FINAL
Site Inspection Report
Rickenbacker Army Enclave
Columbus, Ohio

Perfluorooctanesulfonic Acid (PFOS) and
Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

December 2022

Prepared for:

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

UNCLASSIFIED

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
6:2 FTS	6:2 Fluorotelomer sulfonic acid
8:2 FTS	8:2 Fluorotelomer sulfonic acid
AECOM	AECOM Technical Services, Inc.
Aerostar	Aerostar SES LLC
AFFF	aqueous film forming foam
AFRPA	Air Force Real Property Agency
ANG	Air National Guard
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CRAA	Columbus Regional Airport Authority
CSM	conceptual site model
DA	Department of the Army
DERR	Division of Environmental Response and Revitalization
DoD	Department of Defense
DPT	direct push technology
DQI	data quality indicator
DQO	data quality objective
DUA	data usability assessment
DVR	data validation report
EIS	extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
EPA	Environmental Protection Agency
ERB	equipment rinsate blank
FedEx	Federal Express Corporation
FRB	field reagent blank
FTA	Fire Training Area
GPRS	Ground Penetrating Radar Services, LLC
HA	Health Advisory
HDPE	high-density polyethylene
HEF	high expansion foam
IDW	investigation-derived waste
IIS	injection internal standards
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
LCS	laboratory control spike

LCSD	laboratory control spike duplicate
LOD	limit of detection
LOQ	limit of quantitation
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
ng/L	nanograms per liter
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
NOAA	National Oceanic and Atmospheric Administration
ODGS	Ohio Division of Geological Survey
OHANG	Ohio Air National Guard
OHARNG	Ohio Army National Guard
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutyrate
PFBS	perfluorobutanesulfonic acid
PFCs	perfluorinated compounds
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUdA	perfluoroundecanoic 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
RAE	Rickenbacker Army Enclave
RI	Remedial Investigation
RIA	Rickenbacker International Airport
RPD	relative percent differences
SI	Site Inspection
SL	screening level

SOP	standard operating procedure
TCRA	Time-Critical Removal Action
TOC	total organic carbon
TPP	Technical Project Planning
UCMR	Unregulated Contaminant Monitoring Rule
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

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Executive Summary

The Army National Guard (ARNG) G9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at per- and polyfluoroalkyl substances (PFAS)-impacted sites at ARNG facilities nationwide. The objective of the SI at each facility is to identify whether there has been a release to the environment from the Areas of Interest (AOIs) identified in the PA and determine the presence or absence of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutanesulfonic acid (PFBS) at or above screening levels (SLs). An SI was completed at the Rickenbacker Army Enclave (RAE) in Columbus, Ohio. Rickenbacker Army Enclave will also be referred to as the "facility" throughout this document.

RAE is located at 8174 S Access Road, in Franklin County, Columbus, Ohio, approximately 12 miles southeast of downtown Columbus, Ohio (**Figure 2-1**). The facility primarily supports readiness and training activities associated with helicopter missions. Helicopter and aircraft parking, maintenance, and fueling, administration, billeting/transient barracks, and mission support facilities are all Ohio ARNG (OHARNG) operations occurring at RAE.

During the PA for PFAS, three potential PFAS release areas were identified: the C26 Hangar, Drainage Ditch, and Helicopter Ramp Area (AECOM, 2019). PFAS-containing Jet-X foam was released inside the C26 Hangar during a test of the HEF fire suppression system, and PFAS-containing aqueous film forming foam (AFFF) could have potentially been released due to storage of Tri-Max™ tanks at the Helicopter Ramp Area. Any potential spills or discharges on either ramp area would eventually flow into the Drainage Ditch. The potential PFAS release areas were designated into three Areas of Interest (AOIs), which were investigated during the SI. The SI field activities were conducted from 14 to 16 June and 25 August 2021 and included the collection of soil and groundwater samples.

To fulfill the project Data Quality Objectives set forth in the approved SI Quality Assurance Project Plan Addendum (AECOM, 2021a), samples were collected and analyzed for a subset of 18 PFAS by liquid chromatography with tandem mass spectrometry compliant with Quality Systems Manual 5.3 Table B-15. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.7** of this Report.

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 Office of the Secretary of Defense (OSD) dated 15 September 2021 (Assistant Secretary of Defense, 2021). 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 and there is a release identified that is likely attributed to ARNG activities, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to three compounds: PFOS, PFOA, and PFBS.

The SLs are presented on **Table ES-1** below. All other results presented in this report are considered informational in nature and serve as an indication as to whether soil and groundwater contain or do not contain the 18 PFAS analyzed within the boundaries of the facility.

