Final
Site Inspection Report
Army Aviation Support Facility
Byrd Field
Sandston, Virginia

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

May 2023

Prepared for:

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Appendices

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Tables

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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
amsl	above mean sea level
AOI	Area of Interest
ARFF	Aircraft Rescue Firefighting
ARNG	Army National Guard
BB&E	BB&E, Inc.
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CRAC	Capital Region Airport Commission
CSM	conceptual site model
DA	Department of the Army
DoD	Department of Defense
DPT	direct push technology
DQO	data quality objective
DUA	data usability assessment
EDR™	Environmental Data Resources, Inc.™
EEE	EEE Consulting, Inc.
EM	Engineer Manual
ELAP	Environmental Laboratory Accreditation Program
FedEx	Federal Express
FRB	field reagent blank
GPS	global positioning system
GPRS	Ground Penetrating Radar Systems
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
MIL-SPEC	military specification
MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
NOAA	National Oceanic and Atmospheric Administration
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment

PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
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
VAANG	Virginia Air National Guard
VAARNG	Virginia Army National Guard

Executive Summary

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

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

AASF Byrd Field is located on the southeast corner of the Richmond International Airport at 700 Portugee Road, Sandston, Virginia in Henrico County. The property is about 94 acres and contains an airfield, fuel farm, hangars, hazardous materials storage areas, and aboveground storage tanks. A former munitions supply area was previously owned and occupied by the Virginia Air National Guard and is currently used by the Virginia ARNG (VAARNG) for general industrial purposes (EEE Consulting, Inc., 2008). The AASF Byrd Field property has been leased from the Capital Region Airport Commission by VAARNG since 1964. AASF Byrd Field is used by VAARNG for the maintenance and repair of military aircraft, military training, and hazardous materials storage.

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

[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	Future Action
1	Flightline and Fuel Point	◐	●	Proceed to RI

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

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum will be referred to as "relevant compounds" throughout this document and include perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS) at ARNG facilities nationwide. The ARNG performed this SI at the Army Aviation Support Facility (AASF) Byrd Field in Sandston, Virginia. AASF Byrd Field 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 AASF Byrd Field (AECOM Technical Services, Inc. [AECOM], 2020) that identified one Area of Interest (AOI) where PFAS-containing materials may have been used, stored, disposed, or released historically. The objective of the SI is to identify whether there has been a release to the environment from the AOI identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

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

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2. Facility Background

2.1 Facility Location and Description

AASF Byrd Field is located on the southeast corner of the Richmond International Airport, at 700 Portugee Road, in Sandston, Henrico County, Virginia (**Figure 2-1**). The AASF Byrd Field property has been leased from the Capital Region Airport Commission (CRAC) by the Virginia ARNG (VAARNG) since 1964. The property is about 94 acres. A former munitions supply area was previously owned and occupied by the Virginia Air National Guard (VAANG) and is currently used by VAARNG for general industrial purposes (EEE Consulting, Inc. [EEE], 2008). The facility has been referred to as the Former Richmond Army Airfield, but will be referred to as AASF Byrd Field, or the "facility" in this SI Report.

The facility is bordered directly to the north by Richmond International Airport and to the south by Chesapeake & Ohio railroad. AASF Byrd Field and adjacent airport properties are generally characterized as light industrial areas; however, residences are present within the vicinity of the airport. Residential areas exist approximately 1.5 miles north of the facility, and the surrounding southern areas contain sparse rural residencies and wooded properties.

2.2 Facility Environmental Setting

AASF Byrd Field is located just east of the Fall Line, which separates the Coastal Plain physiographic province (east) and the Piedmont physiographic province (west). The terrain is relatively flat, with the surface elevation of AASF Byrd Field at approximately 158 feet above mean sea level (amsl) (**Figure 2-2**). The topography gradually slopes downward to White Oak Swamp Creek, which is located approximately 2,000 feet south of the facility (EEE, 2008).

2.2.1 Geology

AASF Byrd Field is located in the Coastal Plain physiographic province. The Virginia Coastal Plain is underlain by a thick wedge of sediments that increase in thickness from the Fall Zone to the continental shelf, where it exceeds 4,000 meters in depth. These sediments rest on an eroded surface of Precambrian to early Mesozoic rock. Two-thirds of this wedge are comprised of late Jurassic and Cretaceous clay, sand, and gravel that were stripped from the Appalachian Mountains, carried eastward by rivers, and deposited in deltas in the newly formed Atlantic Ocean basin (Meng and Harsh, 1988). The uppermost geologic unit at AASF Byrd Field is the Bacons Castle Formation, which directly overlies unconsolidated sand and gravel deposits. Local geologic units are shown on **Figure 2-3**.

Soil borings completed during the SI found poorly graded silty sand and clayey sand as the dominant lithology of the unconsolidated sediments below AASF Byrd Field. All borings were completed to a depth of 20 feet below ground surface (bgs). Boring logs also showed layers of clay and sand observed at thicknesses ranging from a few inches to 15 feet, as well as varying percentages of gravel (trace to 10 percent [%)]. Additionally, brick and asphalt fragments were observed in shallow soil at AOI01-03. These observations are consistent with the expected subsurface material at the facility. Boring logs are presented in **Appendix E**.

2.2.2 Hydrogeology

The facility aquifer (Yorktown aquifer) is a shallow water table aquifer within the sediments comprising fine-grained quartz sand interbedded with silt and clay laminae. Data from the previous investigations at the adjacent former VAANG Base indicate that the aquifer is semi-confined due to the generally impermeable nature of the 20 feet of overlying soil. The base

of the aquifer has been identified locally at depths of approximately 47 to 48 feet bgs. There are two distinct portions of the aquifer referred to as the upper surficial and lower surficial aquifer. The mean hydraulic conductivity of the upper surficial aquifer is approximately 2.41 feet per day (ft/day), while the mean hydraulic conductivity of the lower surficial aquifer is approximately 9.65 ft/day (AECOM, 2018a).

An Environmental Data Resources, Inc.™ (EDR™) report presented results of a well search for a 1-mile radius surrounding the facility (EDR™, 2019). Using additional online resources, such as state and local Geographic Information System databases, wells were researched to a 4-mile radius of the facility. A public water supply well is located approximately 0.25 miles southeast of the facility but is listed in the EDR™ report as having a closed status. Information provided by the Virginia Department of Health (VDH) indicates the well is 331 ft deep with well screens from 240 to 250 and 310 to 330 feet bgs. It is unclear whether the well has been abandoned, but it's operation permit was revoked in February 1998. The VDH list of public waterworks does not include the well identified approximately 0.25 miles southeast of the facility. In addition, three water wells exist within a 1-mile radius of the facility, including one public/municipal/government well, one industrial well, and one domestic well (Virginia Department of Mines, Minerals, and Energy, 2018).

The facility is provided drinking water by the Henrico County Department of Public Utilities, which sources its water from the James River. The nearest known surface water intake to the facility is the Raw Water Pumping Station associated with the Henrico County Water Treatment Facility, which is located on the James River approximately six miles south of AASF Byrd Field (Henrico County Department of Public Utilities, 2022).

Depths to water measured in February 2022 during the SI ranged from 2.79 to 12.7 feet bgs. Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate groundwater flow direction is to the west in the eastern portion of the facility, and to the south in the northern portion of the facility. It is presumed that the observed groundwater flow west converges with southern flow and migrates off facility south towards White Oak Swamp Creek.

2.2.3 Hydrology

AASF Byrd Field is located within the White Oak Swamp Watershed, which drains to the Chickahominy River. The western portion of the property is predominately wooded with wetland areas. Surface water is conveyed via reinforced channels in the southern portion of the facility, which then lead south to an off-facility rip-rap channel. All surface drainage from the facility eventually discharges to White Oak Swamp, which is located approximately 0.15 miles south of the facility.

According to the Virginia Department of Health (VDH) and Virginia Department of Environmental Quality (VDEQ), elevated levels of PFAS were observed in surface water samples collected from White Oak Swamp near the Richmond International Airport (VDH, 2021). PFAS compound concentrations and sample locations associated with the VDH and VDEQ study are unknown. PFAS compounds have also been detected in surface water samples collected as part of the former VAANG Base SI, as discussed in **Section 3.2.1**. Surface water features are presented on **Figure 2-5**.

2.2.4 Climate

The climate of Richmond, Virginia is characterized as humid sub-tropical. Frequent short cold spells occur in winter, with temperatures in the low teens. The summer season experiences normal maximum and minimum temperatures of 88 degrees Fahrenheit (°F) and 67°F, respectively. The winter season experiences normal maximum and minimum temperatures of 50°F and 30°F, respectively (National Oceanic and Atmospheric Administration [NOAA], 2019).

Annual precipitation is well-distributed throughout the year, with an average annual precipitation of 43.60 inches. On average, the most precipitation occurs in the month of August, with an average total accumulation of 4.7 inches, and the least precipitation occurs in the month of February, with an average total accumulation of 2.8 inches (NOAA, 2019).

2.2.5 Current and Future Land Use

AASF Byrd Field is used by VAARNG for the maintenance and repair of military aircraft, military training, and hazardous materials storage. The current lease will expire in 2032. Plans for the construction of a new AASF facility are being developed but will not take place until the termination of the current lease.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

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

- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Birds**: Bald eagle, *Haliaeetus leucocephalus* (recovery)
- **Mammals**: Northern long-eared bat, *Myotis septentrionalis* (threatened); Little brown bat, *Myotis lucifugus* (under review); Tricolored bat, *Perimyotis subflavus* (under review); West Indian Manatee, *Trichechus manatus* (threatened)
- **Clams:** Atlantic pigtoe, *Fusconaia masoni* (threatened)
- **Flowering plants:** Small whorled pogonia, *Isotria medeoloides* (threatened); Swamp pink, *Helonias bullata* (threatened); Sensitive joint-vetch, *Aeschynomene virginica* (threatened); New Jersey rush, *Juncus caesariensis* (species of concern); Least, Virginia trillium, *Trillium pusillum virginianum* (Species of Concern)

2.3 History of PFAS Use

One potential release area was identified during the PA where AFFF may have been used or released historically: AOI 1: the Flightline and Fuel Point (AECOM, 2020). AFFF is stored in ten Tri-Max™ 30 fire extinguishers staged across the Flightline and Fuel Point. Based on the corrosive nature of AFFF, and the Tri-Max™ 30 fire extinguishers exposure to the elements while staged at the AOI, it is possible that AFFF has leaked from the extinguishers. A description of AOI 1 is presented in **Section 3**.

