FINAL
Site Inspection Report
Army Aviation Support Facility #2
Birmingham, Alabama

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
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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
ALARNG	Alabama Army National Guard
ANG	Air National Guard
ANGB	Air National Guard Base
amsl	above mean sea level
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
DO	dissolved oxygen
DOT	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
gpm	gallons per minute
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/MSD	matrix spike/matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
ORP	oxidation-reduction potential
OSD	Office of the Secretary of Defense
OWS	oil-water separator
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
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
WWTP	wastewater treatment plant

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 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 two Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for AOI locations). The objective of the SI is to identify whether there has been a release to the environment from the AOIs 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 Birmingham Army Aviation Support Facility (AASF) #2 in Birmingham, Alabama and determined further investigation is warranted for AOI 1: Hangar and AOI 2: Flight Ramp. The Birmingham AASF #2 will also be referred to as the "facility" throughout this document.

AASF #2 is located at 5701 E Lake Boulevard, approximately 5 miles northeast of downtown Birmingham, in Jefferson County, Alabama. The facility is in the northernmost section of the Birmingham-Shuttlesworth International Airport, situated on a parcel of land owned by the Birmingham Airport Authority (Jefferson County Alabama, 2019). The land is leased from the airport authority by the Alabama Air National Guard, who in turn licenses it for use by the Alabama Army National Guard (ALARNG). Construction of the facility began around 1965. Based on aerial imagery, the hangar building was constructed between 1970 and 1977 and was later expanded around 1998. Since its construction, the approximately 22-acre AASF facility has been used by ALARNG for the operation, maintenance, and repair of rotary-winged aircraft, and facility buildings include one hangar, administrative offices, and classrooms. Water and electric utilities are provided by the City of Birmingham.

The PA identified two AOIs for investigation during the SI phase. SI sampling results from the two AOIs 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: Hangar and AOI 2: Flight Ramp.

[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	Hangar	◐	●	N/A	Proceed to RI
2	Flight Ramp	●	●	●	Proceed to RI

Legend:
N/A = not applicable
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

1

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 Birmingham Army Aviation Support Facility (AASF) #2 in Birmingham, Alabama. The Birmingham AASF #2 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 Birmingham AASF #2 (AECOM Technical Services, Inc. [AECOM], 2020) that identified two Areas of Interest (AOIs) 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 AOIs 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

AASF #2 is located at 5701 E Lake Boulevard, Birmingham, Jefferson County, Alabama, approximately 5 miles northeast of downtown Birmingham. The roughly 22-acre facility is within the property of Birmingham-Shuttlesworth International Airport, at the northernmost portion of the airport property, just south of E Lake Boulevard. The land is leased from the airport authority by the Alabama Air National Guard (ANG), who in turn licenses it for use by the Alabama Army National Guard (ALARNG). The latitude and longitude for the approximate center of the AASF are 33°34'15.35" N; 86°45'0.97" W. Construction of AASF #2 began around 1965. Based on aerial imagery, the hangar building was constructed between 1970 and 1977 and was later expanded around 1998. The site location is depicted on **Figure 2-1**.

Since its construction, AASF #2 is used by ALARNG for the operation, maintenance, and repair of rotary-winged aircraft. The facility is covered almost entirely by paved or developed surfaces, except for some grassy areas south and east of the flight ramp, and a drainage basin between the northeast corner of the AASF and adjacent Birmingham Airport runway. The facility is contiguous with the Birmingham Airport to the south and east, as well as an ANG Base (ANGB) to the west-northwest, and it is connected to these adjacent facilities via its flight ramp and taxiways. Additional ALARNG facilities are located to the north of AASF #2.

2.2 Facility Environmental Setting

AASF #2 is situated in the Valley and Ridge Physiographic Province, which is characterized by a series of northeast-trending linear ridges and valleys underlain by alternating beds of hard and soft, highly faulted and folded, sedimentary rocks ranging from Cambrian to Pennsylvanian in age (Johnson et al., 2002). AASF #2 sits at an elevation of around 630 feet above mean sea level. Topography at the facility is relatively flat and slopes gently southward, towards the airport runway. Hills rise above the facility towards the north and west (**Figure 2-2**).

AASF #2 is immediately surrounded on all sides by the Birmingham Airport, the ANGB, and other ALARNG facilities. The nearest residential areas are located northwest and southeast of the facility, beyond these adjacent facilities. Other commercial and industrial use properties are located in the vicinity of the airport.

2.2.1 Geology

Surface soils in the valleys of the Valley and Ridge Province were formed mainly in residuum of weathered limestone and are predominantly red, iron-rich clays with silt loam surface textures. The ridges consist of cherty limestone that produce a gravelly loam, gravelly clay subsoil, and a gravelly silt loam surface layer. The Bodine and Fullerton soil series cover an extensive part of the Valley and Ridge Province (Johnson et al., 2002).

The facility is underlain by the Ketona Dolomite and is located on the Airport anticline, close to the contact with the Ordovician and Upper Cambrian Knox Group (**Figure 2-3**). The Ketona Dolomite is characterized as a light to medium gray, thick-bedded, fine- to coarse-grained dolomite. The Ketona Dolomite is underlain by the Middle to Upper Cambrian-aged Conasauga Formation. The Conasauga Formation comprises three intervals of calcium carbonate rock. The uppermost interval is dolomitic, the middle interval is bioclastic and oolitic limestone, and the lowest interval is interbedded shale and micritic limestone. The adjacent Knox Group is generally described as a light to medium gray, laminated, finely crystalline, cherty dolomite and limestone (Rindsberg et al., 2003; Irvin et al., 2006).

Soil borings generally encountered lean clay with varying percentages of sand. Additionally, isolated layers of silt and well-graded sand were observed in AOI02-04 and AOI01-02, respectively. A reddish brown or reddish yellow lean clay layer was consistently observed in every boring, at depths beginning between 13 feet bgs and 19 feet bgs. The aforementioned clay layers range in thickness between 8 feet to 11 feet. These observations are consistent with the Bodine and Fullerton soil series, which generally produces red, clayey soils through weathering of limestone. Direct-push technology (DPT) refusal was encountered at each boring except AOI01-02, and bedrock was encountered at 33 feet below ground surface (bgs) at boring BHM-01. Boring depths ranged from 17 to 38 feet bgs, with refusal depth increasing in the northwest direction. Based on bedrock observation and refusal depth, depth to bedrock is assumed to increase in the northwest direction. This observation is consistent with the known anticline hinge zone to the south of the facility, where depth to bedrock is expected to be the shallowest. Bedrock compositions were observed to be pulverized carbonate rock and are consistent with the descriptions of the Ketona Dolomite.

Boring logs are presented in **Appendix E**. Samples for grain size analyses were collected at two locations, AOI01-02 and AOI02-01, where finer grain materials were observed and were analyzed via American Society for Testing and Materials (ASTM) Method D-422. The results for both samples were similar and indicate that the soil sample is mostly silt (around 58 percent [%]) and clay (38%). The grain size results are presented in **Appendix F**.

2.2.2 Hydrogeology

The facility sits atop the Valley and Ridge aquifer system, which includes the Knox Group and Ketona Dolomite, the two formations present in the immediate vicinity of the AASF (Kopaska-Merkel et al., 2005). Generally, the Knox Group ranges in thickness from 1,500 to 3,500 feet and produces large quantities of water, with wells yielding up to 800 gallons per minute (gpm). The Ketona Dolomite ranges in thickness from 0 to 760 feet and is a major producer of groundwater in Jefferson County, with wells yielding around 300 gpm. Groundwater in these units is typically found in dissolution channels, where circulating water has dissolved the rock and thus increased the secondary porosity (Hunter and Moser, 1990; Kopaska-Merkel et al., 2005).

Shallow groundwater in the vicinity of AASF #2 was anticipated within the unconsolidated overburden based on a previous investigation at the adjacent Birmingham ANGB. During that investigation, saturated soil was observed at shallow depths of less than 20 feet bgs and generally did not yield significant quantities of water. Depths to water measured during the Birmingham ANGB SI ranged from 4.57 to 11.75 feet bgs (Leidos, 2019).

Depths to water measured in February 2022 during the AASF #2 SI ranged from 15.49 to 22.91 feet bgs. Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate groundwater flow direction is generally to the south. Regional groundwater flow is towards the west, according to Valley and Ridge aquifer system potentiometric contour maps (Kopaska-Merkel, 2005) (**Figure 2-3**).

Drinking water at the facility and surrounding area is supplied by Birmingham Water Works, which sources its water from the Cahaba River and Lake Purdy, which are 6 and 9 miles southeast of the facility, respectively. Based on the research done as part of the PA, only inactive US Geological Survey monitoring wells were identified within a 4-mile radius of the facility (AECOM, 2020). However, a recent review of well records on the Geological Survey of Alabama Groundwater Assessment Program's Water Well Finder identified the nearest wells being just over 3 miles southeast of the facility. Based on available information, the wells are constructed within bedrock greater than 300 feet deep and designated as industrial or public use (GSA, 2022).

2.2.3 Hydrology

AASF #2 lies within the Mobile River Basin (Johnson et al., 2002) in the Upper Village Creek Watershed. The only surface water body near the facility is a retention pond located across the airport runway, less than 0.5 miles northeast, but considered hydrologically sperate from the facility, and Village Creek, which flows southeast to southwest of AASF #2 and flows into Bayview Lake, which is located approximately 11 miles west of the facility. Village Creek and Bayview Lake are used for recreational purposes. Surface water features surrounding the facility are shown in **Figure 2-5**.

Local storm water runoff north of the Hangar flows southwest along the AASF #2 boundary. Storm water runoff on the Flight Ramp primarily flows across paved surfaces to the southeast. Storm water runoff that is not captured by the sanitary system (i.e. building trench drains and wash rack) would infiltrate into unpaved areas or flow into nearby storm drains, such as in the drainage basin between the northeast corner of the facility and the adjacent Airport runway. Storm water captured at AASF#2 is inferred to join with the larger Airport storm water system and drain to the southwest, towards Village Creek.

2.2.4 Climate

The climate of the Mobile River Basin is warm and humid, ranging from subtropical at the coast to temperate at higher elevations. In the summer, the Gulf of Mexico produces warm, humid air that moves inland, creating precipitation (Johnson et al., 2002). The average temperature at Birmingham is 63.3 degrees Fahrenheit (°F), with an average high of 73.8 °F and an average low of 52.8 °F. Birmingham receives an average of 53.71 inches of rain per year (World Climate, 2020).

2.2.5 Current and Future Land Use

The Birmingham AASF #2 is a restricted access facility located on the property of Birmingham-Shuttlesworth International Airport. The facility is surrounded by the Airport to the south and east and Birmingham ANGB to the west-northwest. Additional ALARNG facilities are located to the north. Residential areas exist to the northwest and southeast, beyond the Airport and ANGB. 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 insects, mammals, plants, and reptiles are federally endangered, threatened, proposed, and/ or are listed as candidate species in Jefferson County, Alabama (US Fish and Wildlife Service [USFWS], 2022.

- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Mammals**: Gray Bat, *Myotis grisescens* (endangered), Indiana Bat, *Myotis sodalis* (endangered), Northern long-eared bat, *Myotis septentrionalis* (threatened)
- **Flowering plants:** Gentian pinkroot, *Spigelia gentianoides* (endangered), tennessee yellow-eyed-grass, *Xyris tennesseensis* (endangered), Georgia rockcress, *Arabis georgiana* (threatened), White fringeless orchid, *Platanthera integrilabia* (threatened),

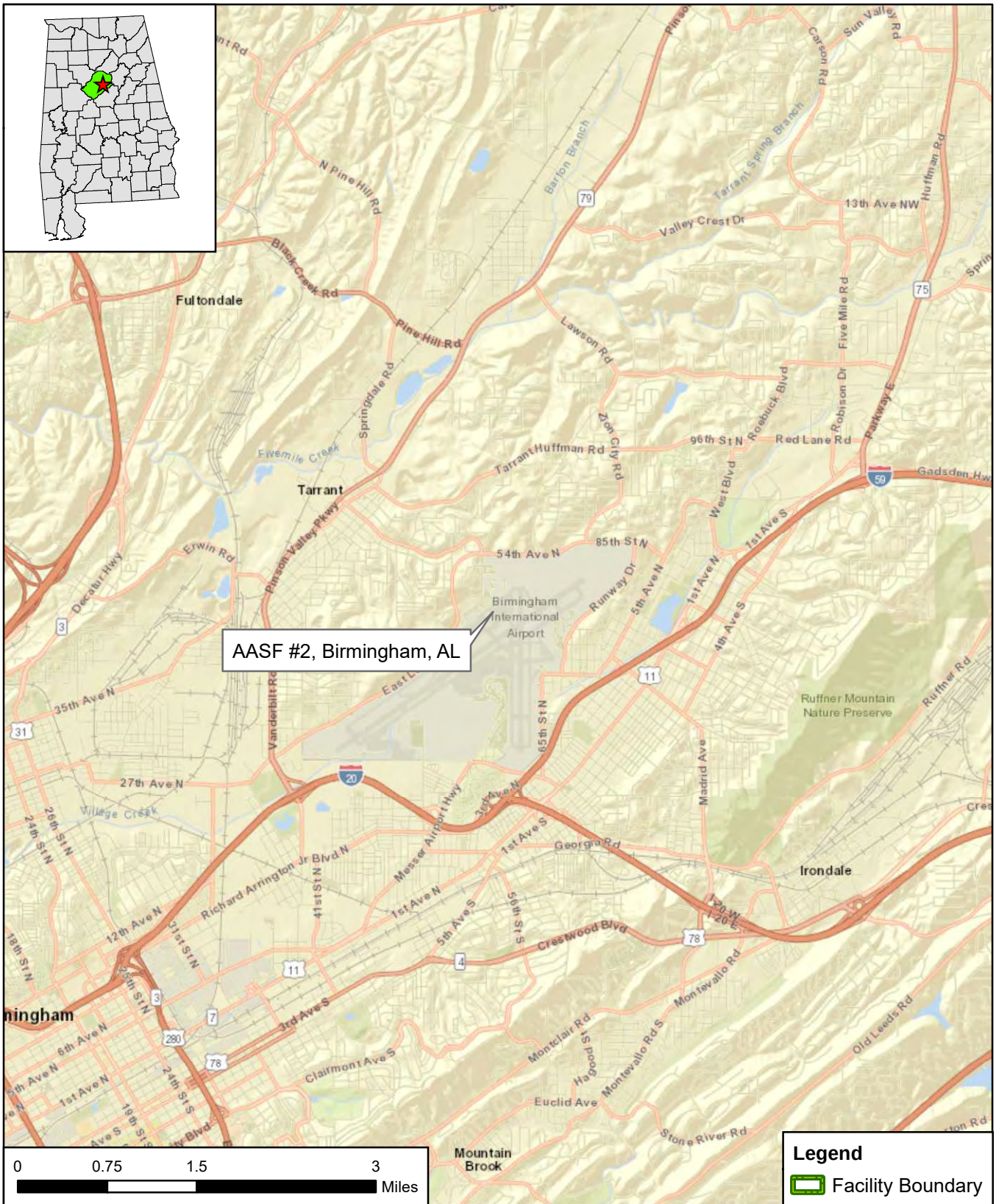
Mohr's Barbara's buttons, *Marshallia mohrii* (threatened), Small whorled pogonia, *Isotria medeoloides* (threatened)

- **Reptiles:** Flattened must turtle, *Sternotherus depressus*, (threatened)

2.3 History of PFAS Use

Two AOIs were identified in the PA where AFFF may have been used, stored, disposed, or released historically at AASF #2 (AECOM, 2020). PFAS-containing materials were potentially released to surface soil within the boundary of AASF #2 through equipment discharge, accidental leaks and spills, and any potential undocumented fire suppression system testing.