Sample chemical analytical concentrations were compared against the project SLs as described in **Table ES-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1, refusal was encountered, and groundwater was unable to be sampled at the C26 Hangar potential PFAS release area. Based on the results of the SI, further evaluation of groundwater at AOI 1 is recommended to make site-related remedial decisions.
- At AOI 2, PFOA, PFOS, and PFBS were detected in groundwater at the Drainage Ditch potential PFAS release area below the OSD SLs. Although no PFAS analytes exceeded

their respective SLs at AOI 2, the shallow depth to groundwater encountered and fat clays observed at location AOI02-01 indicate that it is possible groundwater was sampled from a perched water bearing unit. Therefore, there is insufficient information to make a remedial decision and further evaluation of groundwater at AOI 2 is recommended.

- At AOI 3, PFOS, PFOA, and PFBS were non-detect in groundwater at the Helicopter Ramp Area potential PFAS release area; however, PFOS in groundwater exceeded the SL at facility boundary location, RAE-01. Although the groundwater flow direction observed in onsite temporary wells was to the west, a 2018 Base Realignment and Closure (BRAC) Report for the Rickenbacker Air National Guard (ANG) Base projects that groundwater across the southern portion of the airport flows southwest (Aerostar, 2018). If groundwater flows southwest across the eastern portion of the RAE, temporary well location RAE-01 may be considered downgradient of AOI 3. Therefore, based on the presence of PFOS in groundwater at location RAE-01, there is insufficient information to make a remedial decision and further evaluation of groundwater at AOI 3 is recommended.
- At the Facility Boundary location, RAE-01, PFOS was detected in exceedance of the OSD SL at 75.1 nanograms per liter (ng/L), and PFOA was detected at 13.3 ng/L. PFOS detections at location RAE-01 indicate that offsite PFAS sources may be contributing to PFAS concentrations in environmental media at the facility; however, it is also possible that groundwater flows southwest across the facility based on the 2018 BRAC Report for the ANG Base. If groundwater flows southwest across the facility, then location RAE-01 would be considered downgradient from AOI 3. Due to this uncertainty and the concentrations of PFOS in groundwater at location RAE-01 exceeding the SL, further evaluation of the Facility Boundary is recommended.
- The detected concentrations of PFOA, PFOS, and PFBS in soil at all AOIs were below the SLs.

Table ES-2 summarizes the SI results for soil and groundwater. Based on the conceptual site models (CSMs) developed and revised in light of the SI findings, there is potential for exposure to drinking water receptors caused by DoD activities at or adjacent to the facility.

Table ES-3 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, additional information is required to make remedial decisions for all AOIs at this facility.

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

Analyte	Residential (Soil) (µg/kg)[a,b] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a,b] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a,b]
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	1,900	25,000	600

Notes:

a.) Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 15 September 2021.

b.) USEPA. 2016a. Drinking Water Health Advisory (HA) for Perfluorooctanoic Acid (PFOA). Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. USEPA Document Number: 822-R-16-005. May 2016. / USEPA. 2016b. Drinking Water HA for Perfluorooctane Sulfonic Acid (PFOS). Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. USEPA Document Number: 822-R-16-004. May 2016.

Table ES-2: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	C26 Hangar	◐	N/A(1)	N/A
2	Drainage Ditch	◐	◐	◐
3	Helicopter Ramp Area	◐	○	●
Facility Boundary	Off-Facility/ Upgradient	◐	●	●

Legend:

N/A = not applicable

(1) Groundwater was not encountered at AOI 1; therefore, groundwater samples could not be collected.

● = PFOA, PFOS, and/or PFBS detected; exceedance of the screening levels

◐ = PFOA, PFOS, and/or PFBS detected; no exceedance of the screening levels

○ = PFOA, PFOS, and/or PFBS not detected

Table ES-3: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	C26 Hangar	Unable to collect groundwater samples. No exceedances of SLs in soil.	Consider further groundwater evaluation.
2	Drainage Ditch	Detections in groundwater below SLs at potential source area. Additionally, groundwater samples collected could possibly represent perched water, not water table. No exceedances of SLs in soil.	Consider further groundwater evaluation.
3	Helicopter Ramp Area	No detections in groundwater; however, exceedances are present in potential downgradient sample location. No exceedances of SLs in soil.	Consider further groundwater evaluation.
Facility Boundary	Off-Facility/ Upgradient	Exceedances of SL in groundwater at source area. No exceedances of SLs in soil.	Consider further groundwater evaluation.