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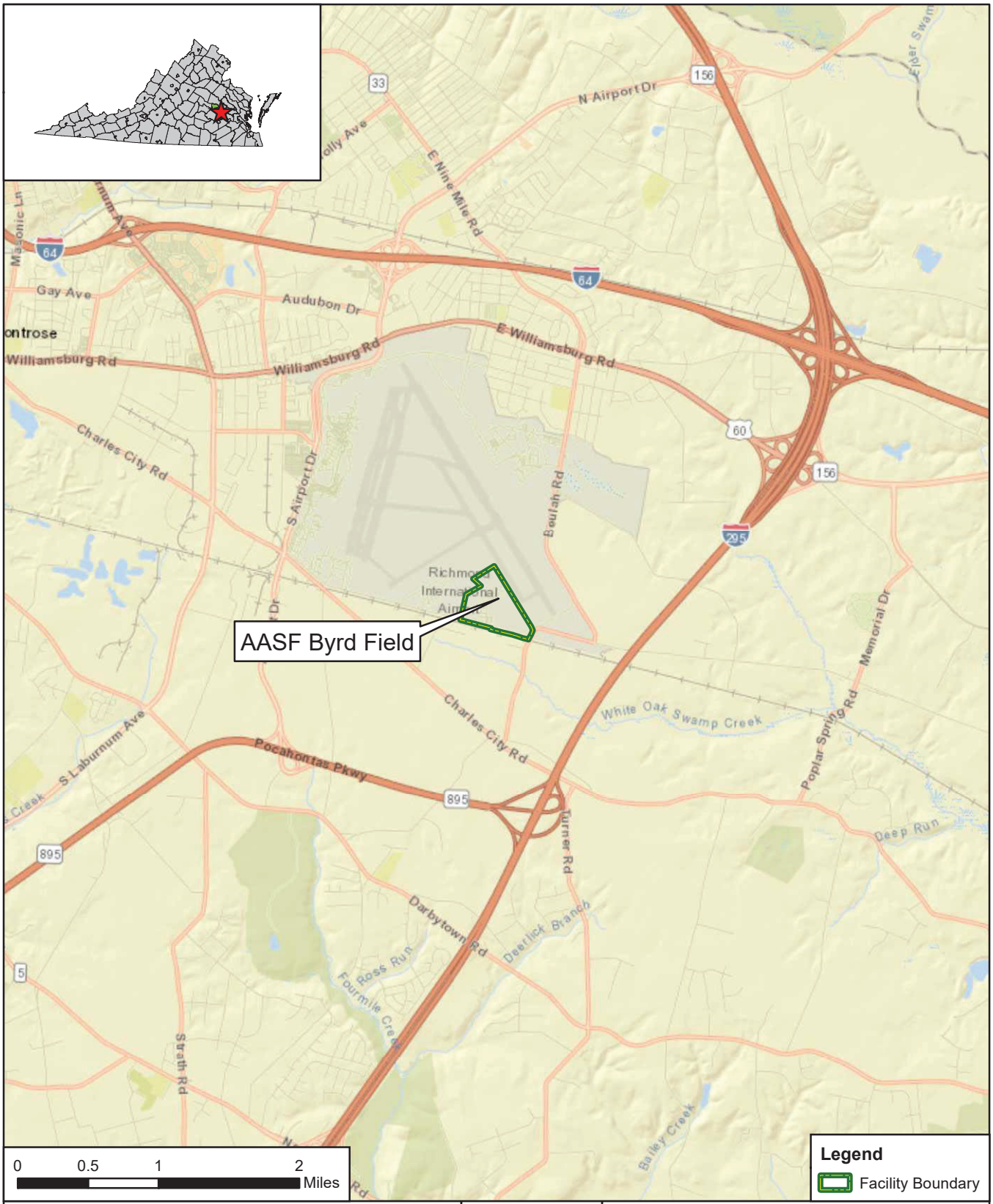

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PROJECT	Site Inspection at AASF Byrd Field, VA			
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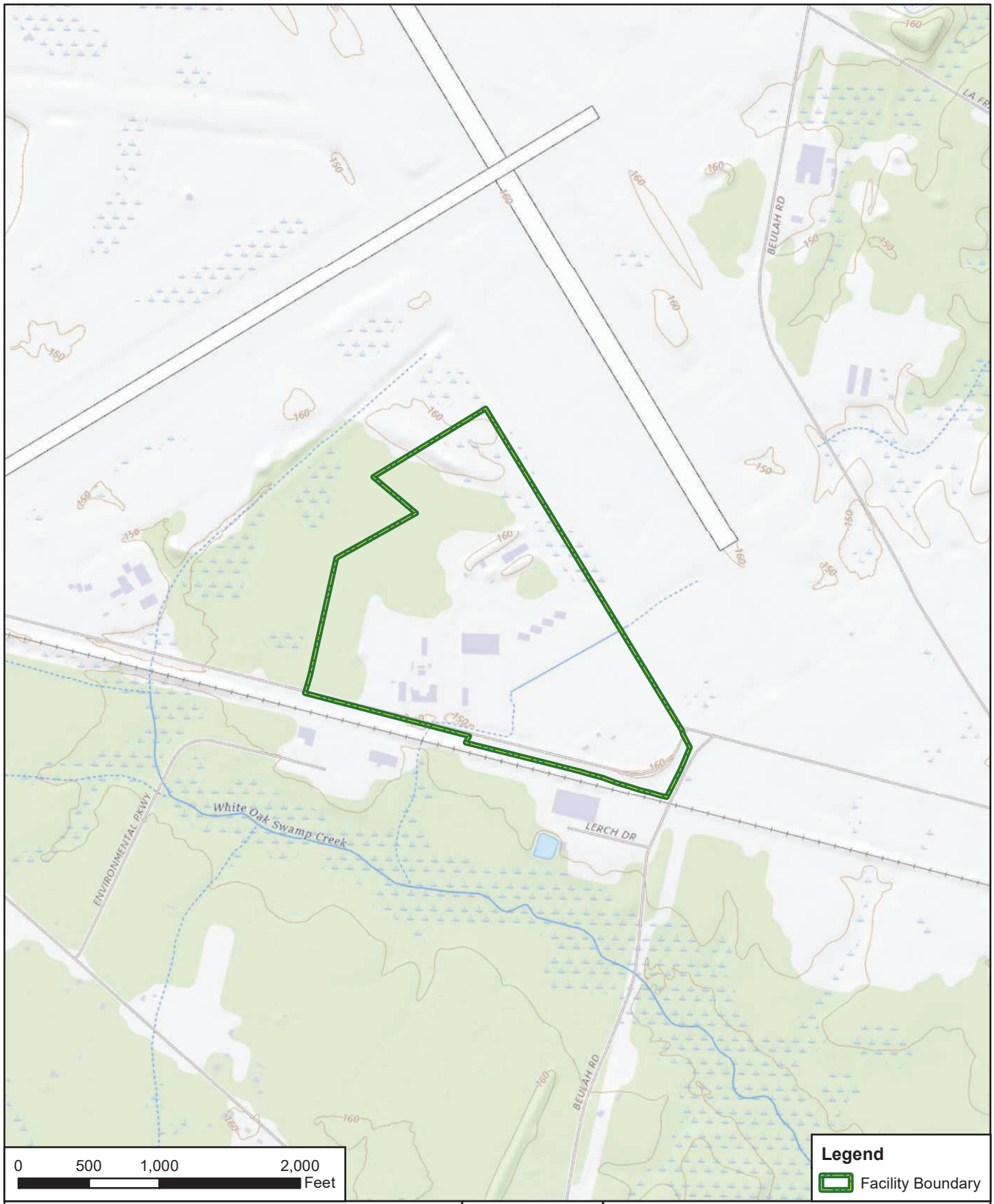
SCALE	1:63,360	CHK BY	JW	8/25/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	8/25/2022

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
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SCALE	1:12,000	CHK BY	JW	8/25/2022
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	8/25/2022

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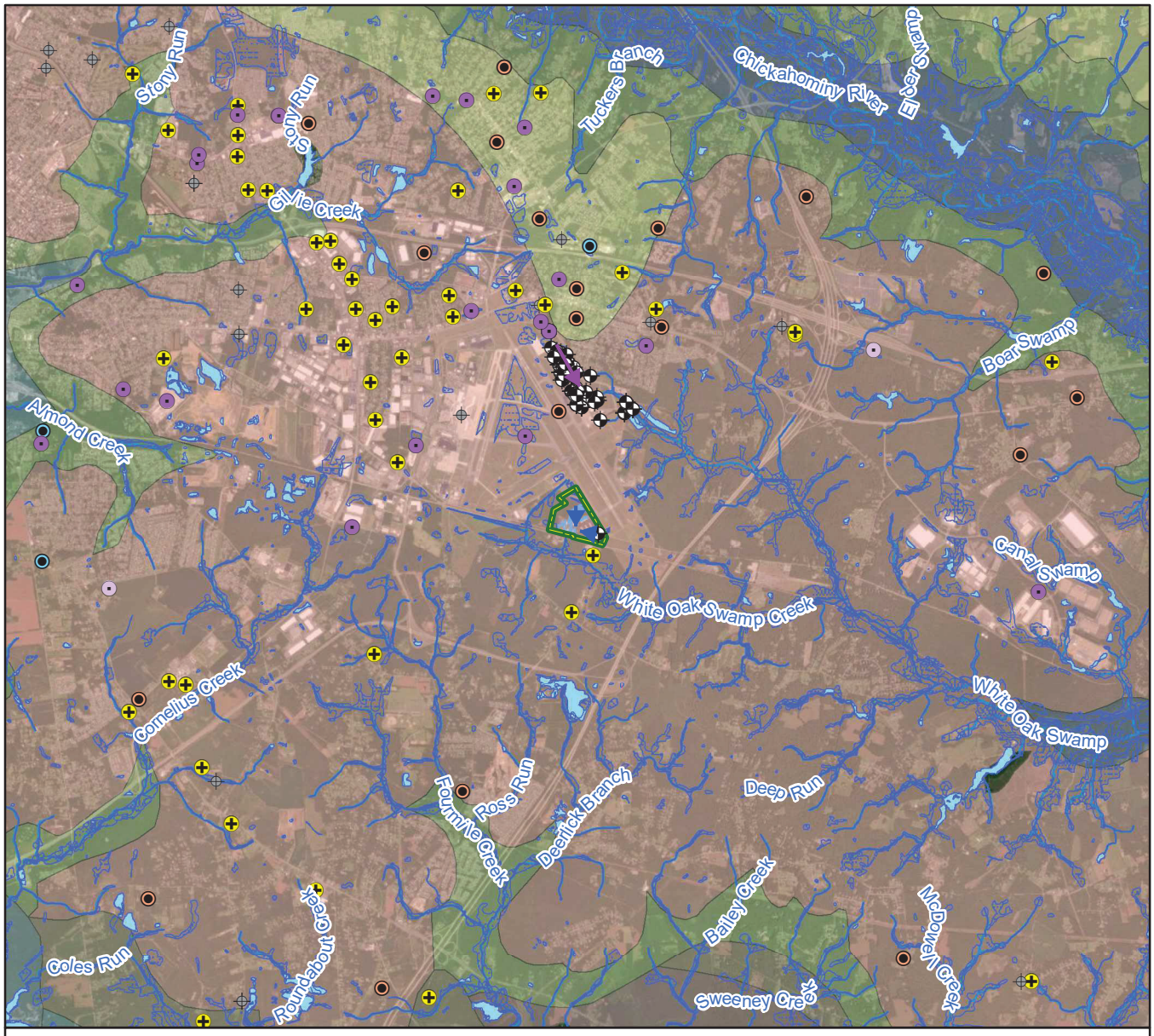
Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



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

Geology

Alluvium
Quaternary and Tertiary Deposits (Undifferentiated)
Chuckatuck Formation
Windsor Formation
Bacons Castle Formation
Pliocene Sand and Gravel
Chesapeake Group
Lower Tertiary Deposits

Wells

Domestic
Commercial
Industrial
Irrigation/Agriculture
Public / Municipal / Government
Unknown
Monitoring