The Hangar is equipped with a fire suppression system that utilizes AFFF. Although there are no documented releases from the system, AFFF may have been released during system maintenance or accidental leaks and spills, as supported by information provided by ALARNG during SI report preparation that noted a 2010 release of AFFF along the northwest side of the Hangar. The Hangar floor and trench drains convey to the oil-water separator (OWS) located just east of the building. AFFF releases may also have occurred from incidental spills on the Flight Ramp, where ARNG staged mobile fire extinguishers until 2010. Information obtained during SI planning indicated that nozzle testing may have been performed by the ANGB fire department at AASF #2, on the paved area just southwest of the Flight Ramp. A description of each AOI is presented in **Section 3**.



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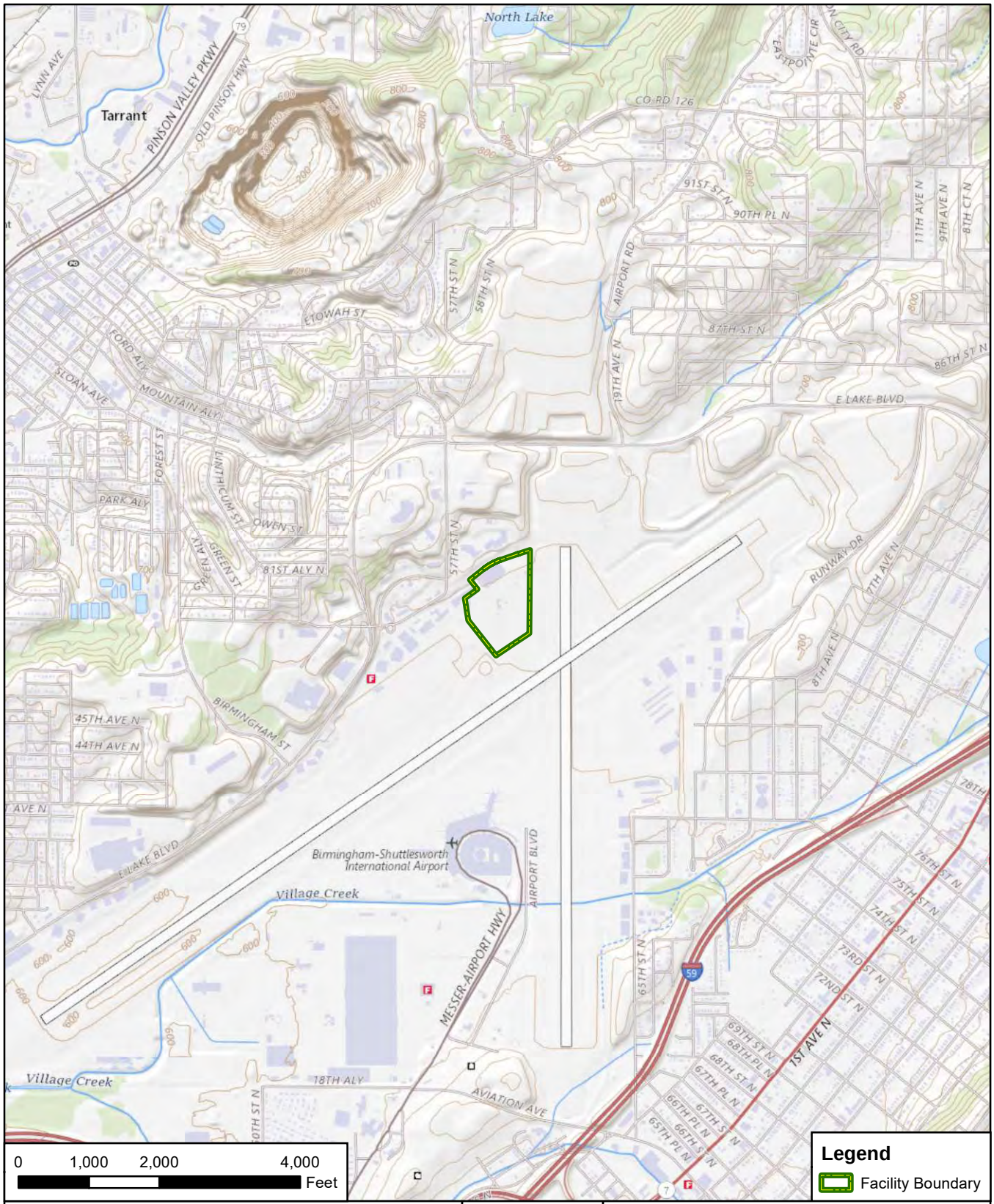
SCALE	1:75,000	CHK BY	BM	8/24/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	8/24/2022

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



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SCALE	1:24,000	CHK BY	BM	8/24/2022
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	8/24/2022

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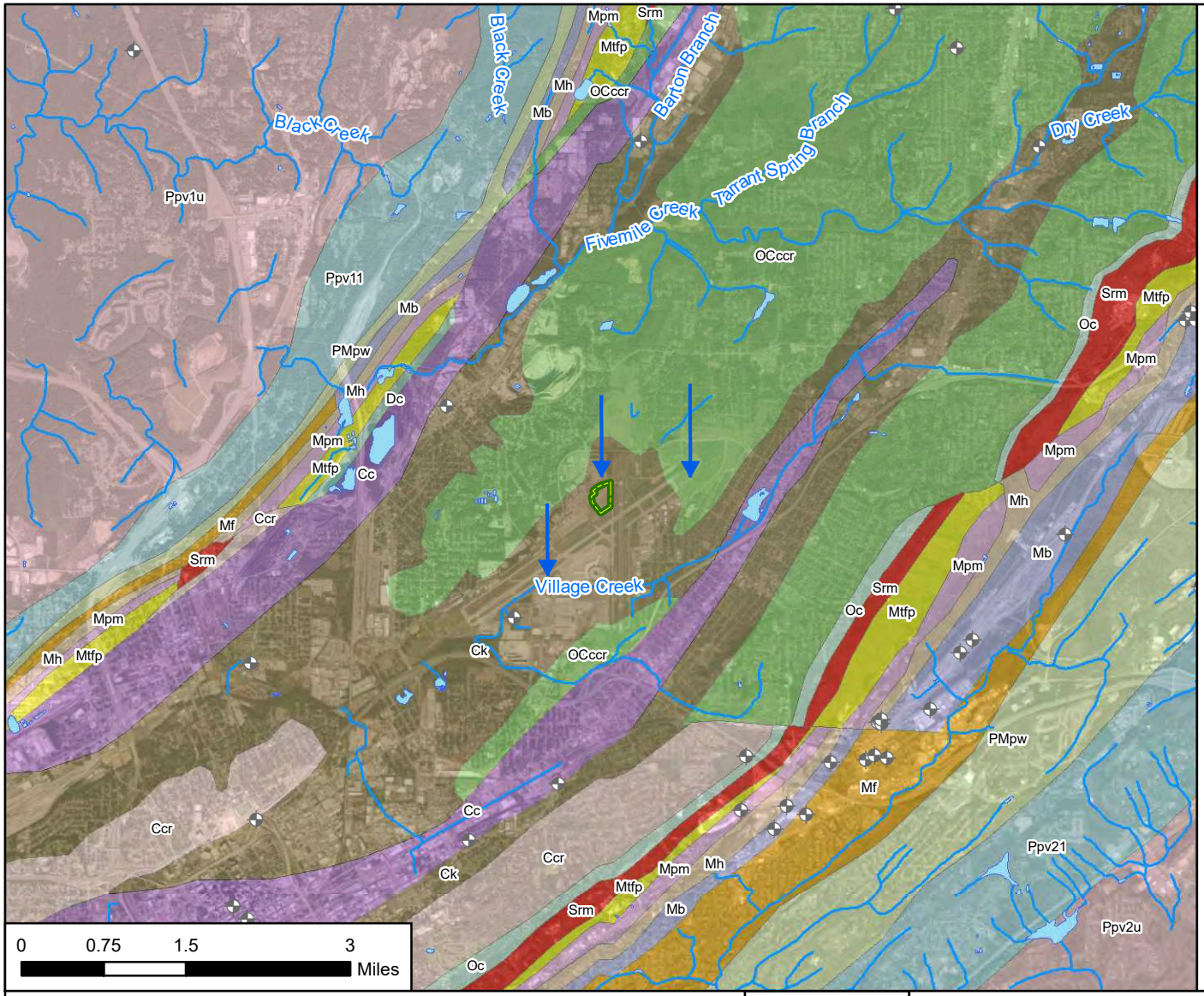
Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



Legend

- Facility Boundary
- Water Body
- Wetland
- Stream/River
- Inferred Groundwater Flow Direction

Geology

- Ppv1u/Ppv2u - Pottsville Formation (upper)
- Ppv11/Ppv21 - Pottsville Formation (lower)
- PMpw - Parkwood Formation
- Mb - Bangor Limestone
- Mf - Floyd Shale
- Mh - Hartselle Sandstone
- Mpm - Pride Mountain Formation
- Mtfp - Tuscumbia Limestone and Fort Payne Chert
- Dc - Chattanooga Shale
- Srm - Red Mountain Formation
- Oc - Chickamauga Limestone
- OCccr - Knox Group (undifferentiated)
- Ccr - Copper Ridge Dolomite
- Ck - Ketona Dolomite
- Cc - Conasauga Formation

Wells

- Inactive USGS Monitoring Well

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #2, Birmingham, AL			
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SCALE	1:95,040	CHK BY	MC	8/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/24/2022

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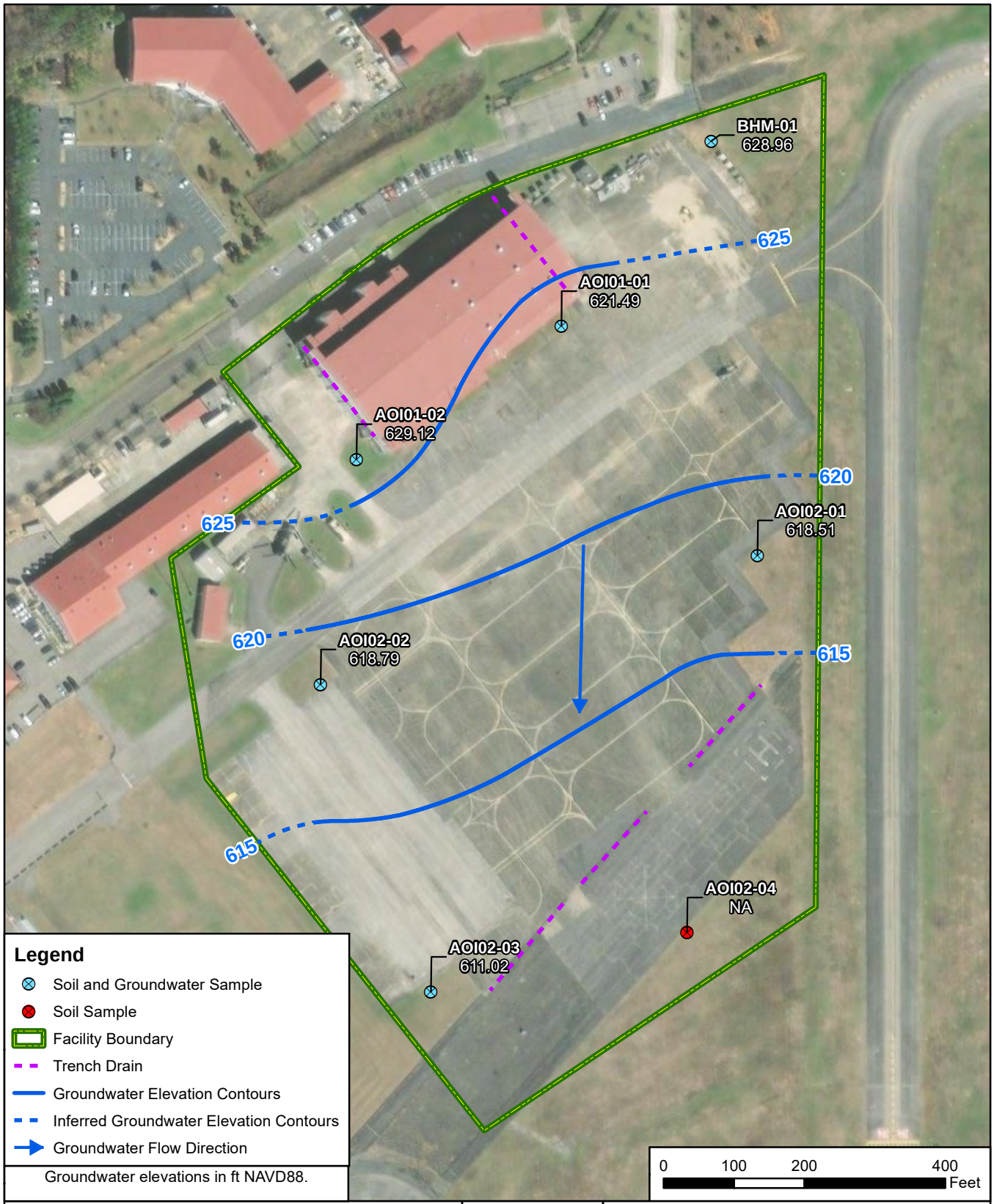
Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3



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Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/27/2023

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Groundwater Elevations, February 2022