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) at Impacted Sites, ARNG Installations, Nationwide. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor, AECOM Technical Services, Inc. (AECOM), under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017. The ARNG performed this SI at the Rickenbacker Army Enclave (RAE) in Columbus, Ohio. The RAE 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; 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 including specific requirements for sampling for PFOA, PFOS, and perfluorobutanesulfonic acid (PFBS), and the group of related compounds known in the industry as per- and polyfluoroalkyl substances (PFAS). The term PFAS is used throughout this report to encompass all PFAS chemicals being evaluated, including PFOA, PFOS, and PFBS, which are the key components of the suspected releases being evaluated, and the other 15 related compounds listed in the task order.

1.2 SI Purpose

A PA was performed at RAE (AECOM, 2019) that identified three potential PFAS release areas at the facility, which were designated into three Areas of Interest (AOIs). The objective of the SI is to identify whether there has been a release to the environment from the AOIs and determine the presence or absence of PFOA, PFOS, and PFBS at or above screening levels (SLs).

As stated in the *Federal Facilities Remedial Site Inspection Summary Guide* (USEPA, 2005), an SI has five goals:

1. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment;
2. Determine the potential need for a removal action;
3. Collect or develop data to evaluate potential release;
4. Collect data to better characterize the release for more effective and rapid initiation of a Remedial Investigation (RI), if determined necessary; and
5. Collect data to determine whether the release is more than likely the result of activities associated with the Department of Defense (DoD).

In addition to the USEPA-identified goals of an SI, the ARNG SI also identifies whether there are potential off-facility PFAS sources.

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2. Facility Background

2.1 Facility Location and Description

RAE is located at 8174 S Access Road, in Franklin County, Columbus, Ohio, approximately 12 miles southeast of downtown Columbus, Ohio (**Figure 2-1**). The facility primarily supports readiness and training activities associated with helicopter missions. Ohio ARNG (OHARNG) operations at RAE include helicopter and aircraft parking, maintenance, fueling, administration, billeting/transient barracks, and mission support facilities.

The area comprising RAE was originally named the “Northwest Training Center of the Army Air Corps” in 1942, later renamed to the “Lockbourne Air Force Base” in 1948, and finally renamed “Rickenbacker Air Force Base” in 1974 (Air Force Real Property Agency [AFRPA], 2007). The base was transferred to the Ohio Air National Guard (OHANG) in 1980 and renamed the “Rickenbacker Air National Guard Base”. A portion of the property was transferred to the Rickenbacker Port Authority in 1984, at which time Rickenbacker International Airport (RIA) was established. RIA primarily serves as a cargo-only airport for the City of Columbus, allowing government, private, and commercial cargo planes to transport goods internationally. In 1987, the ARNG entered into a federal-state agreement with the State of Ohio for the construction of an Army Aviation Support Facility on land owned by the Rickenbacker Air National Guard (ANG) Base. An indefinite license was granted in 1998 for the use, occupancy, training, and support of 126 acres for the OHARNG.

In 2003, the Rickenbacker Port Authority merged with the Columbus Airport Authority to form the Columbus Regional Airport Authority (CRAA). The CRAA currently owns and operates RIA, of which the OHARNG is an adjacent tenant. RAE is located within the Rickenbacker ANG Base as part of a joint military facility, with additional tenants including the CRAA, the OHANG, a Naval Reserve Center, and various commercial businesses (USACE, 2017). RAE is part of the 126-acre parcel of land that was licensed to the ARNG per the aforementioned August 1998 agreement (AECOM 2019, Appendix A).

2.2 Facility Environmental Setting

RAE is located in the Interior Plains region of Ohio. The Interior Plains encompass most of the western part of the state and are characterized by lower relief than the Appalachian Highlands to the east. The terrain around the facility exhibits moderately low relief, with a broad regional slope to the southeast towards the Scioto Valley. The elevation of the facility is approximately 740 feet above mean sea level (Engineering-Science, 1988). The facility is surrounded by farmland and deciduous forest to the west, and by RIA to the east.

2.2.1 Geology

RAE lies within the Central Lowland physiographic province, Columbus Lowland district. The Columbus Lowland is a lowland area with many larger streams that is bounded to the north by Powell Moraine, to the east/south by the Berea and Allegheny Escarpments, and to the west by the flatter and higher Darby Plain (Ohio Division of Geological Survey [ODGS], 1998).

RAE is situated on loamy, medium-lime, Wisconsinan-age clay glacial till and outwash (ODGS, 1998); the glacial drift unit is generally 211 to 260 feet thick (ODGS, 2004). The glacial drift unit is underlain by the Ohio Shale Unit, an Upper Devonian sedimentary bedrock unit composed primarily of black shale. The Chagrin Member of the Ohio Shale also contains some siltstone and very fine-grained sandstone (Slucher, E.R. *et al*., 2006).