0 0.75 1.5 3 Miles

CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	2/6/2023	GIS BY	MS	2/6/2023
SCALE	1:95,040	CHK BY	JW	2/6/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/6/2023

N

Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	10/18/2022	GIS BY	MS	10/18/2022
SCALE	1:5,160	CHK BY	JW	10/18/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	10/18/2022

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Groundwater Elevations, February 2022

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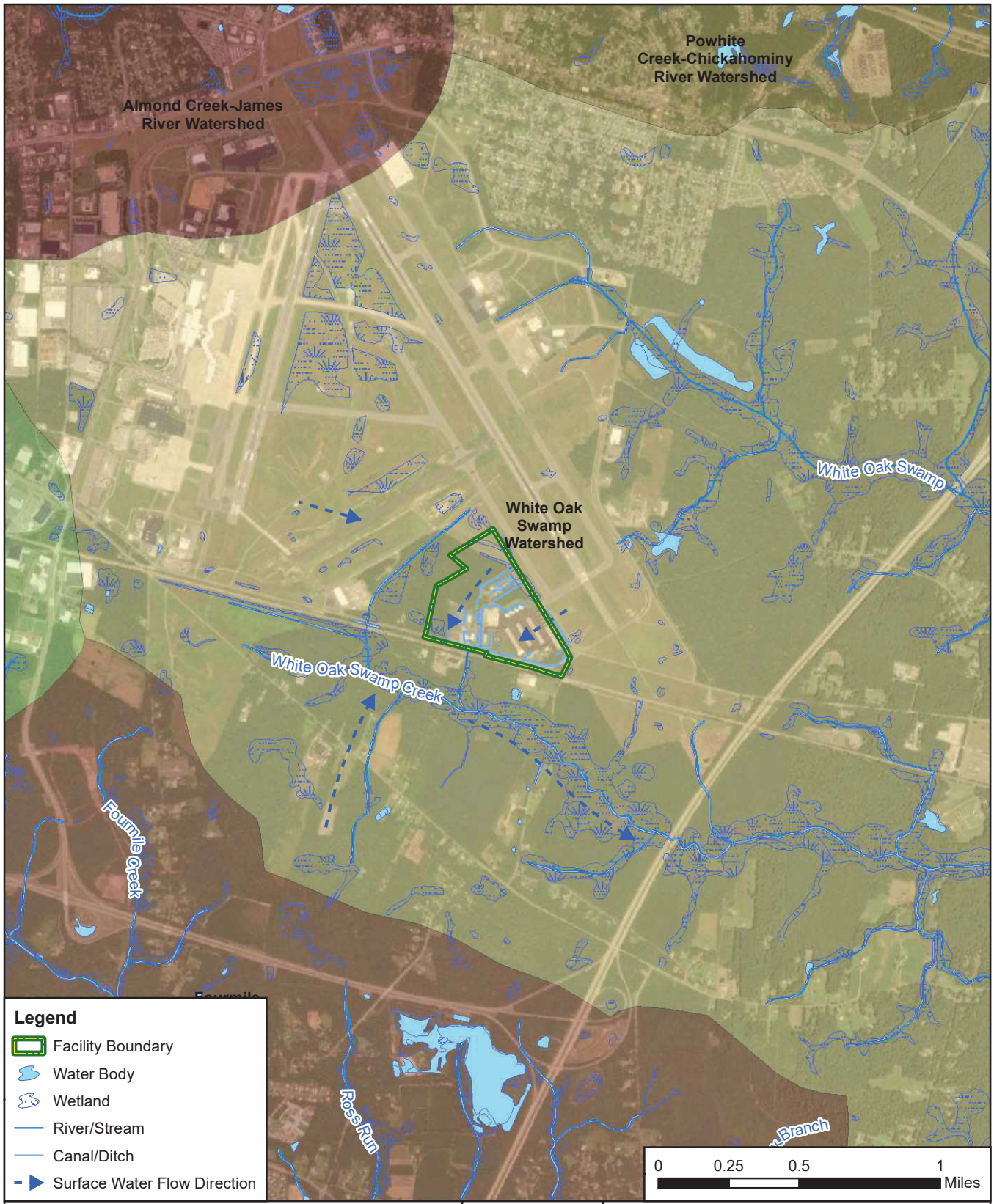
Germantown, MD 20876

Figure 2-4



CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
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SCALE	1:31,680	CHK BY	BN	8/25/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/25/2022

Surface Water Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-5

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3. Summary of Areas of Interest

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, one potential release area, AOI 1: Flightline and Fuel Point, was identified at AASF Byrd Field (AECOM, 2020). The potential release areas are shown on **Figure 3-1**. Other adjacent potential release areas are described in **Section 3.2** and are also shown on **Figure 3-1** for informational purposes.

3.1 AOI 1: Flightline and Fuel Point

AOI 1 includes the Flightline and Fuel Point, where AFFF is stored in ten Tri-Max™ 30 fire extinguishers. The fire extinguishers are staged outdoors across the Flightline and Fuel Point. Based on the corrosive nature of AFFF, and the Tri-Max™ 30 fire extinguishers exposure to the elements while staged at the AOI, it is possible that AFFF has leaked from the extinguishers. According to VAARNG staff, the Tri-MaxTM extinguishers were acquired in 2010 and have never been used.

3.2 Adjacent Sources

Numerous potential off-facility sources adjacent to the facility, not under the control of the VAARNG, have been identified. Descriptions of the potential adjacent sources are presented below.

3.2.1 Former Virginia Air National Guard Base

The former VAANG Base is located north of AASF Byrd Field, adjacent to the Richmond International Airport runway. During its operational history, the facility housed and serviced a variety of military aircraft. According to a 2016 PA report for PFAS by BB&E, Inc. (BB&E), five potential release locations were identified at the former VAANG Base (BB&E, 2016). Based on the PA's recommendations, an SI was completed for the five potential release locations. The SI included soil, groundwater, sediment, and surface water sampling at each of the locations (Amec Foster Wheeler, 2019). The potential release locations are described below with information drawn from the Phase I Regional SI for Perfluorinated Compounds at the VAANG Former 192nd Fighter Wing at Richmond International Airport Byrd Field (Amec Foster Wheeler, 2019).

Building 3649 is the former VAANG Base Main Hangar, and based on the timeline of its operational use, AFFF releases are possible. Groundwater samples collected at Building 3649 exceeded the screening criteria established in the SI Report, and the SI Report recommended additional groundwater and soil investigations to determine the nature and extent of a confirmed release.

Building 3645 is the former VAANG Base Fire Station and housed four Aircraft Rescue Firefighting (ARFF) vehicles. No known AFFF releases occurred. Groundwater and surface water samples collected at Building 3645 exceeded the screening criteria established in the SI Report, and the SI Report recommended additional groundwater, soil, and surface water investigations to determine the nature and extent of a confirmed release.

Building 2851 is the former VAANG Base Fuel System Maintenance Dock, which included an AFFF fire suppression system. It is unknown whether the system were ever triggered or leaked. Groundwater and surface water samples collected at Building 2851 exceeded the screening criteria established in the SI Report, and the SI Report recommended additional groundwater, soil, and surface water investigations to determine the nature and extent of a confirmed release.

Building 96 is the former VAANG Base Hush House (also known as the Jet Engine Test Cell), which was an enclosed aircraft jet engine testing facility. It is unknown whether AFFF were stored or used within the Hush House. No samples collected at Building 96 during the SI exceeded their respective screening criteria; however, the SI Report recommended additional groundwater and soil investigations to determine the nature and extent of a confirmed release.

The Concrete Ramp/Apron area at the former VAANG Base used for aircraft de-icing operations was also investigated during the SI. The concrete ramp included a wash rack with a drain on the southern portion of the apron and was used for annual fire training with Class B foam. Approximately 5-gallons of AFFF product was used during each annual event. Groundwater and surface water samples collected at the Concrete Ramp/Apron area exceeded the respective screening criteria established in the SI Report, and the SI Report recommended additional groundwater, soil, and surface water investigations to determine the nature and extent of a confirmed release.

In addition to investigating the potential release locations identified above, the SI investigated the former VAANG Base boundaries. Groundwater samples collected at the base boundary locations exceeded the screening criteria established in the SI Report, and the SI Report recommended additional groundwater investigation to evaluate potential off bases sources and determine the nature and extent of confirmed releases.

3.2.2 Other Potential Release Areas at Richmond International Airport

According to the 2016 PA report for PFAS at the former VAANG Base (BB&E, 2016), a former fire training pit was located in the southwest portion of the Richmond International Airport. The fire training pit was used by VAANG and the Richmond International Airport ARFF Department. A mockup aircraft was stationed at the fire pit, where Jet Propellant Type 4 fuel was poured and then ignited. It is possible that AFFF might have been used during the fire training exercises conducted by VAANG. The area has since been remediated and has not been used since 1991.

The Richmond Fire Academy is located on the northeast side of the airport. The academy was rebuilt in 1988 and is currently used for training municipal firefighters. According to the 2016 PA report for PFAS (BB&E, 2016), the Fire Training Academy burns a mixture of #2 fuel oil and water approximately once per year for fire training purposes. It is possible that AFFF might have been used historically during the fire training exercises and may be used currently.

Several other areas not investigated as a part of the former VAANG Base PA or SI where potential releases may have occurred exist across the Richmond International Airport complex. The Richmond International Airport ARFF Department has a fire station between Runways 20 and 16. Approximately 4,000 gallons of AFFF are stored in totes at the fire station. Three firetrucks containing AFFF are additionally stored at the station. In the event of an emergency response, AFFF buckets are taken onto the firetrucks and then mixed at the location of the incident. The firetrucks/AFFF tanks are cleaned at the fire station after use. The Fire Department also has a maintenance shop and a nozzle testing area at the airport. The fire department performs nozzle testing everyday with water (AECOM, 2020).

There are also several hangars at the airport known to store AFFF, although use of AFFF at the locations is unknown. Altria Group, Inc. and the Virginia Department of Aviation maintain hangars to the west of Runway 20 with known AFFF storage, and the Federal Bureau of Investigation has a hangar located in a secured area to the east of Runway 16 with an AFFF fire suppression system (AECOM, 2020).

Lastly, several aircraft crash locations exist at the airport where AFFF was used in emergency response. In 1996, a fighter jet crashed onto Runway 16, adjacent to the former VAANG Base,

and AFFF was used in response. In 2008, a private aircraft crashed just west of Runway 20, and AFFF was used in response. In 2012, an aircraft crashed onto Runway 20, adjacent to the Richmond International Airport terminals, and AFFF was used in response. No information about the cleanup of AFFF at the crash locations is available (AECOM, 2020).