AECOM
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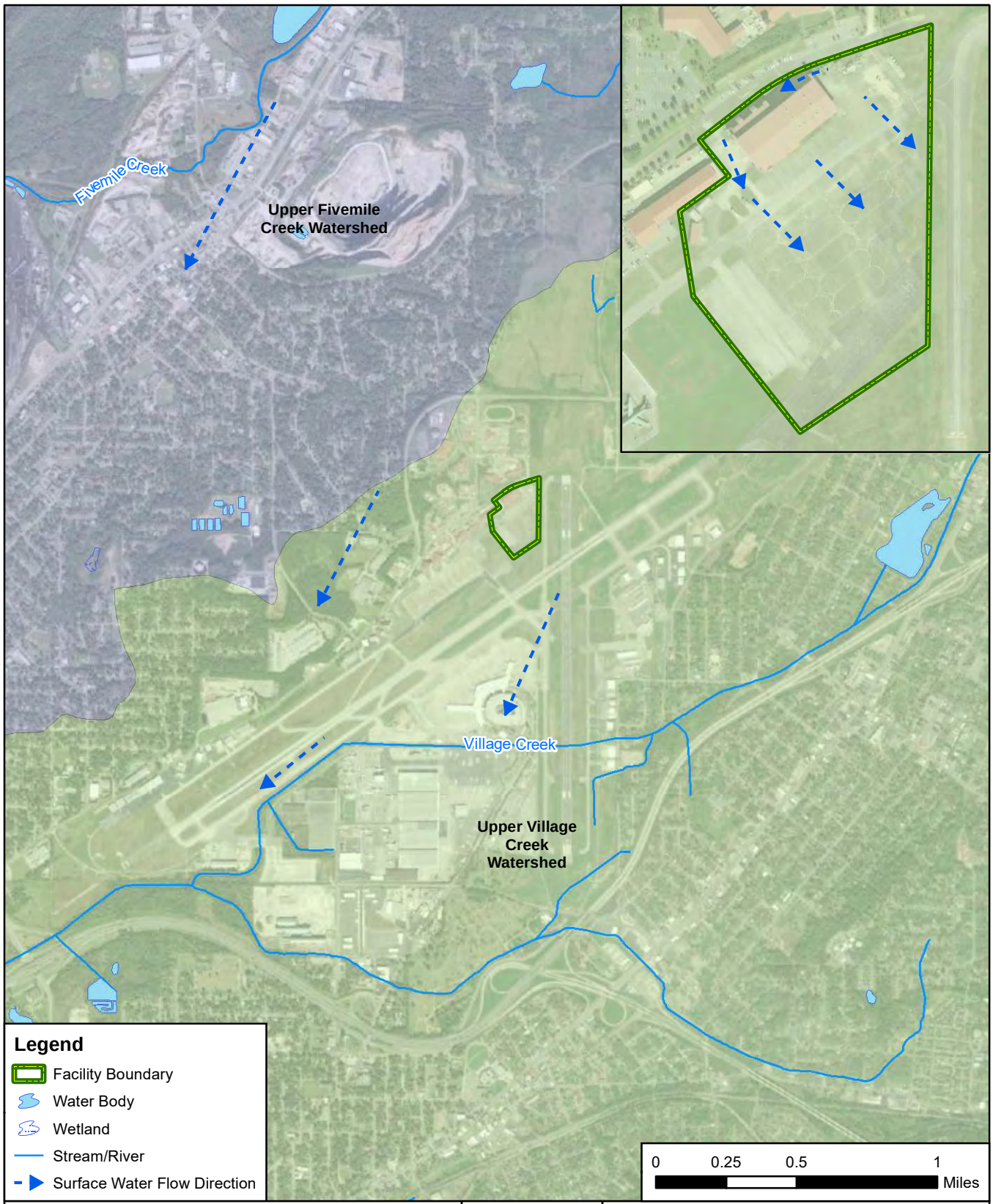
Figure 2-4



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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, two potential release areas, the Hangar and the Flight Ramp, were identified at Birmingham AASF #2 and made into two AOIs (AECOM, 2020). The potential release areas are shown on **Figure 3-1**.

3.1 AOI 1 Hangar

AOI 1 is located in the north part of the facility and encompasses the Hangar. Eight 55-gallon floor tanks containing Ansulite 3 percent (%) AFFF were obtained in 1996 and kept in the Hangar. In 1998, an overhead fire suppression system equipped with two 1,400-gallon AFFF tanks was installed. The AFFF tanks are housed in the mechanical room (Room #115), which is located near the east corner of the building. Based on markings, the tanks were likely filled in 1997 and refilled in August 1998. In 2010, the fire suppression system was refurbished, and the AFFF was again replaced. Information regarding a full-scale test of the suppression system, prior to or after refurbishment, could not be ascertained. The PA indicated there were no reported leaks or spills of AFFF; however, corrosion on the side of the large tanks was evident. Additionally, information provided by ALARNG during SI report preparation noted the apparent release of AFFF around 2010, likely during replacement of the AFFF in the Hangar fire suppression system. Photographs provided by ALARNG suggest that AFFF was released to the ground surface on the service drive located immediately beside the northwest exterior wall of the Hangar. AFFF may have also been released down drains it the Hangar.

Releases at AOI 1 would have occurred on the Hangar floor or mechanical room, both of which drain to floor and trench drains. These drains would convey any AFFF with wastewater to the OWS and then discharge to the sanitary sewer. This discharge includes wastewater captured not only by building floor and trench drains, but also the Wash Rack. The Village Creek Wastewater Treatment Plant (WWTP) treats wastewater from the facility (Jefferson County Environmental Services Department, 2016). AFFF released outside of the Hangar may have infiltrated into the subsurface or run off to storm water drains. It is also possible AFFF released may have infiltrated into the subsurface soil via joints in the floor slab or could have traveled outside the Hangar and onto the flight ramp and surrounding grassy areas.

3.2 AOI 2 Flight Ramp

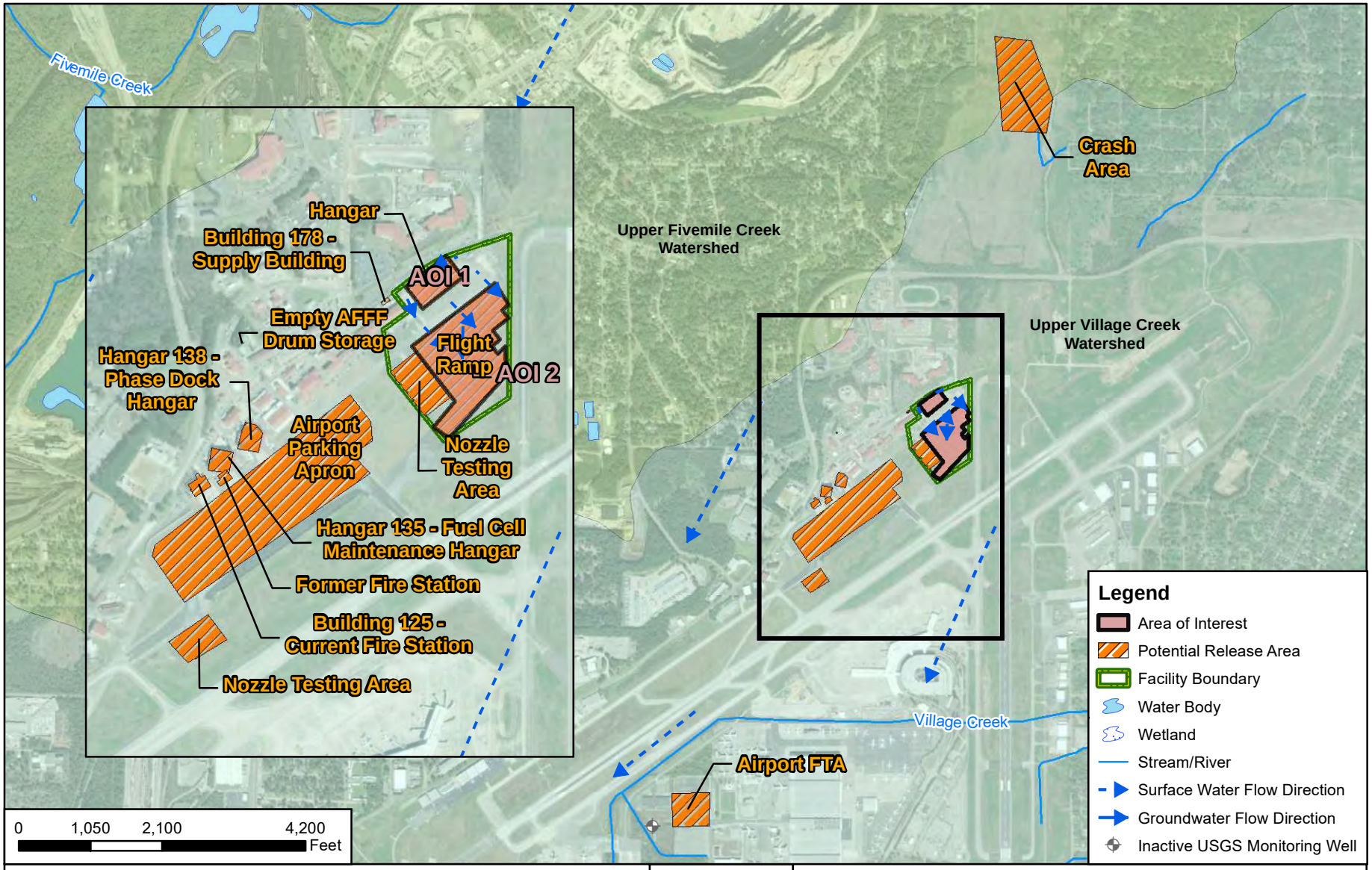
AOI 2 encompasses the Flight Ramp located south of the Hangar. Approximately 16 Tri-Max™ 30 mobile extinguisher units equipped with AFFF were staged on the Flight Ramp until 2010. No information was provided regarding the date the units were obtained or on the disposal of the units or AFFF within. There were no records of discharges or spills of AFFF at AOI 2 by ARNG at the time of the PA; however, during a November 2021 site visit, facility personnel noted that fire response personnel from the adjacent ANBG had occasionally performed nozzle testing on the paved area contiguous with the southwest side of the Flight Ramp, on AASF #2. The PA did not originally consider this location a potential release area because ALARNG personnel stated the Flight Ramp was only used for safety training, but it has been added to AOI 2 for this SI.

Any releases at AOI 2 would have occurred on both pavement and grassy surfaces. The pavement drains via trench drains along the southern edge of the Flight Ramp to the storm water sewer. AFFF may have infiltrated into the subsurface soil via cracks or joints in the pavement or, where trench drains are not present, to the surrounding grassy areas.

3.3 Adjacent Sources

Two potential off-facility sources of PFAS adjacent to AASF #2, not under the control of the ALARNG, were identified during the PA. These potential off-facility sources include the Birmingham ANGB and the Birmingham-Shuttlesworth International Airport. The Birmingham ANGB, which licenses use of the AASF property to ALARNG, is located immediately southwest of AASF #2. An SI for PFOS and PFOA was performed at the Birmingham ANGB in February 2019 during which six potential release areas were investigated based on the historical presence of AFFF at the site. Results indicated PFOA and PFOS were detected in groundwater at a combined maximum concentration of 45,230 nanograms per liter (ng/L). Both compounds were also detected in soil (Leidos, 2019).

Birmingham-Shuttlesworth International Airport is located directly adjacent to AASF #2, with its property extending east, south, and west of the facility. A PA report completed for the Birmingham ANGB identified four potential source areas on the airport property (BB&E, 2016). These areas were not addressed in the ANGB SI, as they are not on ANGB property. These potential adjacent sources are also shown on **Figure 3-1**; however, it must be noted that this SI did not evaluate off-facility sources, and these locations are shown for informational purposes only.



CLIENT	ARNG			
PROJECT	Site Inspection at AASF #2, Birmingham, AL			
REVISED	11/9/2022	GIS BY	MS	11/9/2022
SCALE	1:25,200	CHK BY	MC	11/9/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	11/9/2022

N

Areas 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, 2021), 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 AASF #2 Birmingham (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, 2021); 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 SI scope was bounded vertically by the observed depths of the surficial groundwater table or drilling refusal, where encountered. Temporal boundaries were limited by seasonal conditions present during the Winter 2022 field work.

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, 2021).

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, 2021).

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 Preliminary Assessment Report, Birmingham Army Aviation Support Facility #2, Alabama* dated September 2020 (AECOM, 2020);
- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan* dated March 2018 (AECOM, 2018a);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Army Aviation Support Facility #2, Birmingham, Alabama* dated September 2021 (AECOM, 2021);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b); and
- *Final Site Safety and Health Plan, Army Aviation Support Facility #2, Birmingham, Alabama* dated February 2022 (AECOM, 2022).

The SI field activities were conducted from 14 to 17 February 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, 2021), except as noted in **Section 5.8**.

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:

- Twenty-seven (27) soil samples from twelve (12) boring locations;
- Six (6) grab groundwater samples from seven (7) temporary well locations; and
- Fifteen (15) 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**, Field Change Request forms are provided in **Appendix B3,** a Nonconformance and Corrective Action Report is provided in **Appendix B4**, and land survey data are provided in **Appendix B5**. 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 22 September 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, ARNG, ALARNG, USACE, and representatives familiar with the facility. 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, 2021).

A TPP Meeting 3 was held on 26 July 2023 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

Both AECOM and their drilling subcontractor, Walker Hill Environmental, Inc., placed a ticket with the Alabama 811 public utility clearance provider to notify them of intrusive work. Additionally, AECOM contracted Ground Penetrating Radar Systems (GPRS), a private utility location service, to perform utility clearance on the facility. GPRS performed utility clearance of the proposed boring locations on 14 February 2022 with input from the AECOM field team and AASF #2 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

Two potable water sources at Birmingham AASF #2 were sampled on 16 November 2021 to assess usability for decontamination of drilling equipment. Results of both samples collected confirmed the sources to be acceptable for use in this investigation; therefore, the spigot at the wash rack (BHM-DECON-01) was used throughout the field activities. Specifically, the samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water samples 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, 2021). 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 to avoid disturbing concrete or asphalt surfaces. Soil samples were collected via hand auger and DPT, in accordance with the SI QAPP Addendum (AECOM, 2021). 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 5 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 2 feet above the groundwater table, and one subsurface soil sample at the mid-

point between the surface and the groundwater table. One multi-interval surface soil sample was taken near the OWS northeast of AOI 1, at location AOI01-05, to increase data density around the OWS. Two additional surface soil samples, AOI02-05 and AOI02-06, were also added to offer better data density at the recently identified potential release area near the paved area southwest of AOI 2. The soil sample deviations are discussed further in **Section 5.9**.