Soil borings completed during the SI found the majority of the uppermost 25 feet of this unit consist of lean clay with sand and fat clay with sand. The borings were completed at depths between 5 and 25 feet below ground surface (bgs). Varying gravel content was observed in these clay layers, ranging between 5 and 25 percent (%). Gravel size generally increased with depth. Isolated lenses of cobble, coarse and angular gravel were observed at thicknesses ranging from 1 to 2 inches at varying depths between 4.3 and 13.0 feet bgs. Samples for grain size analysis were collected at three locations, AOI01-01, AOI03-01, and RAE-01, and analyzed via American Society for Testing and Materials (ASTM) Method D-422. The results indicate that the soil samples are comprised primarily of silt (41.35% to 50.41%), These results and facility observations are consistent with the understood land fill material and glacial outwash environment. Boring logs are presented in **Appendix E** and grain size results are presented in **Appendix F**.

2.2.2 Hydrogeology

RAE is not located on a principal aquifer system due to the low permeability of the underlying shale bedrock. The surficial aquifer system consists of regionally extensive, thick, permeable deposits of sand and gravel that may be overlain by low-permeability glacial till. Coarse deposits located at depths of 30 to 200 feet bgs may yield as much as 500 gallons per minute (Schmidt, 1958). Groundwater flow is generally to the west, towards Big Walnut Creek (**Figure 2-3, Figure 2-4**).

RAE obtains its drinking water from the City of Columbus public water system, which utilizes both surface water and groundwater for drinking water. The City of Columbus has three main plants that treat all source water; RAE receives water from the Parsons Avenue Water Plant, approximately 5 miles northwest of the facility, which utilizes groundwater for drinking water and serves southeastern Franklin County (City of Columbus, 2018). No potable water wells are located within RAE; however, domestic wells and monitoring wells exist within 4 miles of the facility (**Figure 2-3**).

The City of Lockbourne is located approximately 3,500 feet west of RAE. Like the RAE facility, Lockbourne is connected to the City of Columbus public drinking water system; however, the Ohio State Water Well database shows that several private drinking water wells are located within 1 mile of the facility. One domestic well is reported 0.5 miles north of the facility, while several other domestic wells located within 1 mile northwest of RAE, in the direction of groundwater and surface water flow.

The Unregulated Contaminant Monitoring Rule (UCMR) sampling program was an addition to the 1996 Safe Drinking Water Act which requires every five years the USEPA issue a new list of no more than 30 unregulated contaminants to be monitored by public water systems. PFAS were added as part of the UCMR 3 list (2012). The UCMR 3 dataset was evaluated to determine which public water systems were sampled for PFAS within a 20-mile radius of the facility. Based on this rule, the City of Columbus public drinking water was sampled. The sampling results for PFOA and PFOS were non-detect. No other public water system within 20 miles of the facility had detects for PFOA or PFOS (USEPA, 2017a). PFAS analyses performed in 2016 had method detection limits that were higher than currently achievable. Thus, it is possible that low concentrations of other PFAS were not detected during the UCMR3 but might be detected if analyzed today.

Depths to water measured in June 2021 during the SI field effort ranged from 7.30 feet bgs to 3.65 feet above ground surface (water level measured in temporary monitoring well casing stick-up extending above ground surface at RAE-01). Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate localized groundwater flow direction is generally to the northwest. A 2018 Base Realignment and Closure (BRAC) Report for the Rickenbacker ANG Base interpreted groundwater flowing southwest across the southern portion of the airport, including the RAE facility (Aerostar, 2018). This 2018 BRAC Report interpretation did not utilize

any monitoring wells within 0.5 miles of the RAE facility. Due to the complexity of the geology and hydrogeology in the immediate area, there is a level of uncertainty with respect to the groundwater flow direction immediately beneath the facility. This uncertainty will be acknowledged as a data gap that will need to be addressed in the next phase of work.

2.2.3 Hydrology

Regional surface water features include Big Walnut Creek and the Scioto River. Big Walnut Creek converges with the Scioto River approximately 2.8 miles from the facility.

RAE employs a series of drainage ditches to convey runoff off-site. One drainage ditch originates on OHANG property, enters the facility from the north, runs parallel to the northwest facility boundary, and exits the facility in the western portion. A second drainage ditch originates in the southern portion of the facility and flows northwest, where it converges with the first drainage ditch, at which point it exits the facility on the northwest boundary. The drainage ditch system conveys runoff to Big Walnut Creek, which flows west towards the Scioto River, approximately 1.4 miles from the property boundary (**Figure 2-5**).