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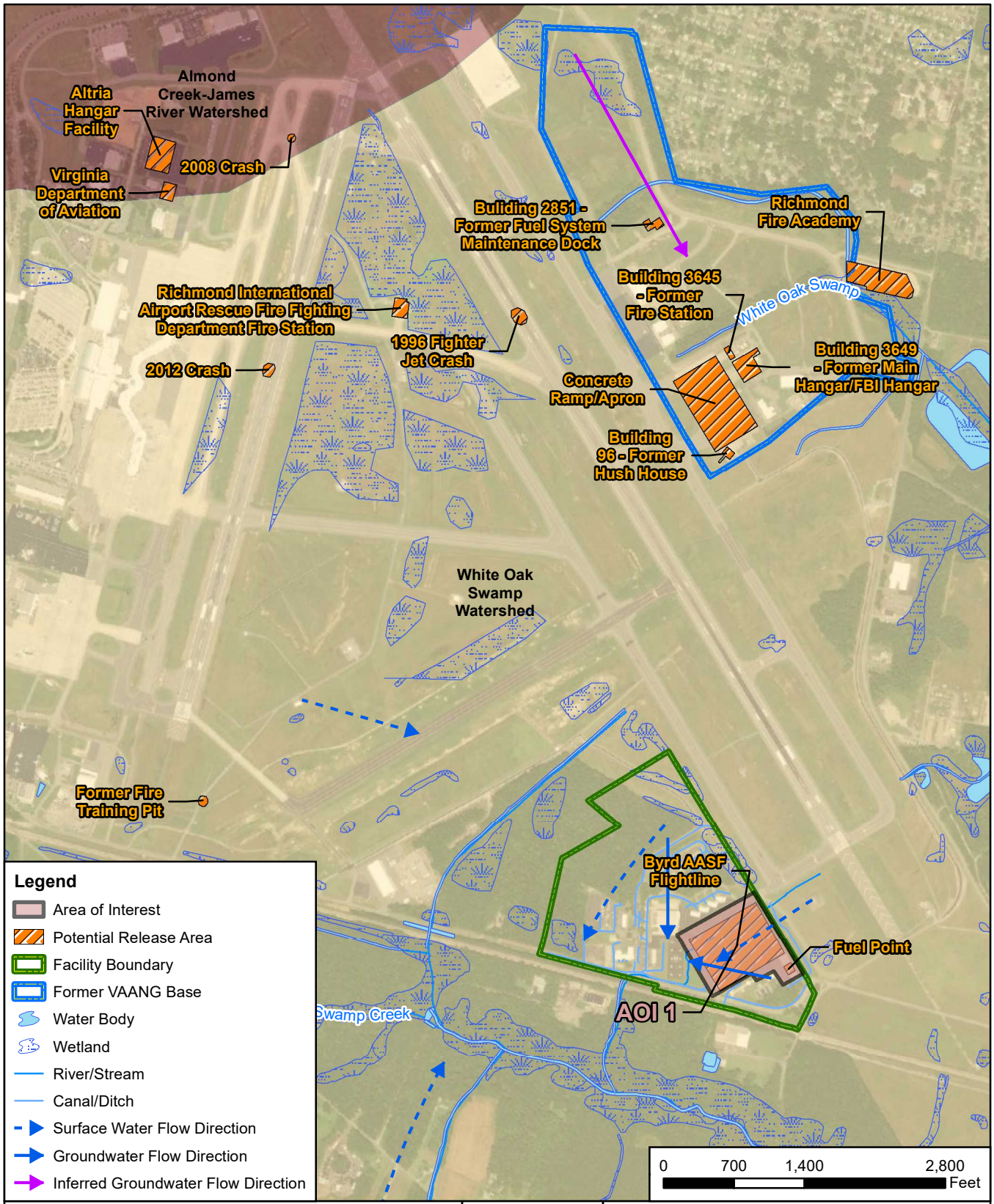

CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	2/6/2023	GIS BY	MS	2/6/2023
SCALE	1:16,800	CHK BY	ST	2/6/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/6/2023

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 the sampled AOI.

4.1 Problem Statement

ARNG will recommend AOIs for remedial investigation (RI) if site-related soil and groundwater samples have concentrations of the relevant compounds above the OSD risk-based screening levels. The SLs are presented in **Section 6.1** of this report.

4.2 Information Inputs

Primary information inputs included:

- The PA for AASF Byrd Field AASF (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 is bounded by the property limits of AASF Byrd Field. Off-facility sampling is not included in the scope of this SI; however, if future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with the property owner(s). Temporal boundaries did not limit the scope of the SI. The SI was conducted in February and the results reflect conditions at the facility at that time. There was no severe weather event before or during field activities.

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 Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan* dated March 2018 (AECOM, 2018b);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018c);
- *Final Preliminary Assessment Report, AASF Byrd Field, Sandston, Virginia* dated July 2020 (AECOM, 2020);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, AASF Byrd Field, Sandston, Virginia* dated October 2021 (AECOM, 2021);
- *Final Site Safety and Health Plan, Army Aviation Support Facility Byrd Field, Sandston, Virginia* dated February 2022 (AECOM, 2022).

The SI field activities were conducted from 18 to 24 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 PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.3 Table B-15 to fulfill the project DQOs:

- Eighteen (18) soil samples from six boring locations;
- Seven grab groundwater samples from six temporary wells and one existing permanent monitoring well; and
- Fourteen (14) 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**, a Field Change Request is provided in **Appendix B3**, land survey data are provided in **Appendix B4**, and investigation-derived waste (IDW) polygons 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 15 October 2021, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, VAARNG, and USACE. 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 will be held after the field event to discuss the results of the SI. Meeting minutes for TPP 3 will be included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM placed a ticket with the “Virginia 811” Virginia utility clearance provider to notify them of intrusive work on 27 January 2022; the ticket was updated on 14 February 2022. However, because the AASF is a private facility, the participating “Virginia 811” locators did not clear utilities across the entire facility. Therefore, AECOM contracted Ground Penetrating Radar Systems (GPRS), a private utility location service, to perform utility clearance. GPRS performed utility clearance of the proposed boring locations on 18 February 2022 with input from the AECOM field team and AASF Byrd Field 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 AASF Byrd Field were sampled on 30 December 2021 to assess usability for decontamination of drilling equipment. Results of the samples collected from a spigot at the wash rack (BF-PW-01) and a spigot at Building 3905 (BF-PW-02) confirmed these sources to be acceptable for use in this investigation; therefore, the sources were used throughout the field activities. A third sample was collected from the drillers tote tank used to contain the potable water from the decontamination water sources (BF-PW-03). The results of the decontamination water sample collected from the drillers tote tank confirmed the tote to be acceptable for use in the investigation as well. The samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water samples associated with the potable water sources and drillers tote tank used during the SI are provided in **Appendix F**. A discussion of the results is presented in the DUA (**Appendix A**).

Materials that were used within the sampling zone were confirmed as acceptable for use in the sampling environment. The checklist of acceptable materials for use in the sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 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 direct push technology (DPT), in accordance with the SI QAPP Addendum (AECOM, 2021). A GeoProbe® 7822DT dual-tube sampling system was be 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.

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 boring logs (**Appendix E**) and in a non-treated field logbook (i.e., composition notebook). Depth interval, recovery thickness, PID concentrations, moisture, relative density, color (using a Munsell soil color chart), and texture (using the USCS) were recorded. The boring logs are provided in **Appendix E**.

Soil borings completed during the SI found poorly graded silty sand and clayey sand as the dominant lithology of the unconsolidated sediments below AASF Byrd Field. All borings were completed to a depth of 20 feet bgs. Layers of clay and sand were also observed in the boring logs for all locations at thicknesses ranging from a few inches to 15 feet, as well as varying percentages of gravel (trace to 10%). Additionally, brick and asphalt fragments were observed in shallow soil at AOI01-03. These observations are consistent with the understood depositional environment of the region.

Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15, total organic carbon (TOC) (USEPA Method 9060A), and pH (USEPA Method 9045D) in accordance with the SI QAPP Addendum (AECOM, 2021). Grain size analysis was not performed, in accordance with the SI QAPP Addendum, because distinguishable extensive horizontal and vertical clay units were not encountered in the field (AECOM, 2021). Clay layers were present across the facility.

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 chips at completion of sampling activities. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

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 2-inch Schedule 40 polyvinyl chloride (PVC) screen with a 0.01-inch slot size and sufficient casing to reach ground surface. New PVC pipe and screen were used to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

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

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 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, 2018b). 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 bentonite chips.

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 24 February 2022. Groundwater elevation measurements were collected from the six new temporary monitoring wells and one existing permanent monitoring well sampled. Water level measurements were taken from the northern side of the well casing. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-2**.

5.5 Surveying

The northern side of each well casing was surveyed by a state-licensed surveyor following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2021). The top of casing and ground surface elevation were surveyed for each newly installed well and one existing permanent monitoring well. Survey data from the wells on the facility were collected on 24 February 2022 in the applicable Universal Transverse Mercator zone projection with North American Datum 1983 State Plane (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B4**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of 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) generated during the SI activities were left in place at the point of the source. The soil cuttings were distributed on the ground surface on the downgradient side of the boring. The soil IDW was not sampled and assumes the characteristics of the associated soil samples collected from that source location.

Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) were discharged directly to the ground surface slightly downgradient of the source. The liquid IDW was not sampled and assumes the characteristics of the associated groundwater samples collected from that source location.

Geographic coordinates were collected using a global positioning system (GPS) around each location where IDW was placed (i.e., an IDW polygon). The IDW polygons are displayed on the figure in **Appendix B5**.

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

One deviation from the SI QAPP Addendum was identified during review of the field documentation. The deviation is noted below and documented in Field Change Request Form (**Appendix B3**):

- Of the six soil sample locations, four (AOI01-01, AOI01-02, AOI01-05, and AOI01-06) were relocated due to accessibility issues resulting from densely wooded areas. The sample locations were offset as necessary to allow for safe access while continuing to meet the SI DQOs. Distances between the original and revised sample locations can be found in the Field Change Request Form. Additionally, proposed groundwater sample location BF-MW-10 was removed from SI sampling because it could not be located and may no longer exist, according to facility personnel; in its place, existing permanent monitoring well BF-MW-5 was added to the sampling program to allow for assessment of the southeastern edge of the flight ramp.