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**.

Direct push soil borings were completed during the SI at depths ranging between 17 to 38 feet bgs. Soil borings completed during the SI found low to medium plasticity lean clays with varying amounts of sand as the dominant lithology of the unconsolidated sediments below AASF #2. Isolated layers of well-graded sand and silt were also observed in borings AOI01-02 and AOI02-04, respectively. A reddish brown or reddish yellow lean clay layer was consistently observed in the borings, at depths beginning between 13 feet bgs and 19 feet bgs. The aforementioned clay layers range in thickness between 8 feet to 11 feet. These observations are consistent with the Bodine and Fullerton soil series, which generally produces red, clayey soils through weathering of limestone. Bedrock refusal was encountered at BHM-01, at a depth of 33 feet bgs, and was observed to be pulverized carbonate rock, consistent with descriptions of the Ketona Dolomite. DPT refusal was encountered at each boring except AOI01-02. These observations are consistent with the reported geological setting of the region.

Each soil sample was collected into laboratory-supplied 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), pH (USEPA Method 9045D), and grain size (ASTM Method D-422) in accordance with the SI QAPP Addendum (AECOM, 2021).

Field duplicate samples were collected at a rate of 10% 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, 2021) using bentonite-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**.

Sufficient time was allowed for groundwater accumulation in the temporary wells before proceeding with collection of groundwater samples. 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 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, 2021).

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, 2021) by removing the PVC and backfilling the hole with a bentonite-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 16 February 2022. Groundwater elevation measurements were collected from the 6 new temporary monitoring wells. Water level measurements were taken from the northern side of the well casing. Groundwater was measured between 15.49 to 22.91 feet bgs. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-2**.

5.5 Surveying

The northern side of each well casing was surveyed by Alabama-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2021). Survey data from the newly installed wells on the facility were collected on 16 February 2022 in the applicable Universal Transverse Mercator zone projection with World Geodetic System 84 datum (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B5**.

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, 2021) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) were generated during the SI activities from the ten soil boring locations. No soil IDW was generated at the surface soil sample locations. Due to the minimal amount of soil IDW generated, all soil IDW were containerized in labeled, 55-gallon Department

of Transportation (DOT)-approved steel drums and stored on the concrete pad adjacent to the wash rack area (just south of boring BHM-01). Based on laboratory results, containerized soil cuttings will be managed and disposed of off-facility by ARNG, under a separate contract held by EA Engineering, Science, and Technology, Inc. (EA). Specifics on the disposal of solid IDW will be addressed in an IDW Treatment Memorandum submitted by EA.

Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) were containerized in two labeled, 55-gallon DOT-approved steel drums and stored next to the soil IDW drums. Based on laboratory results, ARNG will manage and dispose of the liquid IDW off-facility under a separate contract held by EA. Specifics on the disposal of liquid IDW will be addressed in an IDW Treatment Memorandum submitted by EA.

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

Three deviations from the SI QAPP Addendum were identified during review of the field documentation. The deviation is noted below and is documented in two Field Change Request Forms (**Appendix B3**) and a Nonconformance and Corrective Action Report (**Appendix B4**):

- Shortly after the completion of the SI field activities, it was discovered that the laboratory-provided bottleware used to collect soil and groundwater samples for the AASF #2 Birmingham PFAS SI had lids containing PTFE (i.e., Teflon) components, a known potential source of PFAS. The laboratory was instructed to provide rush turnaround of the sample results, including the SI's QC blank samples – which were confirmed to have been collected in containers with PTFE-containing lids – to evaluate data usability and potential contamination to the samples from the lids. The AECOM team also requested the laboratory prepare and analyze an additional QC blank sample using the same PTFE-containing bottles. Laboratory results for all QC blank sample results, both field and laboratory prepared, were non-detect for all analyzed PFAS compounds, indicating that the PTFE-containing lids did not leach PFAS concentrations to the samples. Therefore, data qualification due to the use of the PTFE-containing lids was deemed not to be necessary, no impact on the data is anticipated, and positive results and estimate detections are considered true positives. This action was documented in a nonconformance and corrective action report provided in **Appendix B4**.

- SI field activities found bedrock refusal at varying depths in all direct-push drilling locations, consistent with expectations based on information available during the PA and SI QAPP development. At boring location AOI02-04, the temporary well installed in this borehole did not produce sufficient groundwater to sample over 48 hours. To offset the loss of a groundwater sample at AOI02-04, an alternate soil boring and temporary well were completed at location AOI01-02, originally scoped as a surface soil sample only. The spacing of the other three AOI 2 groundwater sample locations are considered adequate to meet the data quality objectives. Further, the additional groundwater sample at AOI 1 provides an extra data point between the AASF hangar and adjacent ANGB. This action was documented in a field change request form provided in **Appendix B3**.

- The PA for AASF #2 Birmingham identified AOI 2 as the Flight Ramp based on the historical presence of Tri-Max units; however, the PA found there were no known releases of AFFF at AOI 2. Sample location AOI02-03 was identified in the Final SI QAPP to characterize soil and groundwater at the southwest corner of AOI 2. During a preliminary site walk of the sample locations, ALARNG noted that fire response personnel from the adjacent ANG facility have occasionally performed nozzle testing on the paved area just southwest of AOI 2, on the AASF facility. This paved area was not included with AOI 2 previously, since ALARNG noted it was used for safety training only. Due to the possible release of AFFF during the recently identified nozzle testing, AOI 2 was expanded to include the paved area to the immediate southwest side. Location AOI02-03 met the original data quality objectives identified in the SI QAPP. Two additional surface soil samples, AOI02-05 and AOI02-06, were added along the downslope side of the paved area to offer better data density where surface runoff from the paved area occurs. The soil boring locations are shown in **Figure 5-1**. This action was documented in a field change request form provided in **Appendix B3**.

Table 5-1
Site Inspection Results by Medium
Site Inspection Report, AASF #2 Birmingham, Alabama

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	LC/MS/MS QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size	Comments
Soil Samples							
AOI01-01-SB-00-02	2/14/2022	0-2	x	x	x		
AOI01-01-SB-00-02-D	2/14/2022	0-2	x				Duplicate
AOI01-01-SB-00-02-MS	2/14/2022	0-2	x				MS/MSD
AOI01-01-SB-00-02-MSD	2/14/2022	0-2	x				MS/MSD
AOI01-01-SB-10-12	2/15/2022	10-12	x				
AOI01-01-SB-22-24	2/15/2022	22-24	x				
AOI01-02-SB-00-02	2/14/2022	0-2	x				
AOI01-02-SB-13-15	2/16/2022	13-15	x				
AOI01-02-SB-30-32	2/16/2022	30-32	x			x	
AOI01-03-SB-00-02	2/14/2022	0-2	x				
AOI01-03-SB-00-02-D	2/14/2022	0-2	x				Duplicate
AOI01-04-SB-00-02	2/14/2022	0-2	x				
AOI01-05-SB-00-02	2/15/2022	0-2	x				
AOI01-05-SB-04-05	2/15/2022	4-5	x				
AOI02-01-SB-00-02	2/14/2022	0-2	x				
AOI02-01-SB-10-12	2/15/2022	10-12	x				
AOI02-01-SB-19-21	2/15/2022	19-21	x			x	
AOI02-02-SB-00-02	2/14/2022	0-2	x				
AOI02-02-SB-13-15	2/14/2022	13-15	x				
AOI02-02-SB-28-30	2/14/2022	28-30	x				
AOI02-03-SB-00-02	2/14/2022	0-2	x	x	x		
AOI02-03-SB-00-02-D	2/14/2022	0-2		x	x		Duplicate
AOI02-03-SB-00-02-MS	2/14/2022	0-2		x	x		MS/MSD
AOI02-03-SB-00-02-MSD	2/14/2022	0-2		x	x		MS/MSD
AOI02-03-SB-10-12	2/14/2022	10-12	x				
AOI02-03-SB-18-20	2/14/2022	18-20	x				
AOI02-04-SB-00-02	2/14/2022	0-2	x				
AOI02-04-SB-08-10	2/14/2022	8-10	x				
AOI02-04-SB-15-16	2/14/2022	15-16	x				
AOI02-05-SB-00-02	2/14/2022	0-2	x				
AOI02-05-SB-00-02-MS	2/14/2022	0-2	x				MS/MSD
AOI02-05-SB-00-02-MSD	2/14/2022	0-2	x				MS/MSD
AOI02-06-SB-00-02	2/14/2022	0-2	x				
BHM-01-SB-00-02	2/15/2022	0-2	x				
BHM-01-SB-00-02-D	2/15/2022	0-2	x				Duplicate
BHM-01-SB-13-15	2/15/2022	13-15	x				

Table 5-1
Site Inspection Results by Medium
Site Inspection Report, AASF #2 Birmingham, Alabama

BHM-01-SB-28-30	2/15/2022	28-30	x				
Groundwater Samples							
AOI01-01-GW	2/16/2022	NA	x				
AOI01-02-GW	2/16/2022	NA	x				
AOI02-01-GW	2/16/2022	NA	x				
AOI02-01-GW-D	2/16/2022	NA	x				Duplicate
AOI02-02-GW	2/15/2022	NA	x				
AOI02-03-GW	2/15/2022	NA	x				
AOI02-03-GW-MS	2/15/2022	NA	x				MS/MSD
AOI02-03-GW-MSD	2/15/2022	NA	x				MS/MSD
BHM-01-GW	2/16/2022	NA	x				
Blank Samples							
BHM-FRB-01	2/16/2022	NA	x				FRB
BHM-ERB-01	2/14/2022	NA	x				ERB
BHM-ERB-02	2/15/2022	NA	x				ERB
DECON Samples							
BHM-DECON-01	11/16/2022	NA	x				DECON
BHM-DECON-02	11/16/2022	NA	x				DECON

Notes:

AASF = Army Aviation Support Facility
AOI = Area of Interest
bgs = below ground surface
D = duplicate
ERB - equipment blank
FRB - field reagent blank
MW = monitoring well
MS/MSD = matrix spike/matrix spike duplicate
pH = potential for hydrogen
SB = soil boring
SHEL = Shelbyville
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, AASF #2 Birmingham, Alabama

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)	Groundwater Elevation (feet NAVD88)
AOI 1	AOI01-01	24	19 - 24	644.53	644.40	23.04	22.91	621.49
	AOI01-02	38	33 - 38	644.97	644.61	15.85	15.49	629.12
AOI 2	AOI02-01	23	18 - 23	637.71	637.57	19.2	19.06	618.51
	AOI02-02	33	28 - 33	637.11	636.91	18.32	18.12	618.79
	AOI02-03	20	15 - 20	628.87	628.81	17.85	17.79	611.02
	AOI02-04	17	12 - 17	629.42	629.49	NA	NA	NA
	BHM-01	33	28 - 33	647.89	645.75	18.93	16.79	628.96

Notes:
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 AASF #2, Birmingham, AL			
REVISED	2/9/2023	GIS BY	MS	2/9/2023
SCALE	1:2,400	CHK BY	MC	2/9/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/9/2023

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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 each AOI is provided in **Section 6.3** through **Section 6.5**. **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, pH, and grain size, which are important for evaluating transport through the soil medium. **Appendix F** contains the results of the TOC, pH, and grain size 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: Hangar. 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) from boring locations AOI01-01 through AOI01-05. Soil was also sampled from shallow subsurface soil (13 to 15 feet bgs) from boring locations AOI01-01, AOI01-02, and AOI01-05 and deep subsurface soil (15 to 32 feet bgs) from boring locations AOI01-01 and AOI01-02. **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, PFBS, PFHxS, and PFNA were detected in surface soil, at concentrations below their SLs. PFOS and PFHxS were also detected in shallow subsurface soil below their SLs, and PFOS, PFBS, and PFHxS were detected in the deep subsurface soil.

PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in surface soil, at concentrations below their SLs. PFOA, PFOS, PFHxS, and PFNA were detected at all five locations, and PFBS was detected at two of the five locations. The maximum detected concentration among all five compounds in surface soil was PFOS, with a concentration of 3.79 micrograms per kilogram (µg/kg) at location AOI01-03.

PFOS and PFHxS were detected in shallow subsurface soil, at concentrations below their SLs. PFOS was detected at all three locations, and PFHxS was detected at two of the three locations. The maximum concentration of these compounds in shallow subsurface soil was PFOS detected at0.444 J µg/kg at AOI01-05. PFOA, PFNA, and PFBS were not detected in shallow subsurface soil. PFOS, PFBS, and PFHxS were detected in deep subsurface soil at location AOI01-02 at a maximum concentration of 0.393 J µg/kg. PFOA and PFNA were not detected in deep subsurface soil.

6.3.2 AOI 1 Groundwater Analytical Results

Groundwater was sampled from temporary monitoring wells AOI01-01 and AOI01-02. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

PFOA, PFOS, and PFHxS were detected in groundwater above their SLs. PFBS and PFNA were detected in groundwater below their SLs.

PFOA exceeded the SL of 6 ng/L at a concentration of 98.4 ng/L at AOI01-02. PFOS exceeded the SL of 4 ng/L at both locations, at a maximum concentration of 10.6 ng/L at AOI01-01. PFHxS exceeded the SL of 39 ng/L, at a concentration of 65.7 ng/L at AOI01-02. PFBS and PFNA were detected below their SLs, at maximum concentrations of 17.3 ng/L and 2.57 ng/L, respectively.

6.3.3 AOI 1 Conclusions

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

6.4 AOI 2

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

6.4.1 AOI 2 Soil Analytical Results

Soil was sampled from surface soil (0 to 2 feet bgs) from boring locations AOI02-01 through AOI02-06 and BHM-01. Soil was also sampled from shallow subsurface soil (13 to 15 feet bgs) and deep subsurface soil (15 to 32 feet bgs) from boring locations AOI02-01 through AOI02-04 and BHM-01. **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.

PFOS was detected in surface soil above the SL. PFOA, PFBS, PFHxS, and PFNA were detected in surface soil, at concentrations below respective SLs. PFOS, PFBS, and PFHxS were detected in shallow and deep subsurface below their SLs.

PFOS was detected in surface soil above the SL of 13 µg/kg at four of the seven locations, with a maximum concentration of 64.5 J µg/kg at BHM-01. PFOA, PFBS, PFHxS, and PFNA were detected at least one order of magnitude below their SLs. The maximum detected concentration among these four compounds detected below the SL was PFHxS, which was detected at a concentration of 1.68 µg/kg at A0I02-05.