2.2.4 Climate

The climate at RAE is temperate, humid subtropical, with cool to cold winters and long, hot summers. The average temperature is 52.7 degrees Fahrenheit (°F), with summer highs of 84.9 °F and winter lows of 21.1 °F. Average annual precipitation is 40.11 inches (National Oceanic and Atmospheric Administration [NOAA], 2021).

2.2.5 Current and Future Land Use

RAE is located adjacent to RIA and an OHANG enclave, surrounded by small residential and industrial areas. The northeast boundary of RAE connects with the southwest boundary of the OHANG enclave. Directly east of RAE lies Runways 5 and 23, which are owned and operated by RIA. Within RAE are several hangars, storage buildings, and a helicopter ramp area. RAE supports the operation of helicopter and aircraft parking, maintenance, and fueling, billeting/transient barracks, and mission support facilities. Operations within the facility will continue to support the aviation operations for the duration of the lease, which was issued for an indefinite term. Future land use is not anticipated to change.

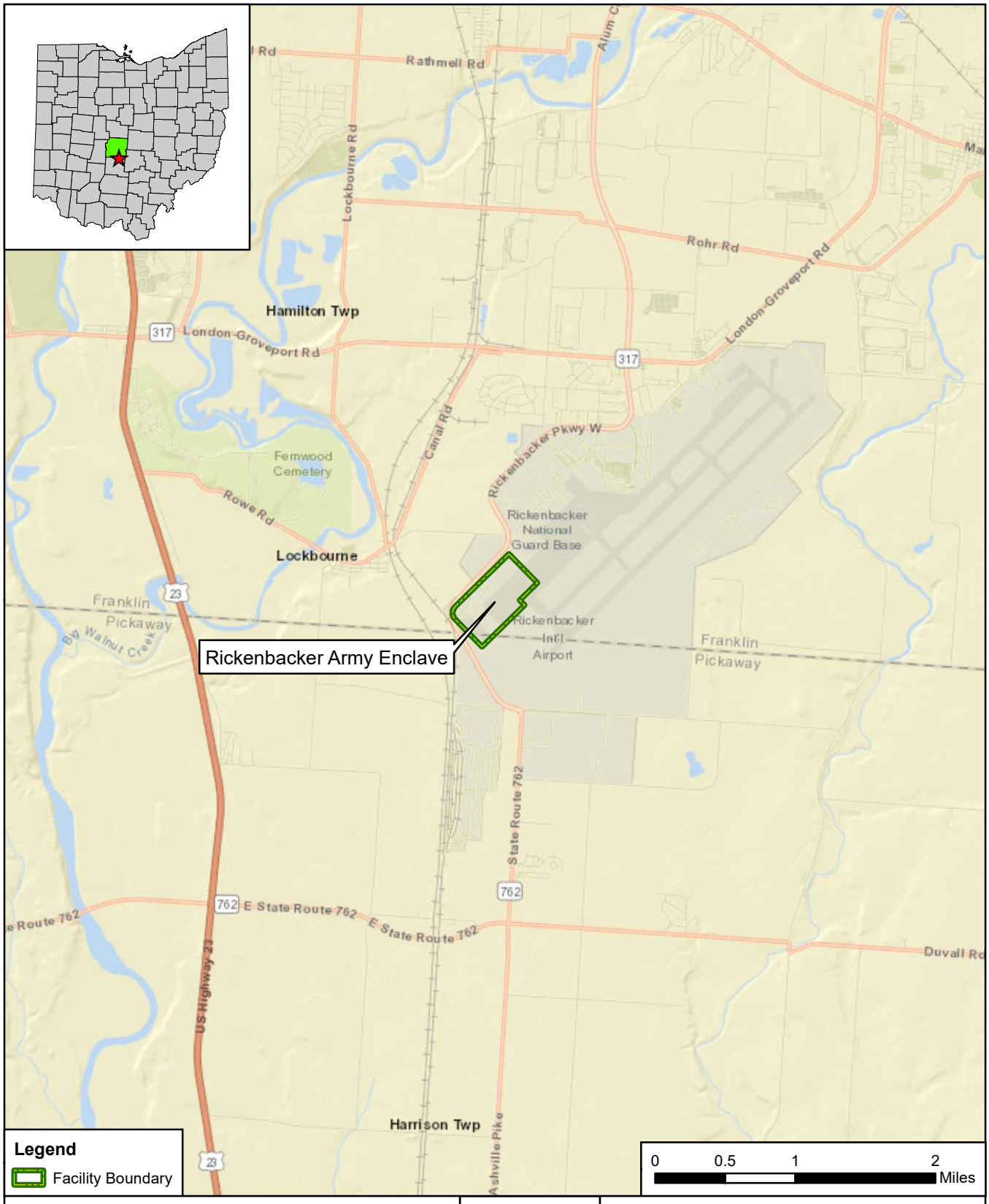
2.2.6 Sensitive Habitat and Threatened/ Endangered Species

The following birds, plants, mammals, and reptiles are federally endangered, threatened, proposed, and/ or are listed as candidate species in Franklin County, Ohio (US Fish and Wildlife Service [USFWS], 2021).

- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Mammals**: Northern long-eared bat, *Myotis septentrionalis* (threatened); Indiana bat, *Myotis 2-3odalist* (endangered)
- **Fishes**: Scioto madtom (*Noturus trautmani*)
- **Clams:** Rayed bean, *Villosa fabalis* (endangered); Northern riffleshell, *Epioblasma torulosa rangiana* (endangered); Rabbitsfoot, *Quadrula cylindrica cylindrica* (threatened); Clubshell, *Pleurobema clava* (endangered); Snufflbox mussel, *Epioblasma triquetra* (endangered)
- **Flowering plants:** Eastern prairie fringed orchid, *Platanthera leucophaea* (threatened)

2.3 History of PFAS Use

Three potential PFAS release areas were identified at RAE during the PA where aqueous film forming foam (AFFF) may have been used, stored, and released historically (AECOM, 2019). PFAS-containing materials were potentially released to soil and groundwater, surface water, and sediment within the boundary of RAE through a fire suppression system testing, AFFF storage, and storm water conveyance. The potential PFAS release areas were grouped into three AOIs based on preliminary data and presumed groundwater flow direction. These AOIs are described in **Section 3.**



CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Rickenbacker Army Enclave, OH			
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Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	11/18/2021

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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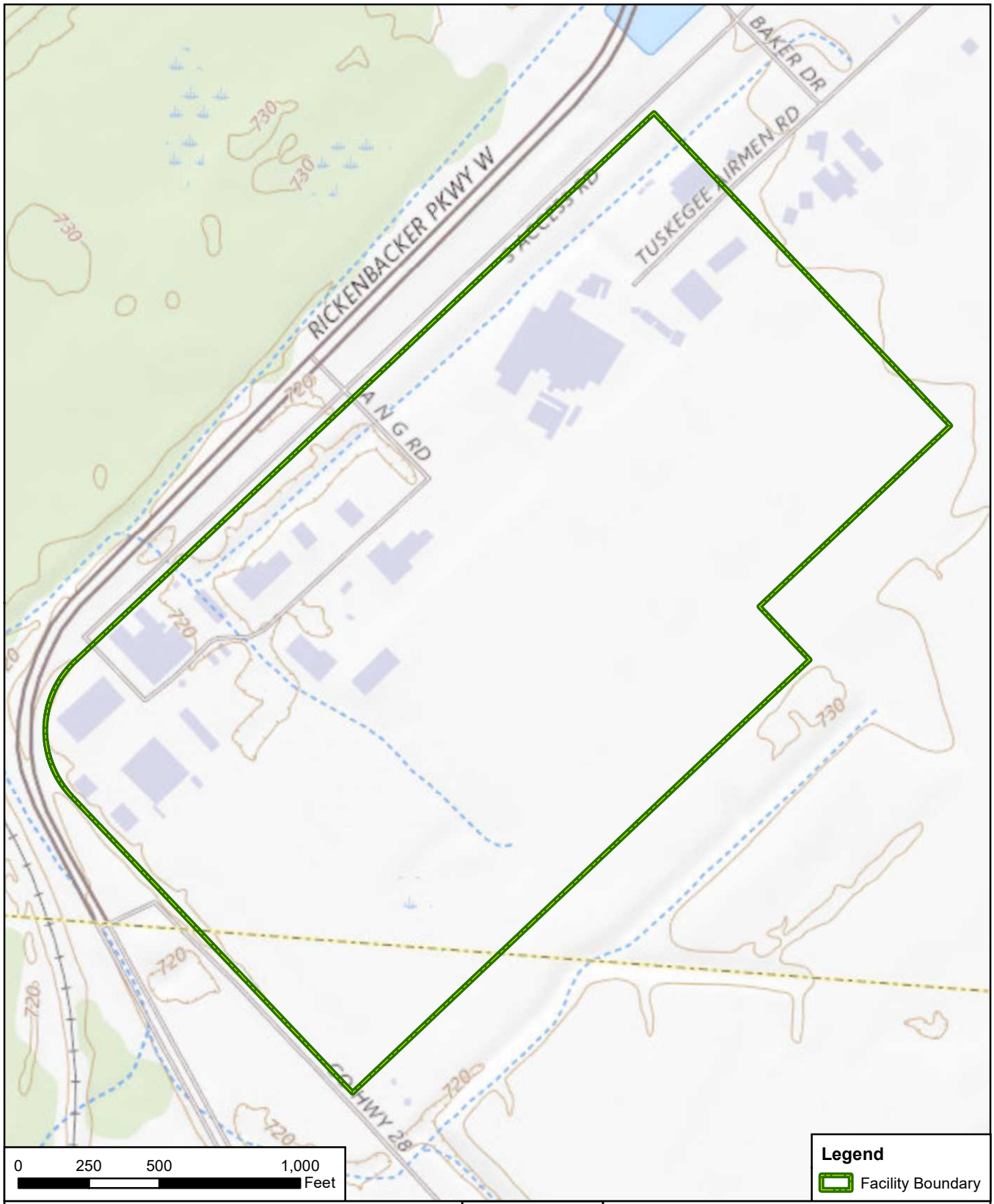