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, AASF Byrd Field, Virginia

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC + pH (EPA 9060A/9045D)	Comments
Soil Samples					
AOI01-01-SB-0-2	2/22/2022 8:25	0 - 2	X		
AOI01-01-SB-0-2-D	2/23/2022 13:40	0 - 2	X		FD
AOI01-01-SB-6-8	2/22/2022 9:00	6 - 8	X		
AOI01-01-SB-12-14	2/22/2022 9:10	12 - 14	X		
AOI01-02-SB-0-2	2/22/2022 9:45	0 - 2	X		
AOI01-02-SB-7-9	2/22/2022 9:55	7 - 9	X		
AOI01-02-SB-13-15	2/22/2022 10:00	13 - 15	X		
AOI01-03-SB-0-2	2/22/2022 13:30	0 - 2	X		
AOI01-03-SB-7-9	2/22/2022 13:35	7 - 9	X		
AOI01-03-SB-17-19	2/22/2022 13:40	17 - 19	X		
AOI01-04-SB-0-2	2/22/2022 12:20	0 - 2	X		
AOI01-04-SB-7-9	2/22/2022 12:35	7 - 9	X		
AOI01-04-SB-13-15	2/22/2022 12:45	13 - 15	X		
AOI01-05-SB-0-2	2/22/2022 10:40	0 - 2	X		
AOI01-05-SB-7-9	2/22/2022 10:50	7 - 9	X		
AOI01-05-SB-13-15	2/22/2022 11:00	13 - 15	X	X	
AOI01-05-SB-13-15-D	2/22/2022 11:00	13 - 15		X	FD
AOI01-05-SB-13-15-MS	2/22/2022 11:00	13 - 15		X	MS
AOI01-05-SB-13-15-MSD	2/22/2022 11:00	13 - 15		X	MSD
AOI01-06-SB-0-2	2/22/2022 8:50	0 - 2	X		
AOI01-06-SB-0-2-MS	2/22/2022 8:50	0 - 2	X		MS
AOI01-06-SB-0-2-MSD	2/22/2022 8:50	0 - 2	X		MSD
AOI01-06-SB-7-9	2/22/2022 9:25	7 - 9	X		
AOI01-06-SB-7-9-D	2/22/2022 9:25	7 - 9	X		FD
AOI01-06-SB-13-15	2/22/2022 9:35	13 - 15	X		

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, AASF Byrd Field, Virginia

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC + pH (EPA 9060A/9045D)	Comments
Groundwater Samples					
AOI01-01-GW	2/23/2022 14:00	NA	X		
AOI01-02-GW	2/23/2022 12:50	NA	X		
AOI01-03-GW	2/23/2022 11:42	NA	X		
AOI01-04-GW	2/23/2022 10:50	NA	X		
AOI01-05-GW	2/22/2022 9:58	NA	X		
AOI01-06-GW	2/22/2022 14:45	NA	X		
BF-MW-05-GW	2/22/2022 13:25	NA	X		
BF-MW-05-GW-D	2/22/2022 13:25	NA	X		FD
BF-MW-05-GW-MS	2/22/2022 13:25	NA	X		MS
BF-MW-05-GW-MSD	2/22/2022 13:25	NA	X		MSD
Quality Control Samples					
BF-ERB-01	2/23/2022 10:30	NA	X		Collected from drill rod tooling
BF-ERB-02	2/23/2022 10:38	NA	X		Collected from hand auger
BF-ERB-03	2/23/2022 14:15	NA	X		Collected from water level meter
BF-FRB-01	2/23/2022 10:25	NA	X		
BF-PW-01	12/30/2021 9:25	NA	X		Decon water source at wash rack
BF-PW-02	12/30/2021 9:40	NA	X		Decon water source at building 3905
BF-PW-03	2/23/2022 10:35	NA	X		Decon water source via driller tote

Notes:
AOI = area of interest
BF = Byrd Field
bgs = below ground surface
Decon = decontamination
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
GW = groundwater
LC/MS/MS = Liquid Chromatography Mass Spectrometry
NA = not applicable
MS/MSD = matrix spike/ matrix spike duplicate
pH = potential of hydrogen; quantitative measure of the acidity or basicity of aqueous or other liquid solutions
QSM = Quality Systems Manual
SB = soil boring
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths, Temporary Well Screen Intervals, and Groundwater Elevations
Site Inspection Report, AASF Byrd Field, Virginia

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)
1	AOI01-01	20	15 - 20	154.98	154.74	10.28	10.04	144.70
	AOI01-02	20	15 - 20	156.97	156.29	11.87	11.19	145.10
	AOI01-03	20	15 - 20	155.00	154.79	10.36	10.15	144.64
	AOI01-04	20	15 - 20	156.15	155.88	7.82	7.55	148.33
	AOI01-05	20	15 - 20	158.54	158.34	12.9	12.70	145.64
	AOI01-06	20	15 - 20	156.48	156.23	11.22	10.97	145.26
Sitewide	BF-MW-05*	10	3 - 10	155.27	155.69	2.37	2.79	152.90

Notes:
AOI = area of interest
BF = Byrd Field
bgs = below ground surface
btoc = below top of casing
NA = not applicable
NAVD88 = North American Vertical Datum 1988
* = existing permanent monitoring well

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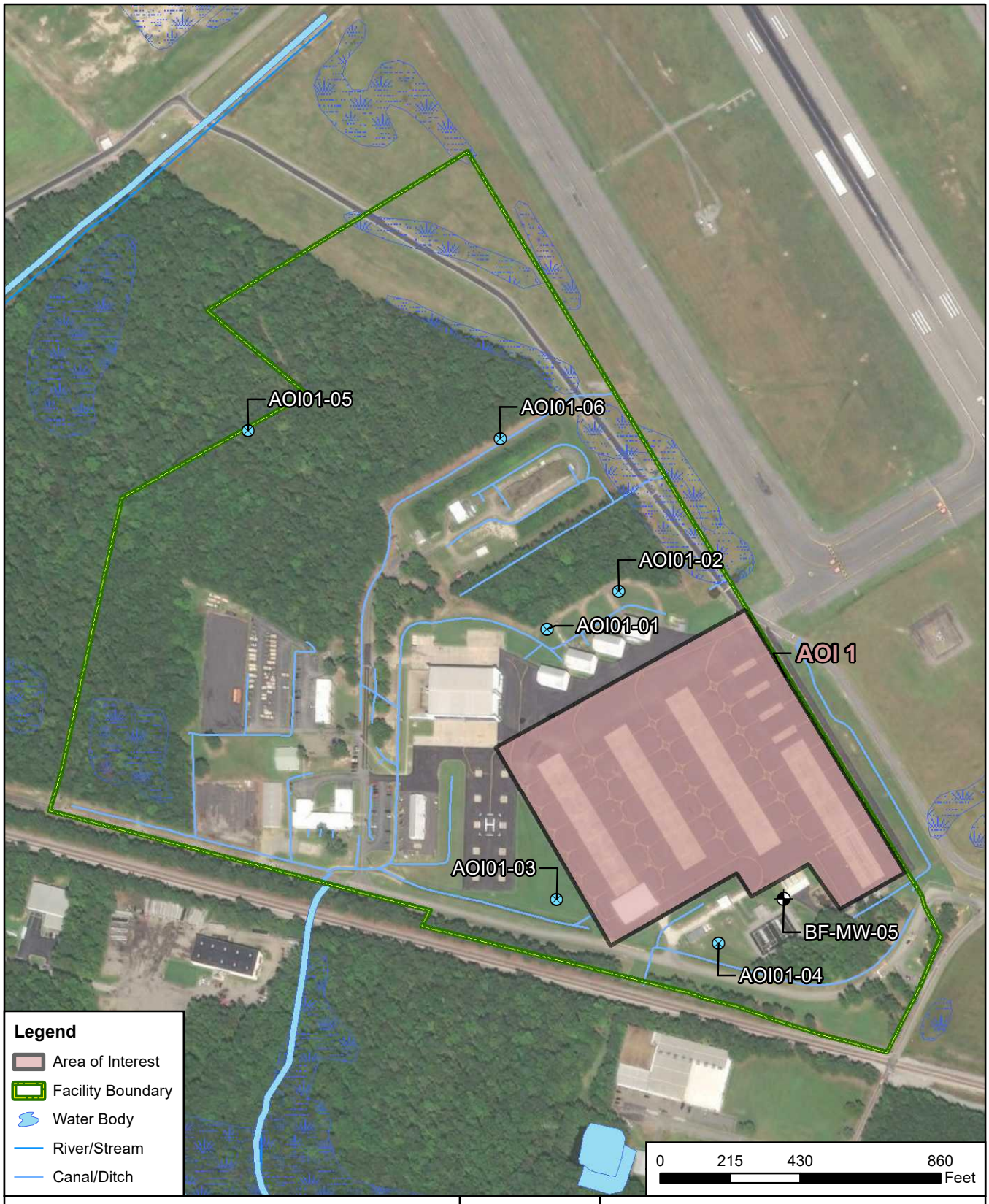

CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	8/25/2022	GIS BY	MS	8/25/2022
SCALE	1:5,160	CHK BY	ST	8/25/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/25/2022

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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 AOI 1 is provided in **Section 6.3**. **Table 6-2** through **Table 6-5** present results in soil or groundwater for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

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

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

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

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

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

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

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

6.2 Soil Physicochemical Analyses

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

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

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1: Flightline and Fuel Point. 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

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.

Surface soil was sampled in 2-foot intervals from 0 to 2 feet bgs at boring locations AOI01-01 through AOI01-06. Soil was also sampled in 2-foot intervals from the shallow subsurface (6 to 15 feet bgs) at boring locations AOI01-01 through AOI01-06, and from a deeper subsurface interval (17 to 19 feet bgs) at boring location AOI01-03. PFOS, PFBS, PFHxS, and PFNA were detected at concentrations below their SLs in surface soil as listed below. PFOA was not detected in surface soil.

- PFOS was detected at two of the six locations, with a concentration of 0.089 J (estimated concentration) micrograms per kilogram (µg/kg) at AOI01-03 and 1.46 J+ (estimated concentration, biased high) µg/kg at AOI01-01.
- PFHxS was detected in three of the six locations, with concentrations ranging from 0.037 J µg/kg to 0.151 J µg/kg.
- PFNA was detected at one location, AOI01-01, with a concentration of 0.036 J µg/kg.
- PFBS was detected at one location, AOI01-01, with a concentration of 0.038 J µg/kg.

Of the relevant compounds, only PFOS was detected in shallow subsurface soil at a concentration below its SL at AOI01-02 (0.256 J+ µg/kg). No relevant compounds were detected in deep subsurface soil.

6.3.2 AOI 1 Groundwater Analytical Results

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

Groundwater was sampled from temporary monitoring wells AOI01-01 through AOI01-06 and existing permanent monitoring well BF-MW-05. The results are summarized below.

- PFOS was detected above the SL of 4 nanograms per liter (ng/L) in one well (AOI01-01) at 27.0 ng/L.
- PFOS was detected below its SL at AOI01-02 and BF-MW-05 at concentrations of 0.902 J ng/L and 2.43 J ng/L, respectively.
- PFHxS was detected above the SL of 39 ng/L in well AOI01-01 at 112 ng/L.
- PFHxS was detected below its SL at AOI01-02, AOI01-03, and BF-MW-05 at concentrations of 15.0 J ng/L or less.
- PFOA was detected below the SL of 6 ng/L in two wells: 5.49 ng/L at AOI01-01 and 2.72 J ng/L at AOI01-02.
- PFBS was detected below the SL of 601 ng/L at AOI01-01, AOI01-02, and BF-MW-05, with concentrations of 17.0 ng/L or less.
- PFNA was not detected in groundwater.

6.3.3 AOI 1 Conclusions

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

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

Area of Interest		AOI01													
Sample ID		AOI01-01-SB-0-2		AOI01-01-SB-0-2-D		AOI01-02-SB-0-2		AOI01-03-SB-0-2		AOI01-04-SB-0-2		AOI01-05-SB-0-2		AOI01-06-SB-0-2	
Sample Date		02/23/2022		02/23/2022		02/23/2022		02/22/2022		02/22/2022		02/22/2022		02/22/2022	
Depth		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)															
PFBS	1900	0.038	J	ND	UJ	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	0.151	J	ND	UJ	0.048	J	0.037	J	ND	U	ND	U	ND	U
PFNA	19	ND	UJ	0.036	J	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	19	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	13	ND	U	1.46	J+	ND	U	0.089	J	ND	UQ	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Notes

ND - Analyte not detected above the LOD.

LOD values are presented in Appendix F.

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

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.