PFOS, PFHxS, and PFBS were detected in shallow subsurface soil at concentrations at least one order of magnitude below their SLs. These compounds were also detected in deep subsurface soil. The maximum detected concentration among the three compounds at both intervals was PFOS, which was detected at 0.925 J µg/kg at BHM-01 in shallow subsurface soil and at 1.49 µg/kg at AOI02-04 in deep subsurface soil. PFOA and PFNA were not detected in shallow or deep subsurface soil.

6.4.2 AOI 2 Groundwater Analytical Results

Groundwater was sampled from temporary monitoring wells AOI2-01 through AOI2-03 and BHM-01. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

PFOA, PFOS, PFHxS and PFNA were detected in groundwater above their respective SLs. PFBS was detected in groundwater below the SL. PFOA, PFOS, and PFHxS exceeded their respective SLs in groundwater in all four locations. PFNA exceeded the SL at only location AOI02-03, at a

concentration of 14.6 ng/L. The maximum concentrations of PFOA, PFOS, and PFHxS were also found at AOI02-03, at 73.8 ng/L, 697 ng/L, and 782 ng/L, respectively. PFBS was detected below the SL at AOI02-03, at a maximum concentration of 84.7 ng/L.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOS was detected in soil at a concentration above the SL. PFOA, PFOS, PFHxS, and PFNA were detected in groundwater at concentrations above their SLs. Based on the exceedances of the SLs in soil and groundwater, further evaluation at AOI 2 is warranted.

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, AASF #2 Birmingham

Area of Interest		AOI01														AOI02					
Sample ID		AOI01-01-SB-00-02		AOI01-01-SB-00-02-D		AOI01-02-SB-00-02		AOI01-03-SB-00-02		AOI01-03-SB-00-02-D		AOI01-04-SB-00-02		AOI01-05-SB-00-02		AOI02-01-SB-00-02		AOI02-02-SB-00-02		AOI02-03-SB-00-02	
Sample Date		02/14/2022		02/14/2022		02/14/2022		02/14/2022		02/14/2022		02/14/2022		02/15/2022		02/14/2022		02/14/2022		02/14/2022	
Depth		0-2 ft		0-2 ft		0-2 ft		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**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	UJ	0.083	J	0.175	J	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	0.565	J	1.00	J	0.908	J	0.053	J	0.043	J	0.071	J	0.241	J	0.053	J	0.124	J	0.274	J
PFNA	19	0.560	J	0.515	J	0.178	J	1.68		2.18		0.286	J	0.055	J	0.057	J	ND	U	0.162	J
PFOA	19	0.578	J	0.657	J	0.273	J	0.777	J	0.726	J	0.387	J	0.092	J	ND	U	ND	U	0.094	J
PFOS	13	2.88	J-	3.17	J-	3.02		2.87		3.79		0.444	J	1.68		1.44		0.589	J	18.2	

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 incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

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

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

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

AASF	Army Aviation Support Facility
AOI	Area of Interest
BHM	Birmingham
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 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, AASF #2 Birmingham

Area of Interest		AOI02									
Sample ID		AOI02-04-SB-00-02		AOI02-05-SB-00-02		AOI02-06-SB-00-02		BHM-01-SB-00-02		BHM-01-SB-00-02-D	
Sample Date		02/14/2022		02/14/2022		02/14/2022		02/15/2022		02/15/2022	
Depth		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**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)											
PFBS	1900	ND	U	0.087	J	0.057	J	0.026	J	0.026	J
PFHxS	130	0.159	J	1.68	J-	1.42		0.443	J	0.525	J
PFNA	19	0.051	J	1.20	J-	0.649	J	ND	U	ND	U
PFOA	19	0.113	J	1.39	J-	0.784	J	ND	U	ND	U
PFOS	13	8.35		54.7	J	17.1		64.5		51.8	

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 incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

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

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

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

AASF	Army Aviation Support Facility
AOI	Area of Interest
BHM	Birmingham
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, AASF #2 Birmingham

Area of Interest		AOI01						AOI02									
Sample ID		AOI01-01-SB-10-12		AOI01-02-SB-13-15		AOI01-05-SB-04-05		AOI02-01-SB-10-12		AOI02-02-SB-13-15		AOI02-03-SB-10-12		AOI02-04-SB-08-10		BHM-01-SB-13-15	
Sample Date		02/15/2022		02/16/2022		02/15/2022		02/15/2022		02/14/2022		02/14/2022		02/14/2022		02/15/2022	
Depth		10-12 ft		13-15 ft		4-5 ft		10-12 ft		13-15 ft		10-12 ft		8-10 ft		13-15 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	0.039	J	ND	U	0.035	J
PFHxS	1600	0.078	J	ND	U	0.065	J	0.065	J	ND	U	0.261	J	0.061	J	0.179	J
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	0.249	J+	0.158	J	0.444	J	ND	U	ND	U	0.523	J	ND	U	0.925	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 industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

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

AASF	Army Aviation Support Facility
AOI	Area of Interest
BHM	Birmingham
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, AASF #2 Birmingham

Area of Interest	AOI01				AOI02									
Sample ID	AOI01-01-SB-22-24		AOI01-02-SB-30-32		AOI02-01-SB-19-21		AOI02-02-SB-28-30		AOI02-03-SB-18-20		AOI02-04-SB-15-16		BHM-01-SB-28-30	
Sample Date	02/15/2022		02/16/2022		02/15/2022		02/14/2022		02/14/2022		02/14/2022		02/15/2022	
Depth	22-24 ft		30-32 ft		19-21 ft		28-30 ft		18-20 ft		15-16 ft		28-30 ft	
Analyte	**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	ND	U	0.031	J	ND	U	ND	U	0.029	J	ND	U	ND	U
PFHxS	ND	U	0.140	J	0.046	J	0.062	J	0.217	J	0.365	J	ND	U
PFNA	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	ND	U	0.393	J	ND	U	0.516	J	0.756	J	1.49		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

AASF	Army Aviation Support Facility
AOI	Area of Interest
BHM	Birmingham
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, AASF #2 Birmingham

Area of Interest		AOI01				AOI02									
Sample ID		AOI01-01-GW		AOI01-02-GW		AOI02-01-GW		AOI02-01-GW-D		AOI02-02-GW		AOI02-03-GW		BHM-01-GW	
Sample Date		02/16/2022		02/16/2022		02/16/2022		02/16/2022		02/15/2022		02/15/2022		02/16/2022	
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	2.65	J	17.3		30.1		28.9		13.2		84.7		8.65	
PFHxS	39	14.3		65.7		390		387		73.7		782	J	40.6	
PFNA	6	ND	U	2.57	J	2.97	J	2.72	J	1.38	J	14.6		ND	U
PFOA	6	4.43		98.4		23.8		25.7		9.80		73.8		6.20	
PFOS	4	10.6		9.98		119		133		54.9		697	J	91.7	

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

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

AASF	Army Aviation Support Facility
AOI	Area of Interest
BHM	Birmingham
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

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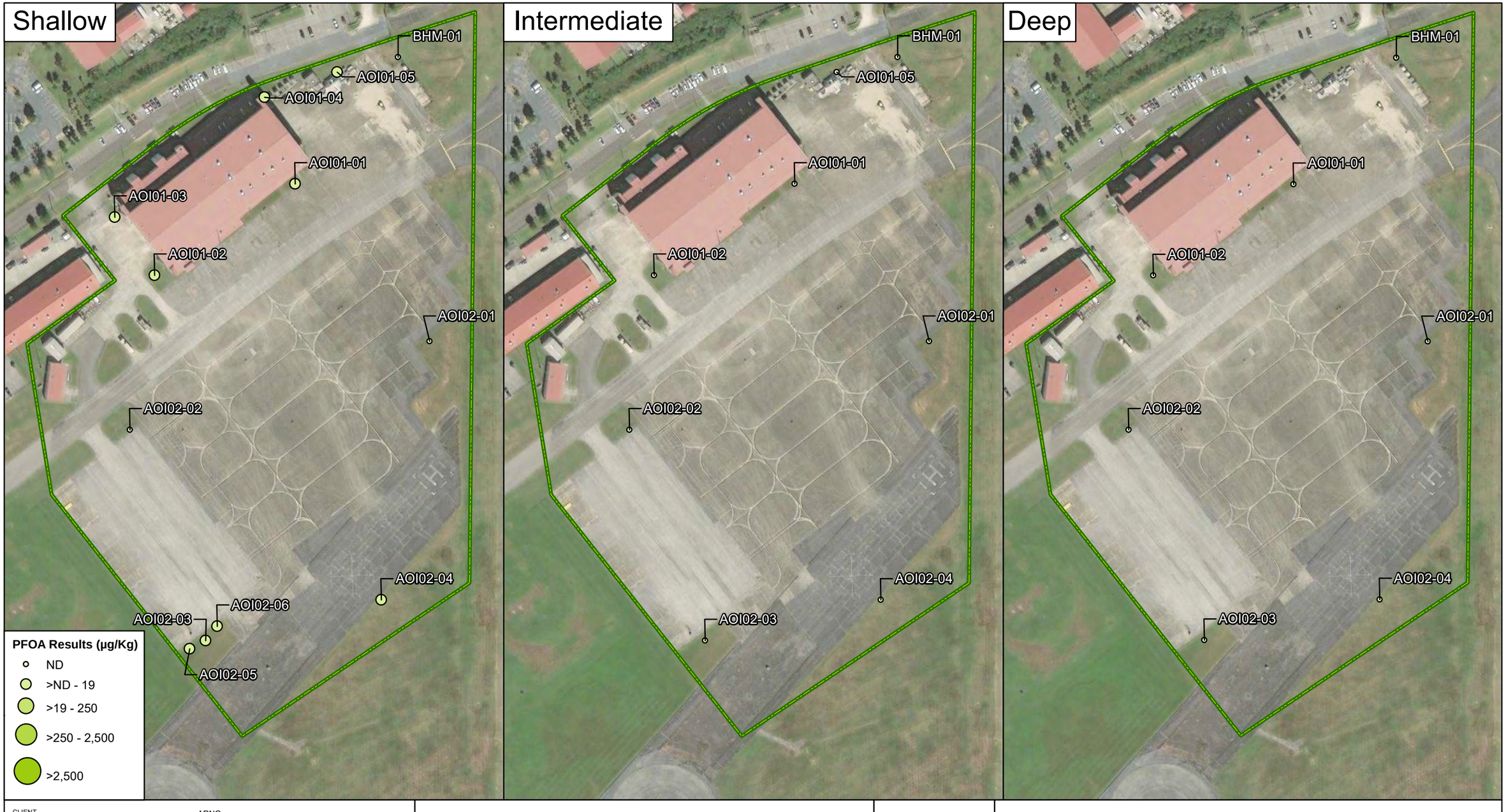


CLIENT	ARNG			
PROJECT	Site Inspection at AASF #2, Birmingham, AL			
REVISED	8/24/2022	GIS BY	MS	8/24/2022
SCALE	1:2,400	CHK BY	MC	8/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/24/2022

Legend

Facility Boundary

0 100 200 400 Feet

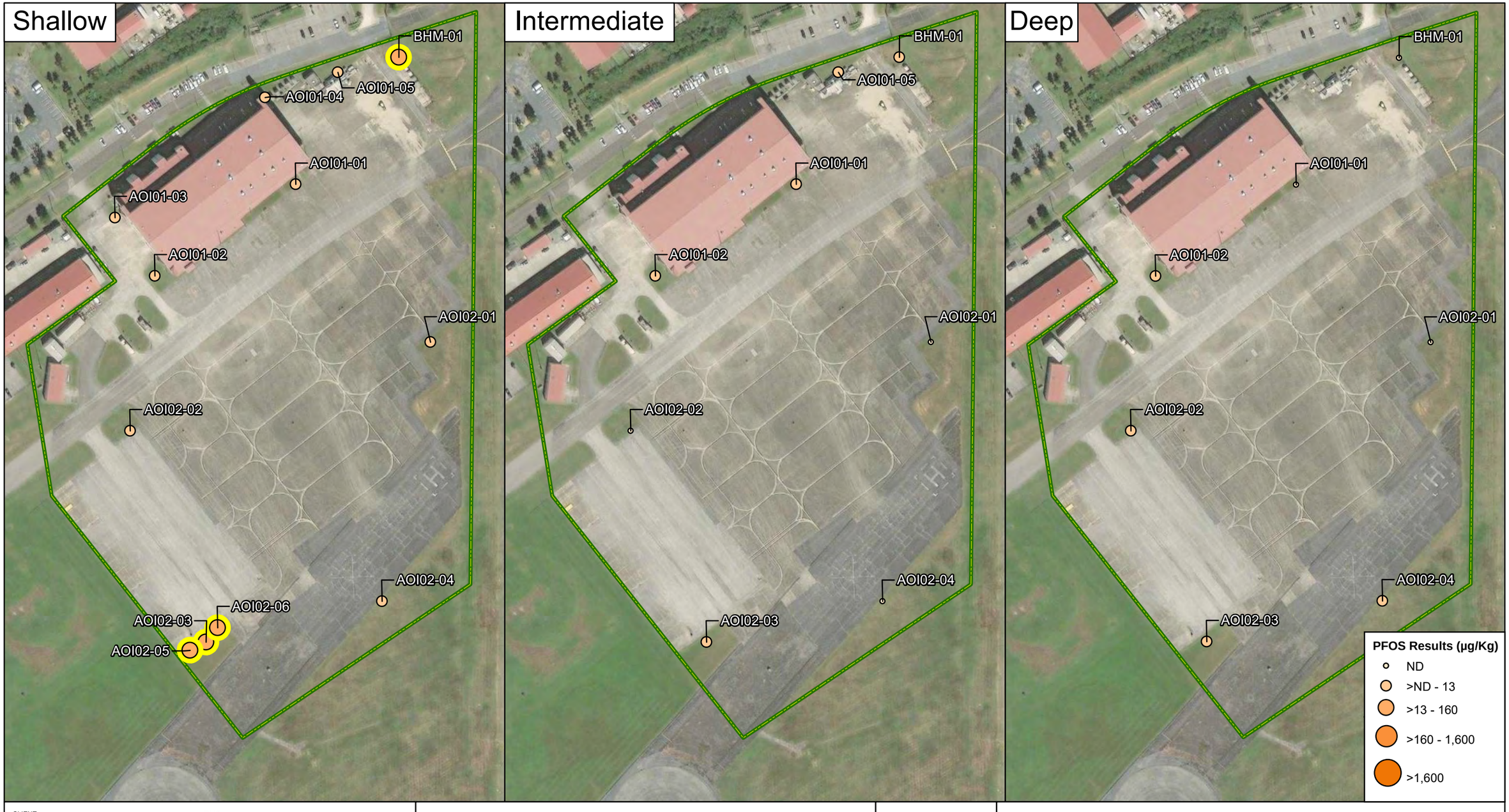
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOA Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-1