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SCALE	1:6,000	CHK BY	EG	11/18/2021
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	11/18/2021

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Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2

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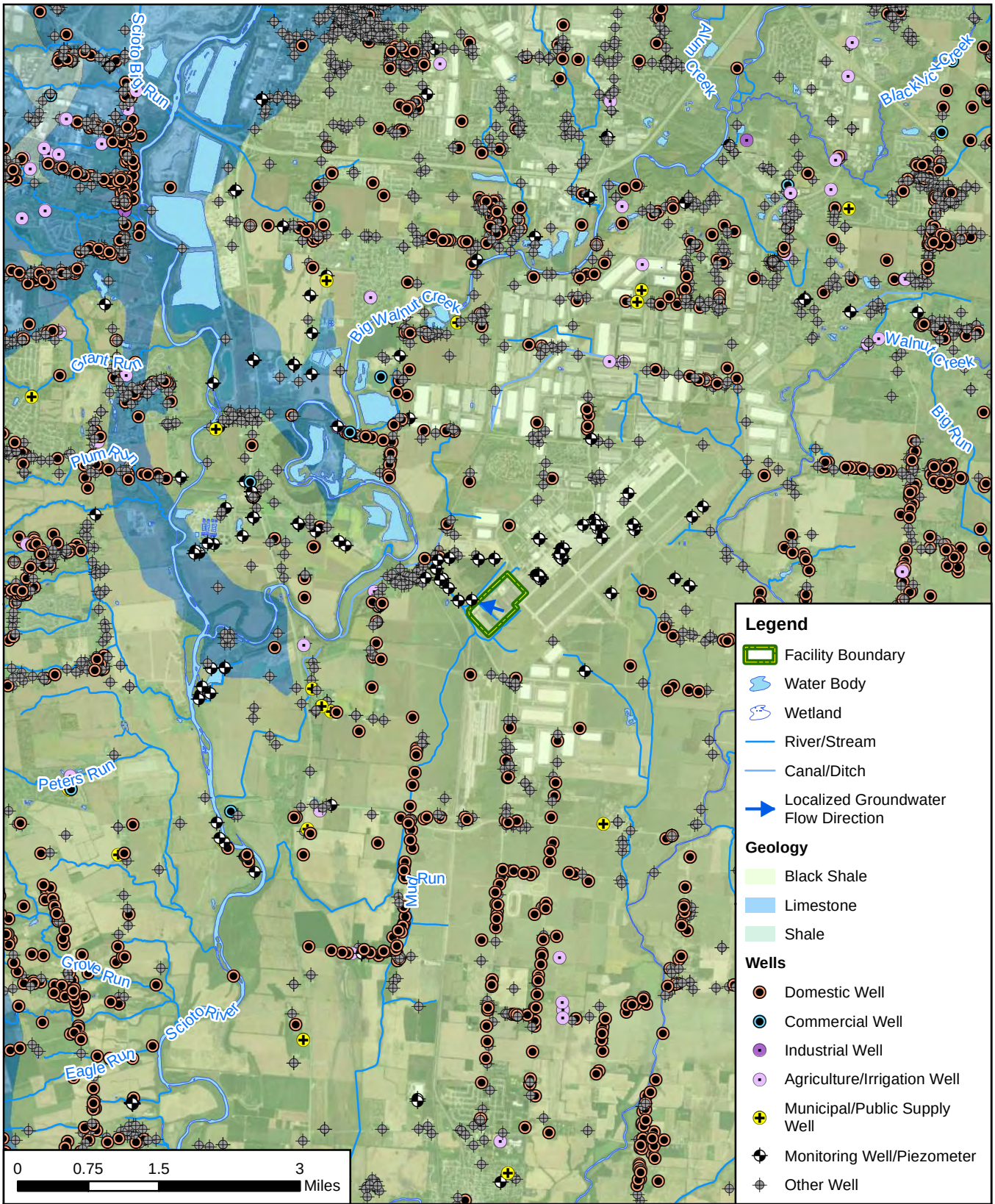