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
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 Byrd Field

Area of Interest		AOI01																							
Sample ID		AOI01-01-SB-6-8		AOI01-01-SB-12-14		AOI01-02-SB-7-9		AOI01-02-SB-13-15		AOI01-03-SB-7-9		AOI01-04-SB-7-9		AOI01-04-SB-13-15		AOI01-05-SB-7-9		AOI01-05-SB-13-15		AOI01-06-SB-7-9		AOI01-06-SB-7-9-D		AOI01-06-SB-13-15	
Sample Date		02/23/2022		02/23/2022		02/23/2022		02/23/2022		02/22/2022		02/22/2022		02/22/2022		02/22/2022		02/22/2022		02/22/2022		02/22/2022		02/22/2022	
Depth		6-8 ft		12-14 ft		7-9 ft		13-15 ft		7-9 ft		7-9 ft		13-15 ft		7-9 ft		13-15 ft		7-9 ft		7-9 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	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																									
PFBS	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	1600	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFNA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	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	ND	U	ND	U	ND	U	ND	U
PFOS	160	ND	U	ND	U	ND	U	0.256	J+	ND	U	ND	U	ND	UQ	ND	UQ	ND	U	ND	UQ	ND	UQ	ND	UQ

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.

Notes

ND - Analyte not detected above the LOD.

LOD values are presented in Appendix F.

Interpreted Qualifiers

J+ = Estimated concentration, biased high

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

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
D	duplicate
DL	detection llimit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
LOQ	limit of quantitation
OSD	Office of the Secretary of Defense
PFAS	per- and polyfluoroalkyl substances
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram
-	not applicable
<	analyte not detected above the LOD

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, AASF Byrd Field

Area of Interest	AOI01	
Sample ID	AOI01-03-SB-17-19	
Sample Date	02/22/2022	
Depth	17-19 ft	
Analyte	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg		
PFBS	ND	U
PFHxS	ND	U
PFNA	ND	U
PFOA	ND	U
PFOS	ND	U

Interpreted Qualifiers
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
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 Byrd Field

Area of Interest		AOI01															
Sample ID		AOI01-01-GW		AOI01-02-GW		AOI01-03-GW		AOI01-04-GW		AOI01-05-GW		AOI01-06-GW		BF-MW-05-GW		BF-MW-05-GW-D	
Sample Date		02/23/2022		02/23/2022		02/23/2022		02/23/2022		02/23/2022		02/22/2022		02/22/2022		02/22/2022	
Analyte	OSD Screening Level [a]	Result	Qual	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	17.0		1.07	J	ND	U	ND	U	ND	U	ND	U	ND	UJ	0.681	J
PFHxS	39	112		15.0		1.79	J	ND	U	ND	U	ND	U	2.51	J	1.85	J
PFNA	6	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	6	5.49		2.72	J	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	4	27.0		0.902	J	ND	U	ND	U	ND	U	ND	U	2.43	J	0.934	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 Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Notes

ND - Analyte not detected above the LOD.

LOD values are presented in Appendix F.

Interpreted Qualifiers

J = Estimated concentration

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.

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
BF	Byrd Field
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

Shallow

Intermediate

Deep

AOI01-05
AOI01-06
AOI01-02
AOI01-01
AOI01-03
AOI01-04
White Oak Swamp Creek

PFOA Results (µg/Kg)

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

CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	8/25/2022	GIS BY	MS	8/25/2022
SCALE	1:7,200	CHK BY	JW	8/25/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/25/2022

Facility Boundary
Water Body
Wetland
River/Stream

0 300 600 1,200 Feet

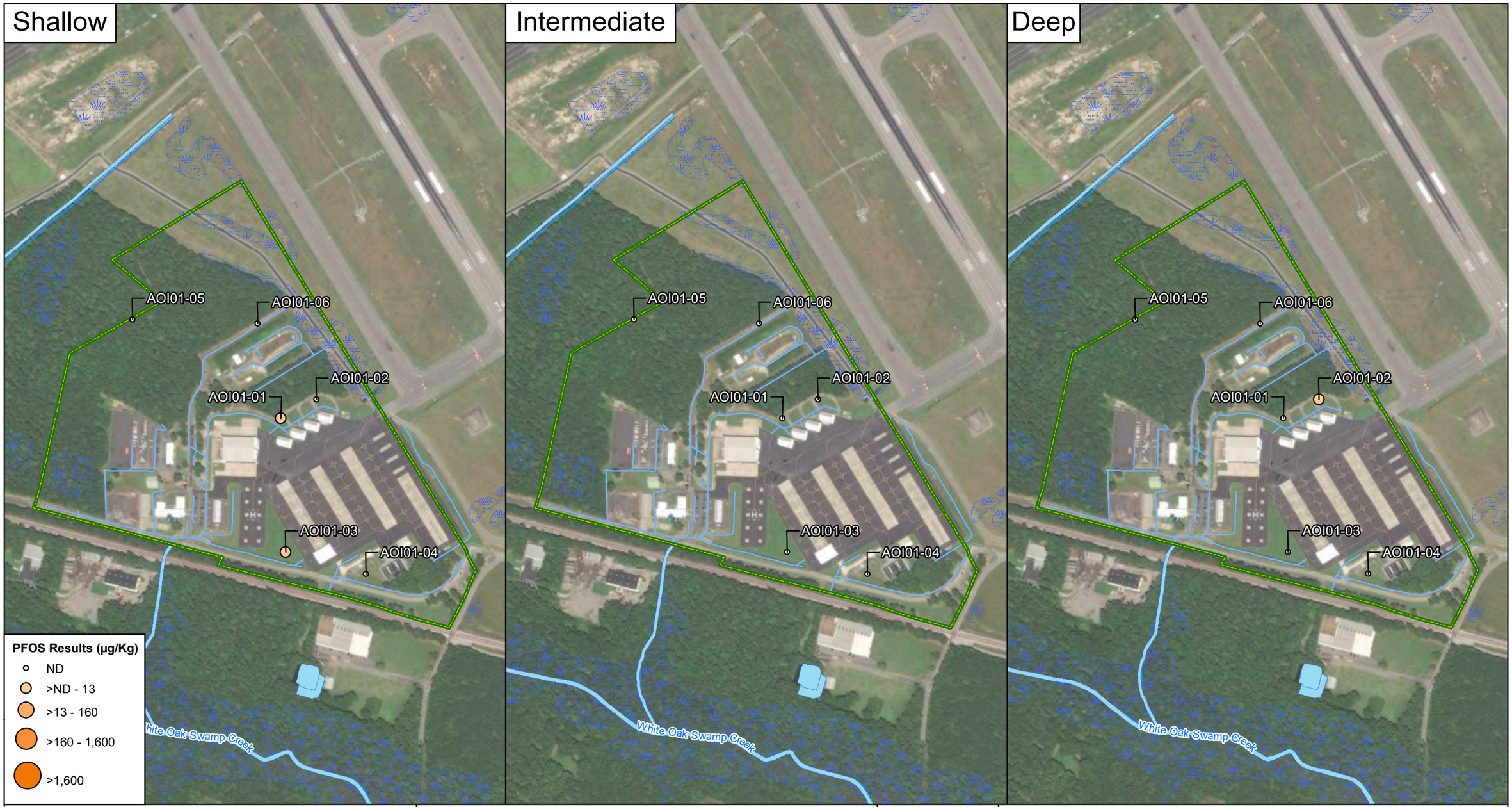
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOA Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1



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PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	8/25/2022	GIS BY	MS	8/25/2022
SCALE	1:7,200	CHK BY	JW	8/25/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/25/2022

Facility Boundary
Water Body
Wetland
River/Stream

0 300 600 1,200 Feet

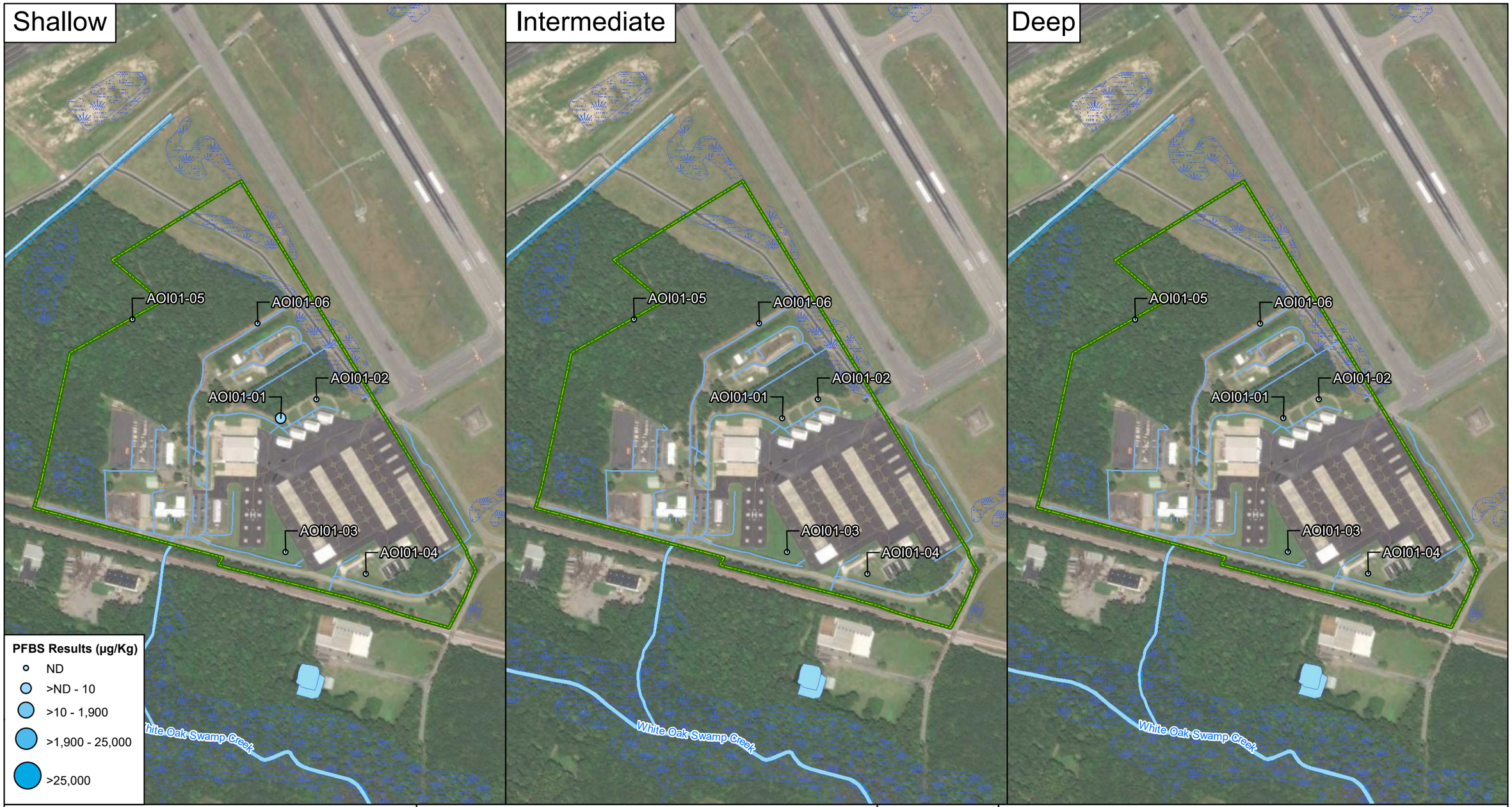
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOS Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-2



CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	8/25/2022	GIS BY	MS	8/25/2022
SCALE	1:7,200	CHK BY	JW	8/25/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/25/2022

Facility Boundary
Water Body
Wetland
River/Stream

0 300 600 1,200 Feet

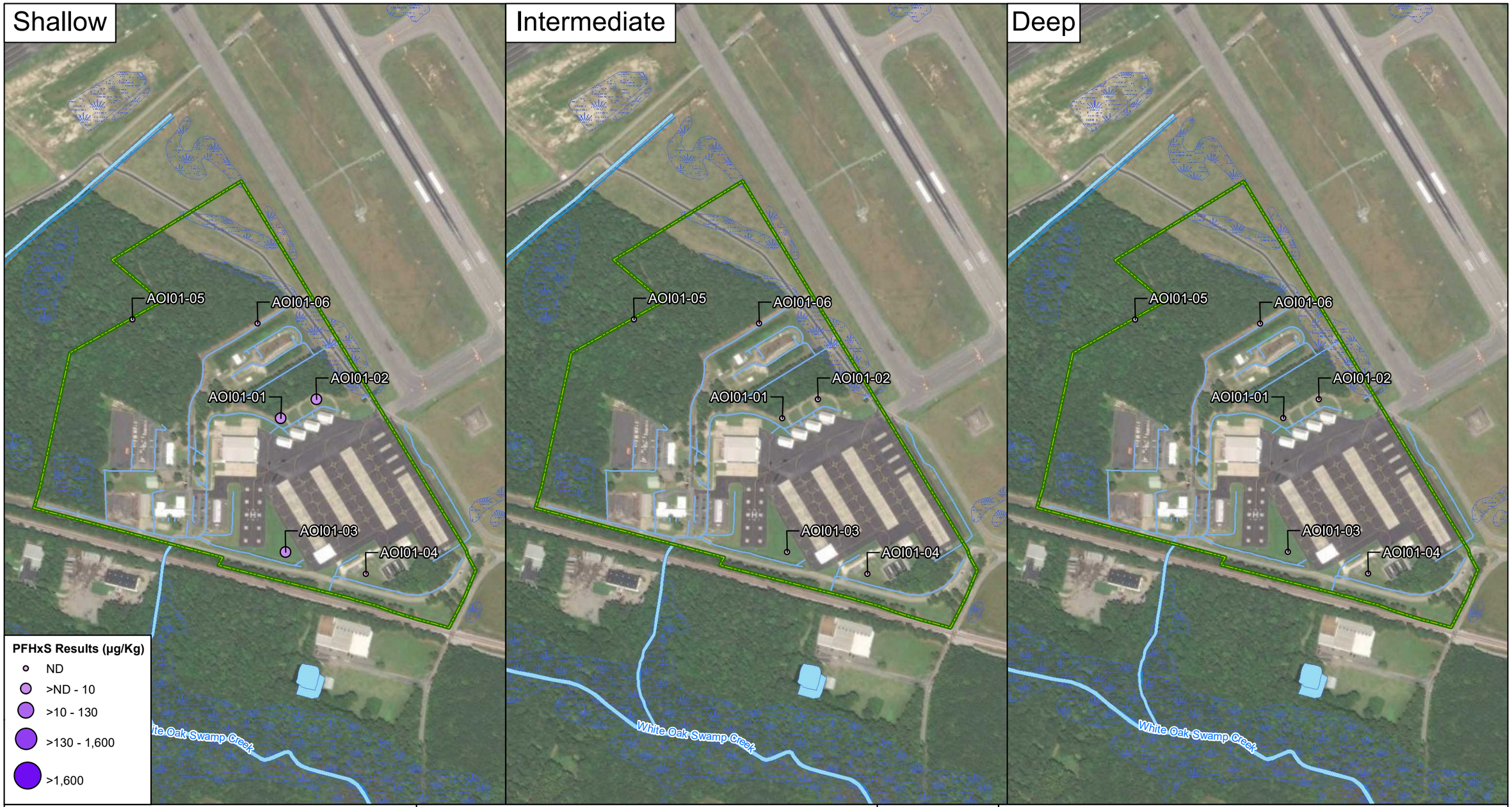
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFBS Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-3



CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	8/25/2022	GIS BY	MS	8/25/2022
SCALE	1:7,200	CHK BY	JW	8/25/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/25/2022

Facility Boundary
Water Body
Wetland
River/Stream

0 300 600 1,200 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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Germantown, MD 20876

Figure 6-4

Shallow

Intermediate

Deep

AOI01-05
AOI01-06
AOI01-02
AOI01-01
AOI01-03
AOI01-04
White Oak Swamp Creek

PFNA Results (µg/Kg)

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

CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	8/25/2022	GIS BY	MS	8/25/2022
SCALE	1:7,200	CHK BY	JW	8/25/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/25/2022

Facility Boundary
Water Body
Wetland
River/Stream

0 300 600 1,200 Feet

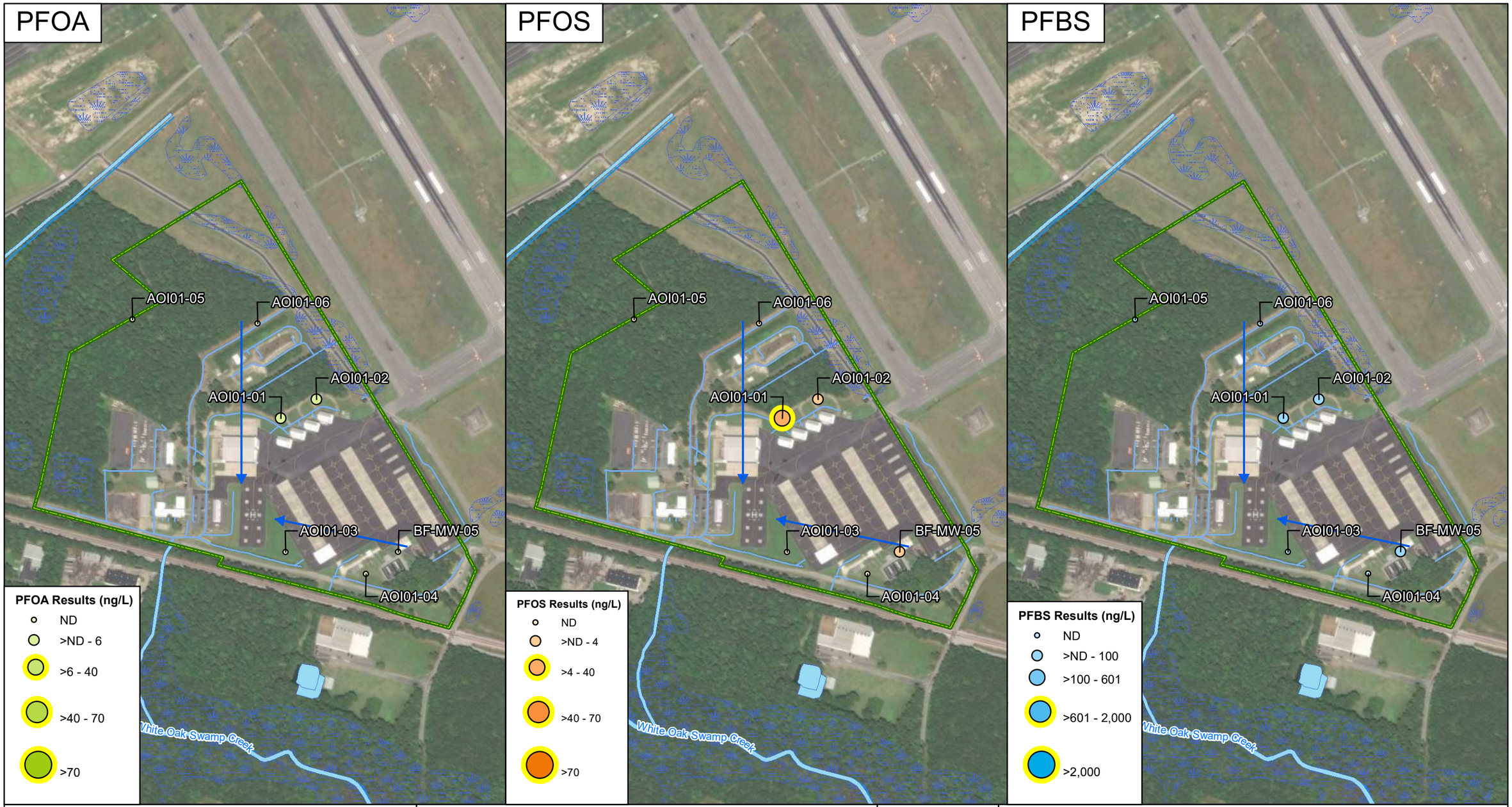
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFNA Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-5



CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	10/5/2022	GIS BY	MS	10/5/2022
SCALE	1:7,200	CHK BY	JW	10/5/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	10/5/2022

Facility Boundary
Water Body
Wetland
River/Stream
Groundwater Flow Direction

0 300 600 1,200 Feet

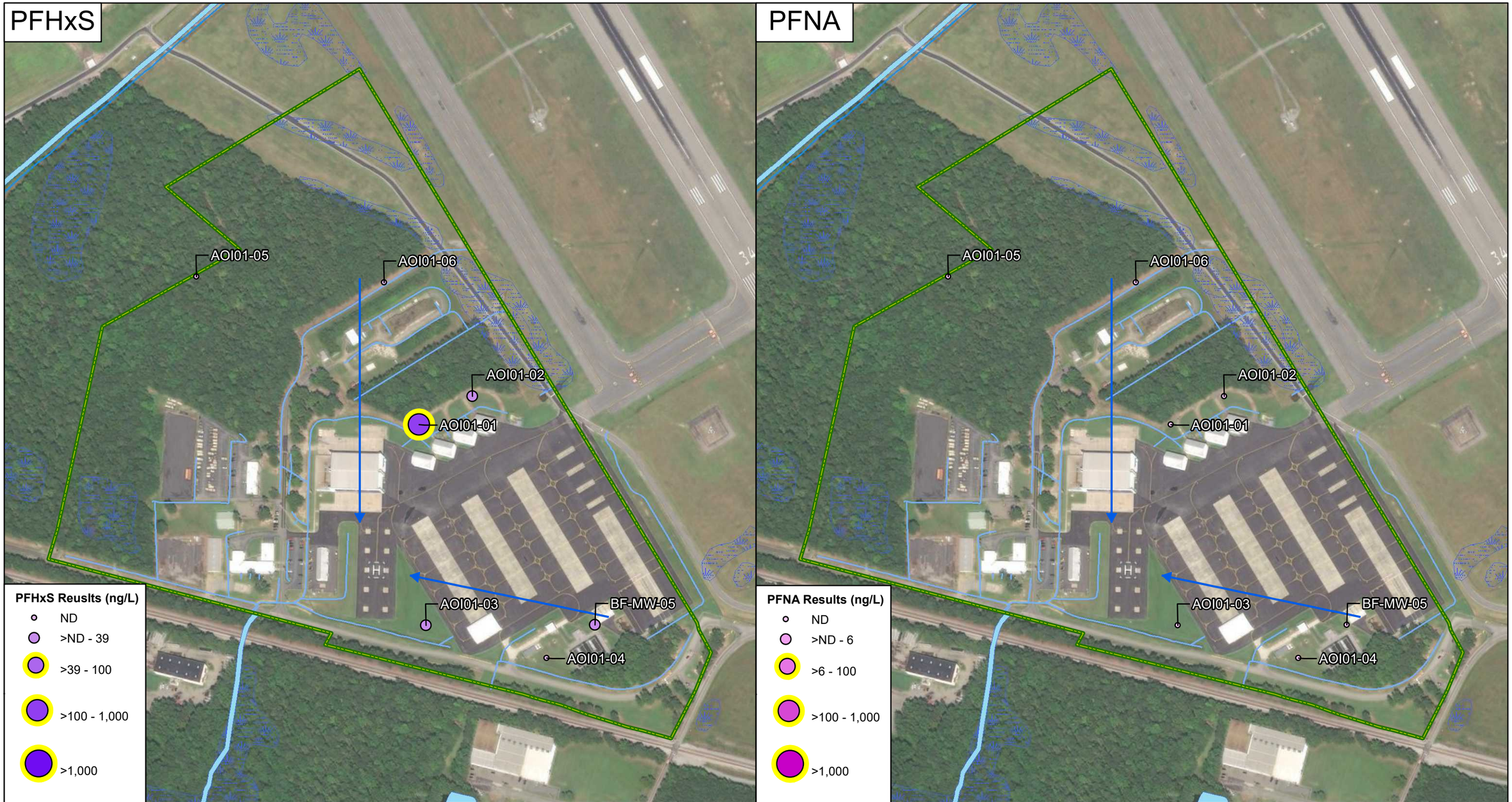
Exceedances of the OSD SL are depicted with a yellow halo.