CLIENT	ARNG			
PROJECT	Site Inspection at AASF #2, Birmingham, AL			
REVISED	8/24/2022	GIS BY	MS	8/24/2022
SCALE	1:2,400	CHK BY	MC	8/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/24/2022

Legend

Facility Boundary

0 100 200 400 Feet

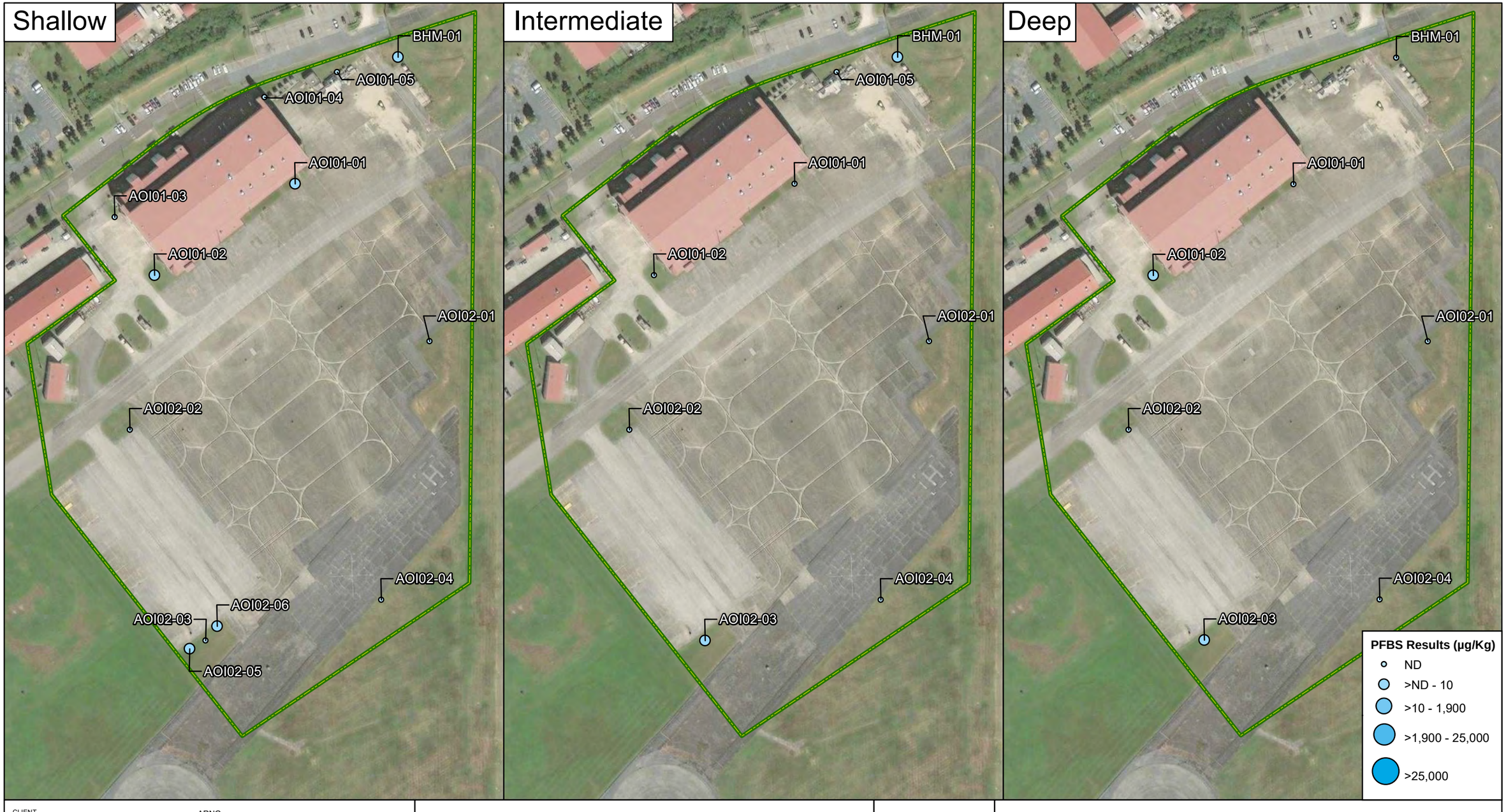
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOS Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-2



CLIENT	ARNG			
PROJECT	Site Inspection at AASF #2, Birmingham, AL			
REVISED	8/24/2022	GIS BY	MS	8/24/2022
SCALE	1:2,400	CHK BY	MC	8/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/24/2022

Legend

Facility Boundary

0 100 200 400 Feet

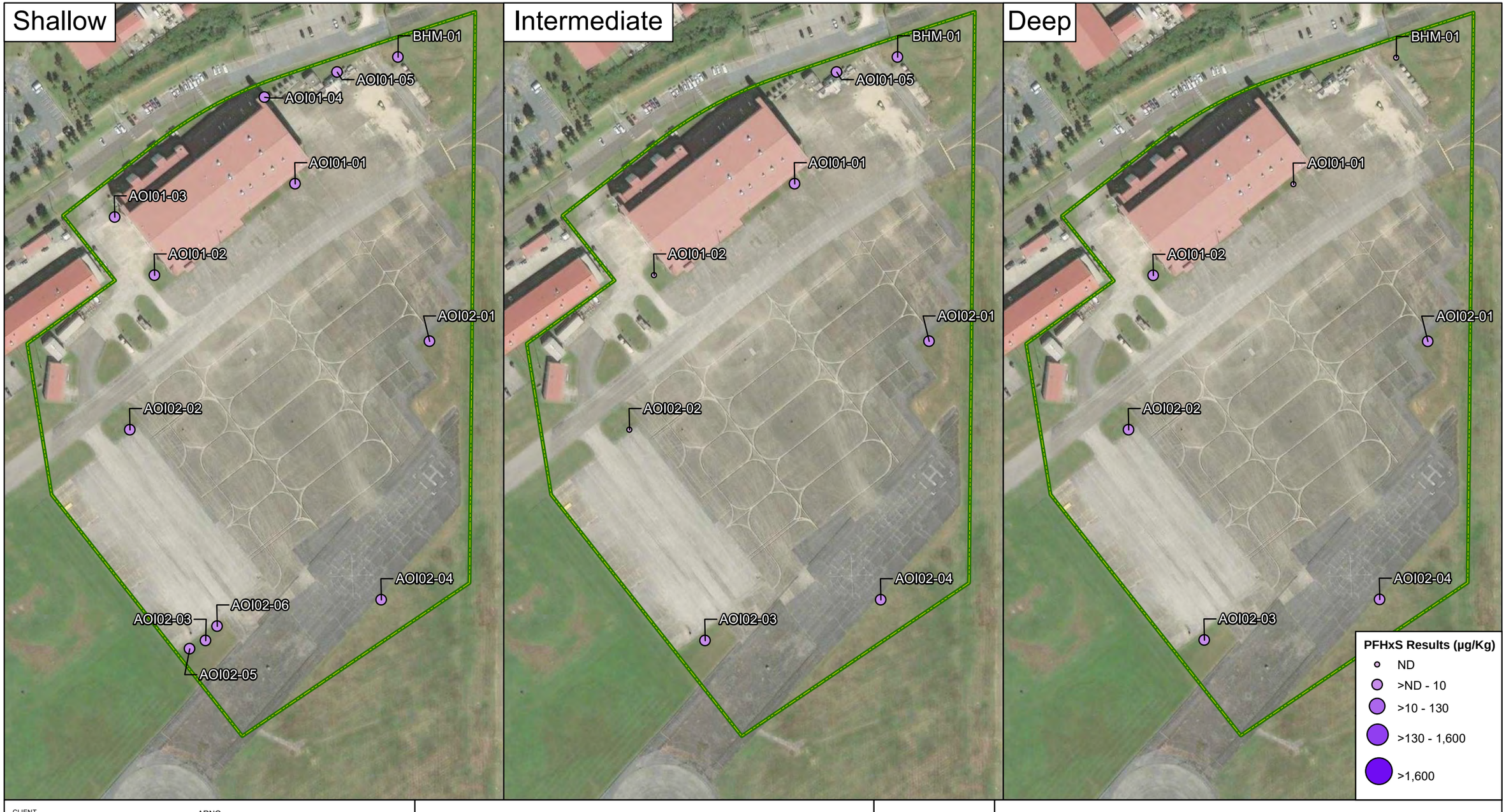
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location

N

PFBS Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-3



CLIENT	ARNG			
PROJECT	Site Inspection at AASF #2, Birmingham, AL			
REVISED	8/24/2022	GIS BY	MS	8/24/2022
SCALE	1:2,400	CHK BY	MC	8/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/24/2022

Legend

Facility Boundary

0 100 200 400 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

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Figure 6-4

Shallow

Intermediate

Deep

BHM-01
AOI01-05
AOI01-04
AOI01-01
AOI01-03
AOI01-02
AOI02-01
AOI02-02
AOI02-04
AOI02-06
AOI02-03
AOI02-05

PFNA Results (µg/Kg)

- ND
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #2, Birmingham, AL			
REVISED	8/24/2022	GIS BY	MS	8/24/2022
SCALE	1:2,400	CHK BY	MC	8/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/24/2022

Legend

Facility Boundary

0 100 200 400 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

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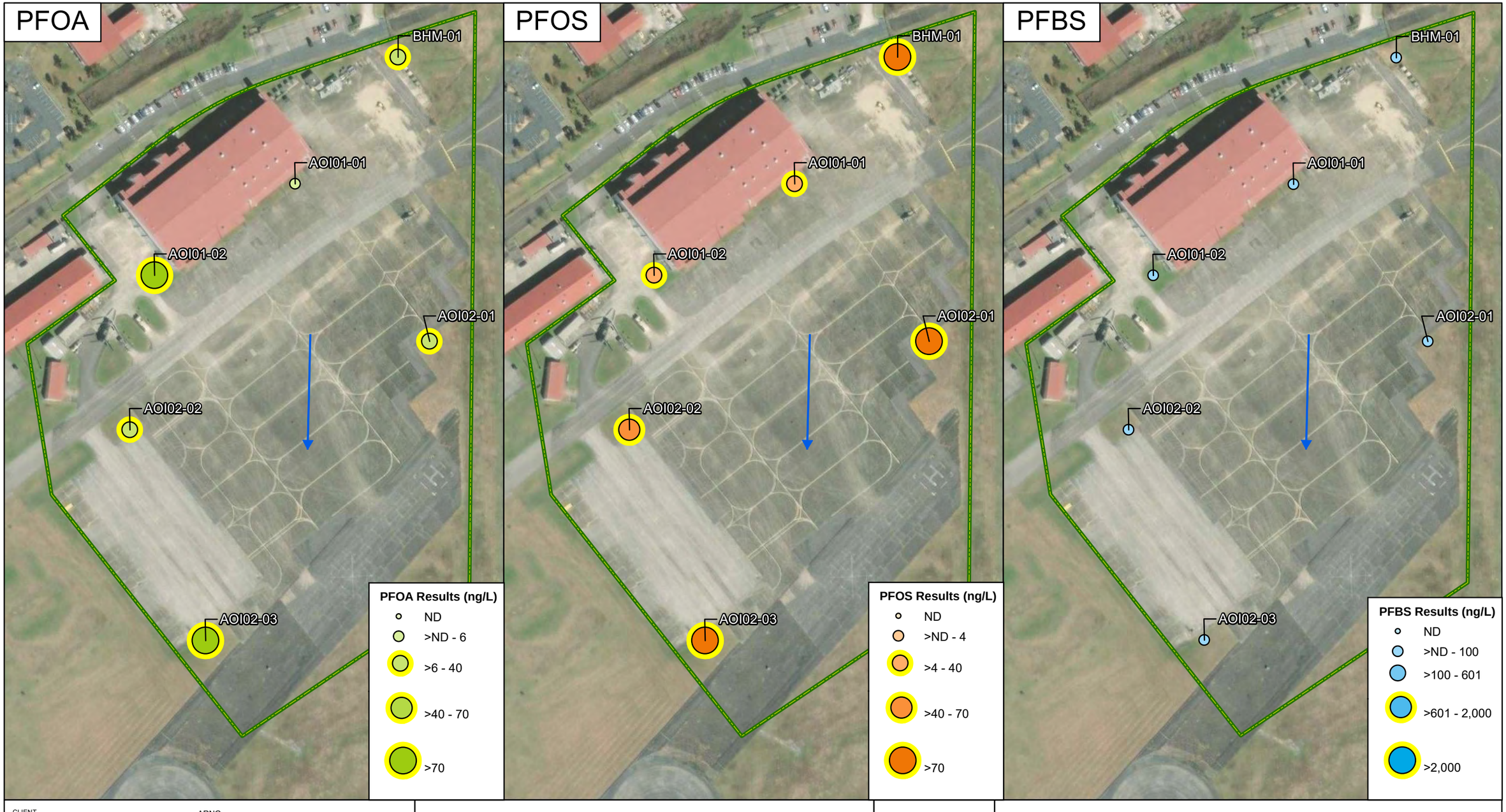
Figure 6-5



CLIENT	ARNG			
PROJECT	Site Inspection at AASF #2, Birmingham, AL			
REVISED	11/9/2022	GIS BY	MS	11/9/2022
SCALE	1:2,400	CHK BY	MC	11/9/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	11/9/2022

