 ng/L, with a maximum concentration of 345 ng/L. PFHxS exceeded the SL of 39 ng/L, with a maximum concentration of 322 ng/L.
    - Based on the exceedances of the SLs in groundwater, further evaluation of AOI 1 is warranted in the RI.
- Facility Wide (Allendale County Fire and Rescue):

- The detected concentrations of the relevant compounds in soil at AOI 1 were below their SLs.
- PFOA and PFOS in groundwater exceeded their SLs, with maximum concentrations detected at AA-02. PFOA exceeded the SL of 6 ng/L, with a maximum concentration of 15.4 ng/L. PFOS exceeded the SL of 4 ng/L, with a maximum concentration of 41.6 ng/L.
- Due to the proximity of an adjacent source to locations AA-01 and AA-02, it is uncertain if detections are representative of AOI 1 or the Allendale County Fire and Rescue station. Increasing concentrations from AA-01 to AA-02 seem to support a release at the fire station occurred, but a definitive association cannot be made due to uncertainties associated with the limited data collected during the SI.

Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS. **Table 8-1** summarizes the SI results for soil and groundwater used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI.

Table 8-1: Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Maintenance Bay	◐	●	●	Proceed to RI

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

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