N

PFOA, PFOS, and PFBS Detections in Groundwater

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-6



CLIENT	ARNG			
PROJECT	Site Inspection at AASF Byrd Field, VA			
REVISED	8/25/2022	GIS BY	MS	8/25/2022
SCALE	1:4,800	CHK BY	JW	8/25/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/25/2022

Facility Boundary
Water Body
Wetland
River/Stream
Groundwater Flow Direction

0 200 400 800 Feet

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

N

PFHxS and PFNA Detections in Groundwater

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12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-7

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7. Exposure Pathways

The CSM for AOI 1, revised based on the SI findings, are presented on **Figure 7-1**. Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to 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 and whether the release is more than likely attributable to the DoD.

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, residents outside the facility boundary, and recreational users outside of the facility boundary.

7.1 Soil Exposure Pathway

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

7.1.1 AOI 1

AOI 1 is the Flightline and Fuel point, where AFFF is stored in 10 Tri-Max™ 30 fire extinguishers staged across the AOI. Due to the corrosive nature of AFFF, and exposure of the Tri-Max™ 30 extinguishers to the elements, it is possible for AFFF to have leaked from the extinguishers. Potential AFFF releases on the Flightline and Fuel Point would have occurred primarily on paved surfaces but may run-off into unpaved surfaces. AFFF releases carried by run-off into surface soil

could potentially infiltrate the subsurface soil. AFFF releases may also infiltrate the subsurface soil via cracks in the pavement or in joints between areas that are paved with different materials.

PFOS, PFBS, PFHxS, and PFNA were detected in surface soil at AOI 1 below their respective SLs. As a result, site workers and future construction workers could contact constituents in surface soil via inhalation of dust and incidental ingestion due to ground disturbing activities. Therefore, the surface soil exposure pathways for site workers and future construction workers are potentially complete. Residents and recreational users of the areas adjacent to the facility could also contact constituents in surface soil via inhalation of dust due to ground disturbing activities. Therefore, the surface soil exposure pathways for residents and recreational users are also potentially complete. PFOS was detected in subsurface soil at AOI 1 below the SL. Future construction workers could contact constituents in subsurface soil via incidental ingestion, and therefore, the subsurface soil exposure pathway for construction workers is potentially complete. No construction activities were observed at the facility during SI field work. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2 Groundwater Exposure Pathway

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

7.2.1 AOI 1

PFOS and PFHxS were detected in exceedance of their SLs, and PFOA and PFBS were detected below their SLs in groundwater samples collected at AOI 1. Depths to water measured in February 2022 during the SI ranged from 2.79 to 12.7 feet bgs. Therefore, future construction workers could contact constituents in shallow groundwater via incidental ingestion during construction activities and the groundwater exposure pathway is potentially complete. Due to the presence of public water system wells within a 4-mile radius of the facility in the downgradient direction, the pathway for exposure to off-facility residents via ingestion of groundwater is considered potentially complete. No groundwater wells exist at the facility. AASF Byrd Field is provided municipal water by Henrico County Department of Public Utilities, which sources its water from the James River located approximately 6 miles away (Henrico County Department of Public Utilities, 2022). Therefore, the pathway for exposure to site workers via ingestion of groundwater is considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.3 Surface Water and Sediment Exposure Pathway

The SI results in soil and groundwater, in combination with knowledge of the fate and transport properties of PFAS, were used to determine whether a potentially complete pathway exists between the source and potential receptors.

7.3.1 AOI 1

Potential AFFF releases carried by run-off would likely drain downslope into the White Oak Swamp Creek. PFAS are water soluble and can migrate readily from soil to groundwater via leaching. Because the relevant compounds were detected in soil and groundwater at AOI 1, it is possible that these compounds may have migrated from soil and groundwater through wetlands at the facility. It is possible that groundwater interacts with surface water at White Oak Swamp Creek. It is also possible that constituents in soil and groundwater were conveyed via reinforced channels to an off-facility rip-rap channel, and ultimately to White Oak Swamp. Therefore, the surface water and sediment ingestion exposure pathway for site workers and future construction workers at the facility as well as off-facility recreational users of White Oak Swamp Creek is considered potentially complete. Because facility surface water is drained by the Chickahominy

River Watershed, it is not expected that surface water conveyed offsite will reach the Henrico County Water Treatment Facility on the James River. Therefore, the surface water pathway to ingestion by off-facility residents is considered incomplete. The Newport News Waterworks sources drinking water from the Chickahominy River; however, the surface water intake is approximately 22 miles east, downstream of the facility (Newport News Waterworks Department, 2021).

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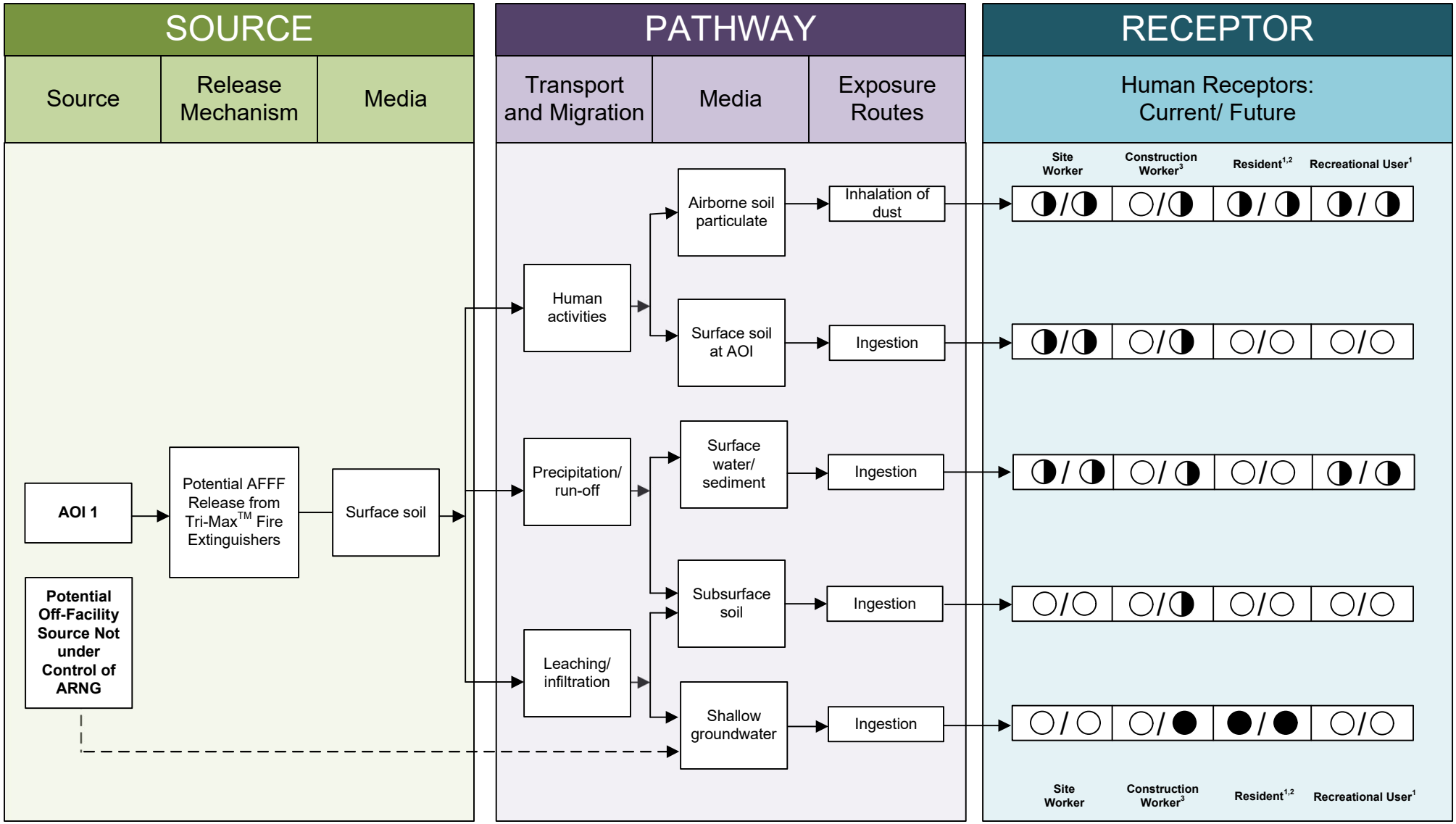

LEGEND

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

Notes:

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. No current active construction at the facility.

Figure 7-1
Conceptual Site Model, AOI 1
AASF Byrd Field

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8. Summary and Outcome

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

8.1 SI Activities

The SI field activities were conducted from 18 to 24 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 5.10**.

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.

- Eighteen (18) soil samples from six boring locations;
- Seven grab groundwater samples from six temporary wells and one existing permanent monitoring well; and
- Fourteen (14) QA/QC samples.

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

8.2 Outcome

Based on the results of this SI, further evaluation is warranted in an RI for the single AOI evaluated during this SI, AOI 1: Flightline and Fuel Point. Based on the CSM developed and revised in light of the SI findings, the pathway for exposure to drinking water receptors from historical DoD activities at AOI 1 is potentially complete. 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 PFOS, PFBS, PFHxS, and PFNA in soil at AOI 1 were below their SLs. PFOA was not detected in soil.
    - PFOS and PFHxS in groundwater exceeded their SLs. PFOS exceeded the SL of 4 ng/L at location AOI01-01 with a concentration of 27.0 ng/L. PFHxS exceeded the SL of 39 ng/L at location AOI01-01 with a concentration of 112 ng/L. PFOA and PFBS were detected in groundwater at concentrations below their SLs. Based on the results of the SI, further evaluation of AOI 1 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	Future Action
1	Flightline and Fuel Point	◐	●	Proceed to RI

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

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