Legend

Facility Boundary

Groundwater Flow Direction

0 100 200 400 Feet

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

N

PFOA, PFOS, and PFBS Detections in Groundwater

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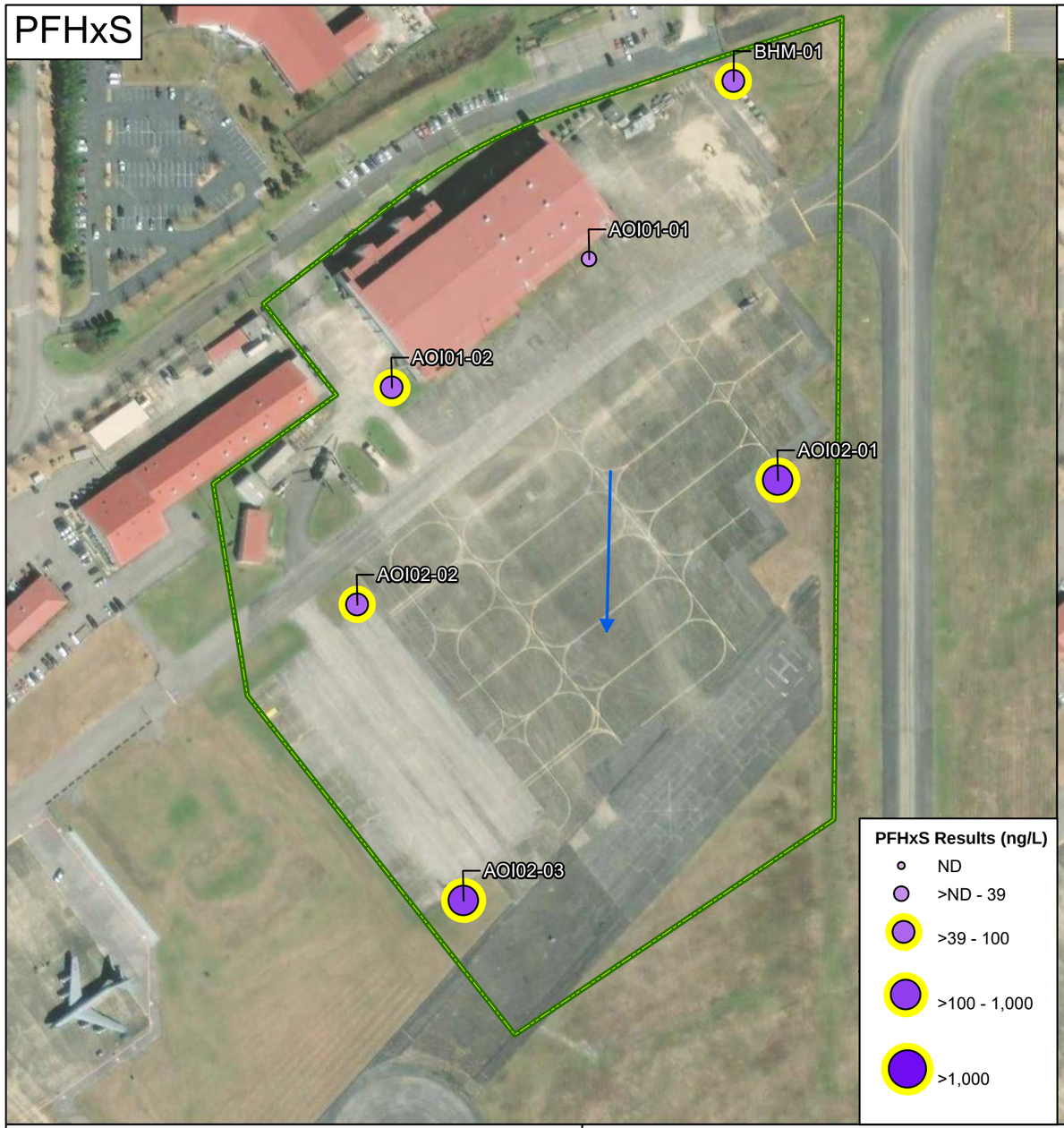
Figure 6-6

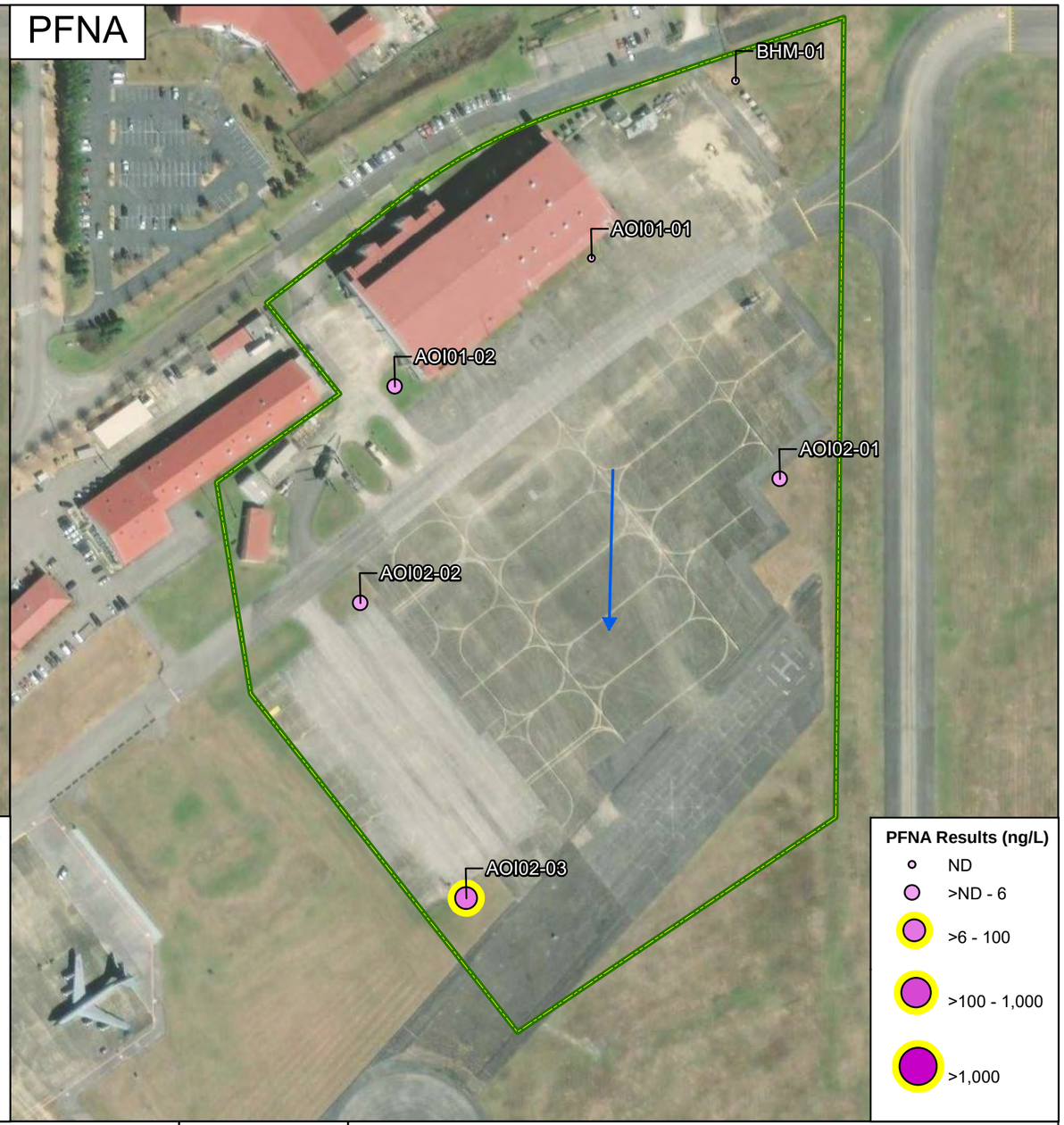
PFHxS



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 AASF #2, Birmingham, AL			
REVISED	11/9/2022	GIS BY	MS	11/9/2022
SCALE	1:2,400	CHK BY	MC	11/9/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	11/9/2022

Legend

- Facility Boundary
- Groundwater Flow Direction

0 100 200 400 Feet

N

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

PFHxS and PFNA Detections in Groundwater

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Germantown, MD 20876

Figure 6-7

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-2**. Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to 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 (though unlikely due to restricted access), 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, AOI 2, and Sitewide based on the aforementioned criteria.

7.1.1 AOI 1

AOI 1 is the Hangar, where AFFF may have been released during maintenance of the fire suppression system or through incidental leaks and spills of stored AFFF. Maintenance has been documented throughout the late 1990s, and AFFF in the system was last replaced in 2010. No information was available regarding the testing of the system. Releases at AOI 1 would have occurred on the Hangar floor or mechanical room, both of which drain to floor and trench drains,

which lead to an onsite OWS and then to the sanitary sewer. Therefore, discharges of AFFF in the Hangar would likely be captured and conveyed to the sanitary sewer system; however, they may have infiltrated into the subsurface via joints in the floor slab or could have traveled outside the Hangar. AFFF releases outside the Hangar may have infiltrated into the subsurface soil or run off to the storm water sewer or onto the Flight Ramp and surrounding grassy areas.

PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in surface soil at AOI 1. Site workers and construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. No ongoing construction was observed at the facility. Therefore, the soil exposure pathway for site workers and future construction workers are potentially complete. The facility is gated and there are no adjacent residential structures; therefore, the incidental ingestion and inhalation of dust exposure pathways for the trespasser, residential, and recreational user receptors are considered incomplete. PFOS and PFHxS were detected in shallow subsurface soil at depths above 15 feet bgs. The construction worker exposure scenario assumes excavation occurs at depths at or above 15 feet bgs. Therefore, the soil exposure pathway for incidental ingestion of subsurface soil by future construction workers is considered potentially complete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

AOI 2 encompasses the Flight Ramp located south of the Hangar. Approximately 16 Tri-Max™ 30 mobile extinguisher units were staged on the Flight Ramp until 2010. No information was provided regarding the date the units were obtained or on the disposal of the units. There are no records of discharges or spills of AFFF at AOI 2. The pavement at the Flight Ramp drains via trench drains along the southern edge of the Flight Ramp to the storm water sewer. AFFF may have infiltrated into the subsurface soil via cracks or joints in the pavement or, where trench drains are not present, to the surrounding grassy areas.

PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in surface soil at AOI 2. PFOS exceeded the residential SL in surface soil. Site workers and construction workers could contact constituents in soil via incidental ingestion and inhalation of dust. Therefore, the soil exposure pathway for site workers and future construction workers are potentially complete. The incidental ingestion and inhalation of dust exposure pathways for the trespasser, residential and recreational user receptors are considered incomplete for the same reasons as AOI 1. PFOS, PFBS, and PFHxS were detected in shallow subsurface soil at depths above 15 feet bgs. Therefore, the soil exposure pathway for incidental ingestion of subsurface soil by future construction workers is considered potentially complete. The CSM for AOI 2 is presented on **Figure 7-2**.

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 respective SLs in groundwater samples collected at AOI 1. Public drinking water and drinking water at the facility is supplied by Birmingham Water Works, who obtains the water from several surface water bodies which are 6 and 9 miles southeast of the facility and not hydrologically connected to the facility. Therefore, the ingestion exposure pathway to site workers is considered incomplete. The nearest identified wells were possible public supply wells located over 3-miles southeast of the facility and screened over 300 feet deep within the bedrock. Due to the distance and direction to the wells, and depths relative to on-facility groundwater, the pathway for exposure to off-facility residents and recreational users via ingestion of groundwater is considered incomplete. Depths to water

measured in February 2022 during the SI ranged from 15.49 to 22.91 feet bgs. The construction worker exposure scenario assumes excavation occurs at depths of less than or equal to 15 feet bgs, however, seasonal changes in depths to water may bring the water table above 15 feet bgs. Therefore, the incidental groundwater exposure pathway is considered potentially complete for future construction workers during excavation at AOI 1. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

PFOA, PFOS, PFHxS, and PFNA were detected above their SLs in groundwater samples collected at AOI 2. The ingestion exposure pathway to site workers is considered incomplete because municipal drinking water is sourced from surface water over 6 miles away. The pathway for exposure to off-facility residents and recreational users via ingestion of groundwater is also considered incomplete due to the distance, direction, and depth of the nearest potential supply wells. Depths to water measured in February 2022 during the SI ranged from 15.49 to 22.91 feet bgs, however, seasonal changes in depths to water may bring the water table above 15 feet bgs. Therefore, the incidental groundwater exposure pathway is considered potentially complete for future construction workers during excavation at AOI 2. The CSM for AOI 2 is presented on **Figure 7-2**.

7.3 Surface Water and Sediment Exposure Pathway

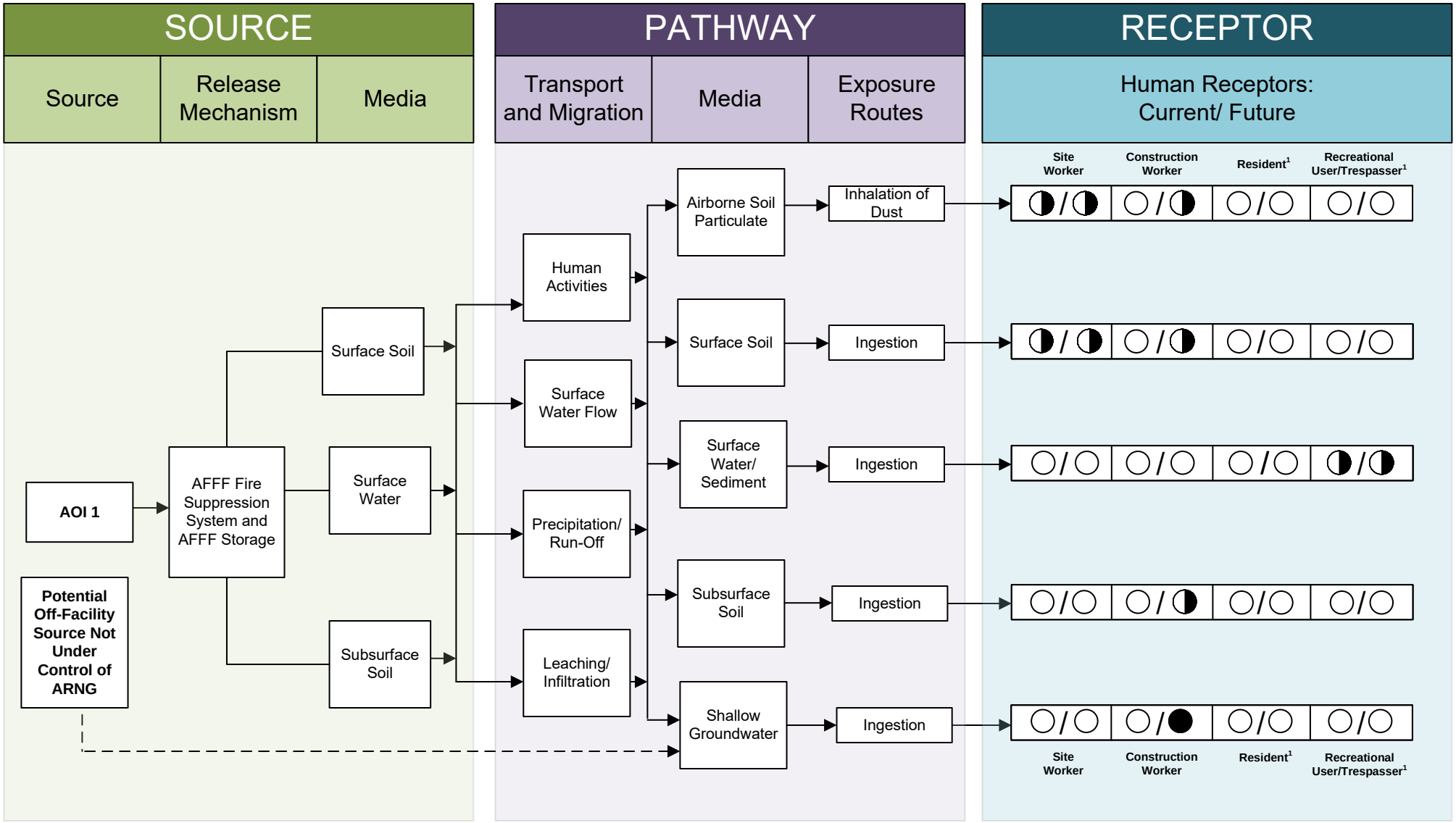
Surface water and sediment samples were not collected during the SI field mobilization at Birmingham AASF #2. The SI results for soil and groundwater, in combination with knowledge of the fate and transport properties of PFAS, were used to determine whether a potentially complete pathway exists between the source and potential receptors. PFAS are water soluble and can migrate readily from soil to surface water via leaching and run-off. At AASF #2, storm water runoff north of the Hangar flows southwest along the AASF boundary. Storm water runoff on the Flight Ramp primarily flows across paved surfaces to the southeast. Storm water runoff at the facility is either captured by the sanitary system (i.e. building trench drains and wash rack), or flows into trench drains at the southeast end of the Flight Ramp and into nearby storm drains. Storm water capture is inferred to join with the larger Airport system and drain southwest, towards Village Creek. Village Creek flows approximately 11 miles west of the facility to Bayview Lake.

7.3.1 AOI 1

PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in soil at AOI 1. It is possible that those compounds may have migrated from soil to Village Creek via overland flow. Storm water runoff from paved surfaces not captured by the sanitary sewer may also discharge to Village Creek, which flows southeast to southwest of AASF #2 and flows into Bayview Lake, located 11 miles west of the facility. Both Village Creek and Bayview Lake are used recreationally; therefore, the surface water and sediment ingestion exposure pathway for recreational users is considered potentially complete. Public drinking water and drinking water at the facility is supplied by Birmingham Water Works, who obtains the water from several surface water bodies which are 6 and 9 miles southeast of the facility and not hydrologically connected to the facility. There are no surface water bodies located on the facility, therefore the exposure pathways for site workers, future construction workers, and off-facility residents are considered incomplete. The surface water and sediment exposure pathway is incomplete for trespassers due to the secure facility access. The CSM for AOI 1 is presented on **Figure 7-1**.

7.3.2 AOI 2

PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in soil at AOI 2. It is possible that those compounds may have migrated from soil to Village Creek via overland flow and further to Bayview Lake from Village Creek. Due to the recreational use of Village Creek and Bayview Lake, the surface water and sediment ingestion exposure pathway for recreational users is considered potentially complete. The exposure pathways for site workers, future construction workers, residents, and trespassers are considered incomplete for the same reasons as outlined in AOI 1. The CSM for AOI 2 is presented on **Figure 7-2**.



LEGEND

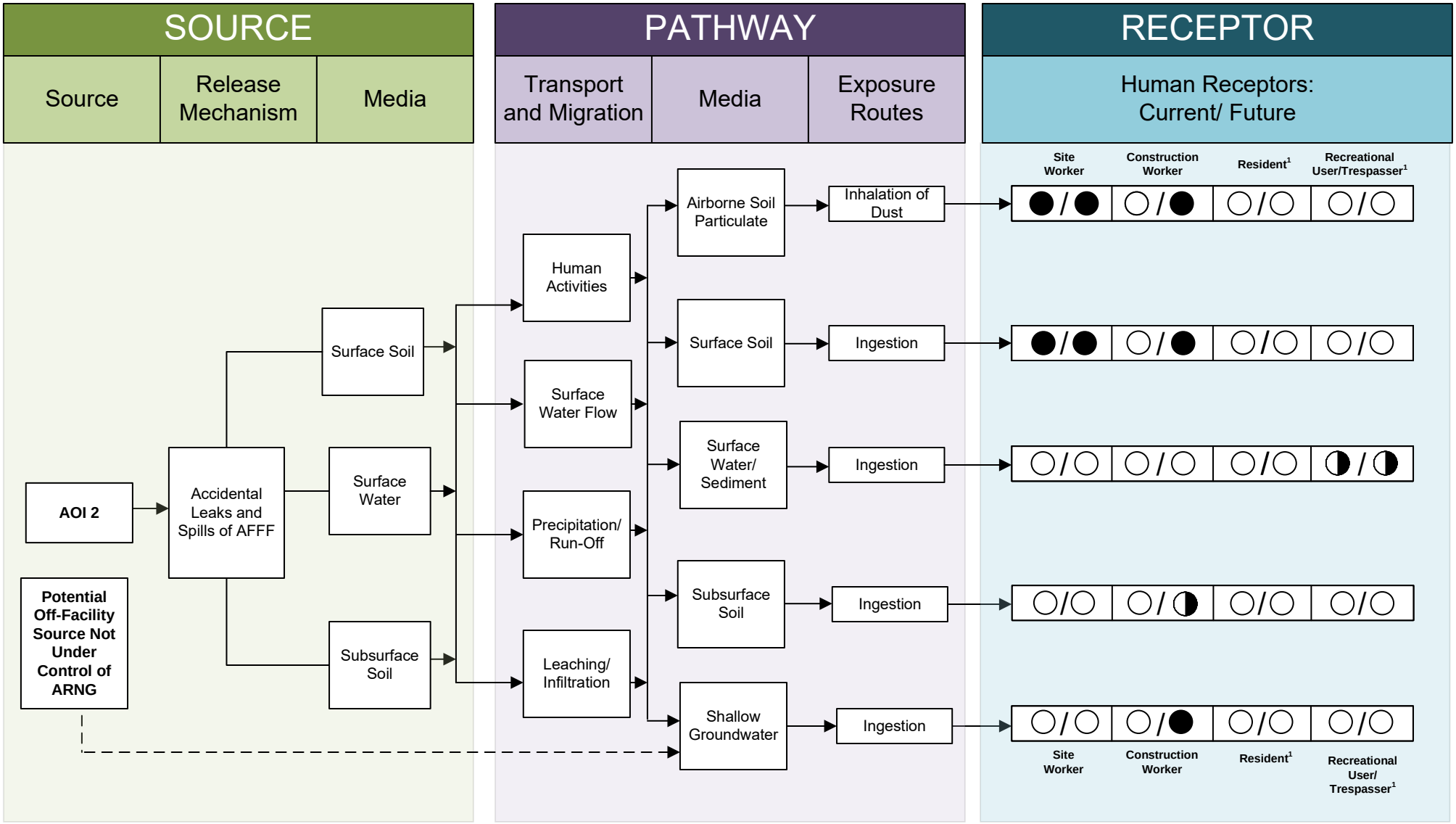
- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

NOTES

1. The resident and recreational users refer to off-site receptors.

Figure 7-1
Conceptual Site Model, AOI 1
AASF #2, Birmingham, Alabama

AECOM



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.

Figure 7-2
Conceptual Site Model, AOI 2
AASF #2, Birmingham, Alabama

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 14 to 17 February 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, 2021), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2021), 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.

- Twenty-seven (27) soil samples from 12 boring locations;
- Six (6) grab groundwater samples from 7 temporary well locations; and
- Fifteen (15) 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 AOIs 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 CSMs were refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure at the AOIs, 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: Hangar and AOI 2: Flight Ramp. Based on the CSMs developed and revised in light of the SI findings, there is not the potential for exposure to drinking water receptors from AOI 1 and AOI 2 from sources on the facility resulting from 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 PFOA, PFOS, PFHxS, PFNA, and PFBS in soil at AOI 1 were below their respective SLs.
    - PFOA, PFOS, and PFHxS in groundwater exceeded their SLs. PFOA exceeded the SL of 6 ng/L, with a maximum concentration of 98.4 ng/L at location AOI01-02. PFOS exceeded the SL of 4 ng/L at both AOI 1 sample locations, with a maximum concentration of 10.6 ng/L at location AOI01-01. PFHxS exceeded the SL of 39 ng/L, with a maximum concentration of 65.7 ng/L at location AOI01-02. Based on the results of the SI, further evaluation of AOI 1 is warranted in an RI.

- At AOI 2:
    - PFOS in surface soil exceeded the SL of 13 µg/kg, with a maximum concentration of 64.5 µg/kg at location BHM-01. The detected concentrations of PFOA, PFHxS, PFNA, and PFBS in soil were below their SLs.
    - PFOA, PFOS, PFHxS, and PFNA in groundwater exceeded their SLs. PFOA exceeded the SL of 6 ng/L, with a maximum concentration of 73.8 ng/L at location AOI02-03. PFOS exceeded the SL of 4 ng/L, with a maximum concentration of 697 J ng/L at location AOI02-03. PFHxS exceeded the SL of 39 ng/L, with a maximum concentration of 782 J ng/L at location AOI02-03. PFNA exceeded the SL of 6 ng/L, with a maximum concentration of 14.6 ng/L at location AOI02-03. Based on the results of the SI, further evaluation of AOI 2 is warranted in an RI.

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	Hangar	◐	●	N/A	Proceed to RI
2	Flight Ramp	●	●	●	Proceed to RI

Legend:
N/A = Not Applicable
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

9. References

AECOM. 2018a. *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan, Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites ARNG Installations, Nationwide Contract No. W912DR-12-D-0014/ W912DR17F0192*. 9 March.

AECOM. 2018b. *Final Programmatic Accident Prevention Plan, Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites ARNG Installations, Nationwide Contract No. W912DR-12-D-0014/W912DR17F0192.* July.

AECOM. 2020. *Final Preliminary Assessment Report, Army Aviation Support Facility #2, Birmingham, Alabama*. September.

AECOM. 2021. *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Army Aviation Support Facility #2, Birmingham, Alabama, Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites ARNG Installations, Nationwide.* November.

AECOM. 2022. *Final Site Safety and Health Plan, Army Aviation Support Facility #2, Birmingham, Alabama, Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites ARNG Installations, Nationwide*. June.

Assistant Secretary of Defense. 2022. *Investigation Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program*. United States Department of Defense. 6 July.

BB&E. 2016. *Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, 117th Air Refueling Wing, Alabama Air National Guard, Birmingham, Alabama.* May.

DA. 2018. *Army Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances.* 4 September.

DoD. 2019a. *Department of Defense (DoD), Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3*.

DoD. 2019b. *General Data Validation Guidelines. Environmental Data Quality Workgroup*. 4 November.

GSA. 2022. *GSA Groundwater Water Well Finder.* Accessed October 2022 at https://groundwater.gsa.state.al.us/. Geological Survey of Alabama.

Guelfo, J.L. and Higgins, C.P. 2013. *Subsurface Transport Potential of Perfluoroalkyl Acids at Aqueous Film-Forming Foam (AFFF)-Impacted Sites.* Environmental Science and Technology 47(9): 4164-71.

Higgins, C.P., and Luthy, R.G. 2006. *Sorption of perfluorinated surfactants on sediments*. Environmental Science and Technology 40 (23): 7251-7256.

ITRC. 2018. *Environmental Fate and Transport for Per- and Polyfluoroalkyl Substances*. March.

Irvin, G.D., Osborne, W.E., Ward, W.E., and Rindsberg, A.K. 2006. *Geologic Map of the Birmingham North 7.5-Minute Quadrangle, Jefferson County, Alabama*. Geological Survey of Alabama. Quadrangle Series Map 45.

Jefferson County Alabama. 2019. *Jefferson County Parcel Map*. Retrieved from ArcGIS: https://www.arcgis.com/home/webmap/viewer.html?webmap=371ab21399514cc49ac9a134d6698ee8. March.

Jefferson County Environmental Services Department. 2016. *Capacity, Management, Operations, and Maintenance (CMOM) Program Organization*. December.

Johnson, G.C., Kidd, R.E., Journey, C.A., Zappia, H., and Atkins, J.B. 2002. *Environmental Setting and Water-Quality Issues of the Mobile River Basin, Alabama, Georgia, Mississippi, and Tennessee*. United States Geological Survey: Water-Resources Investigations Report 02-4162.

Kopaska-Merkel, D.C., Dean, L.S., and Moore, J.D. 2005. *Hydrogeology and Vulnerability to Contamination of Major Aquifers in Alabama: Area 4*. Geological Survey of Alabama: Circular 199D.

Leidos. 2019. *Site Inspection Report for Perfluorooctane Sulfonate and Perfluorooctanoic Acid at Birmingham International Airport, Alabama*. Air National Guard. February.

Rindsberg, A.K., Ward, W.E., Osborne, W.E., and Irvin, G.D. 2003. *Geologic Map of the Irondale 7.5-Minute Quadrangle, Jefferson County, Alabama*. Geological Survey of Alabama Quadrangle Series 26.

USACE. 2016. *Technical Project Planning Process*, EM-200-1-2. 26 February.

USEPA. 1980. *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*.

USEPA. 1994. *National Oil and Hazardous Substances Pollution Contingency Plan (Final Rule)*. 40 CFR Part 300; 59 Federal Register 47384. September.

USEPA. 2001. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)*. December.

USEPA. 2017. *National Functional Guidelines for Organic Superfund Data Review*. OLEM 9355.0-136, EPA-540-R-2017-002. Office of Superfund Remediation and Technology Innovation. January.

USFWS. 2022. *Species by County Report, County: Jefferson, Alabama.* Environmental Conservation Online System. Accessed 05 March 2022 at https://ecos.fws.gov/ecp/report/species-listings-by-current-range-county?fips=06077.

WorldClimate. 2020. *Average Weather Data for Birmingham Alabama*. http://www.worldclimate.com/climate/us/alabama/birmingham. Accessed March 2020.

Xiao, F., Simcik, M. F., Halbach, T. R., and Gulliver, J. S. 2015, *Perfluorooctane sulfonate (PFOS) and perfluorooctanoate (PFOA) in soils and groundwater of a U.S. metropolitan area: Migration and implications for human exposure.* Water Research 72: 64-74.