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Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

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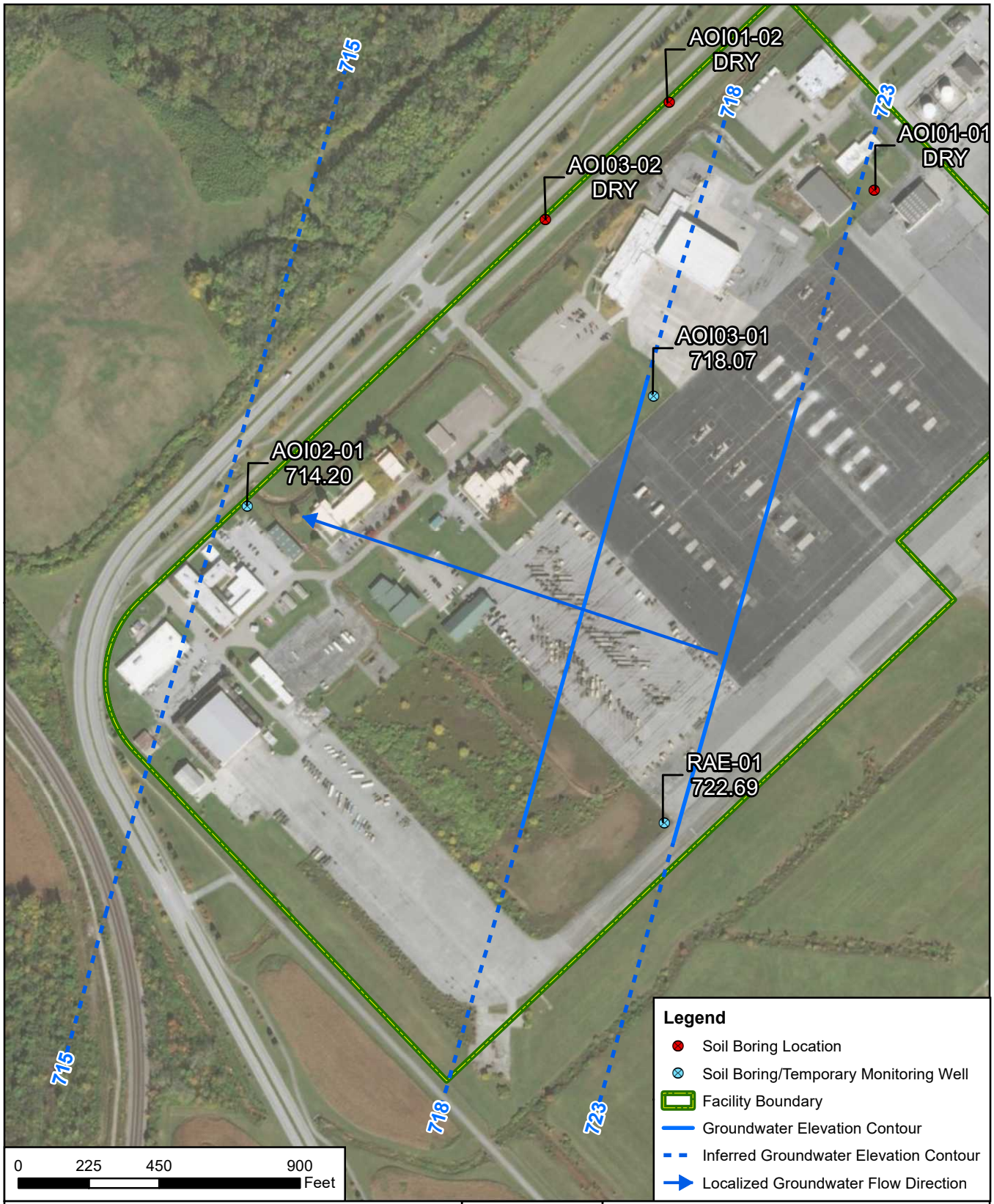

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Rickenbacker Army Enclave, OH			
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Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	4/11/2022

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Groundwater Elevation Contours - June 2021

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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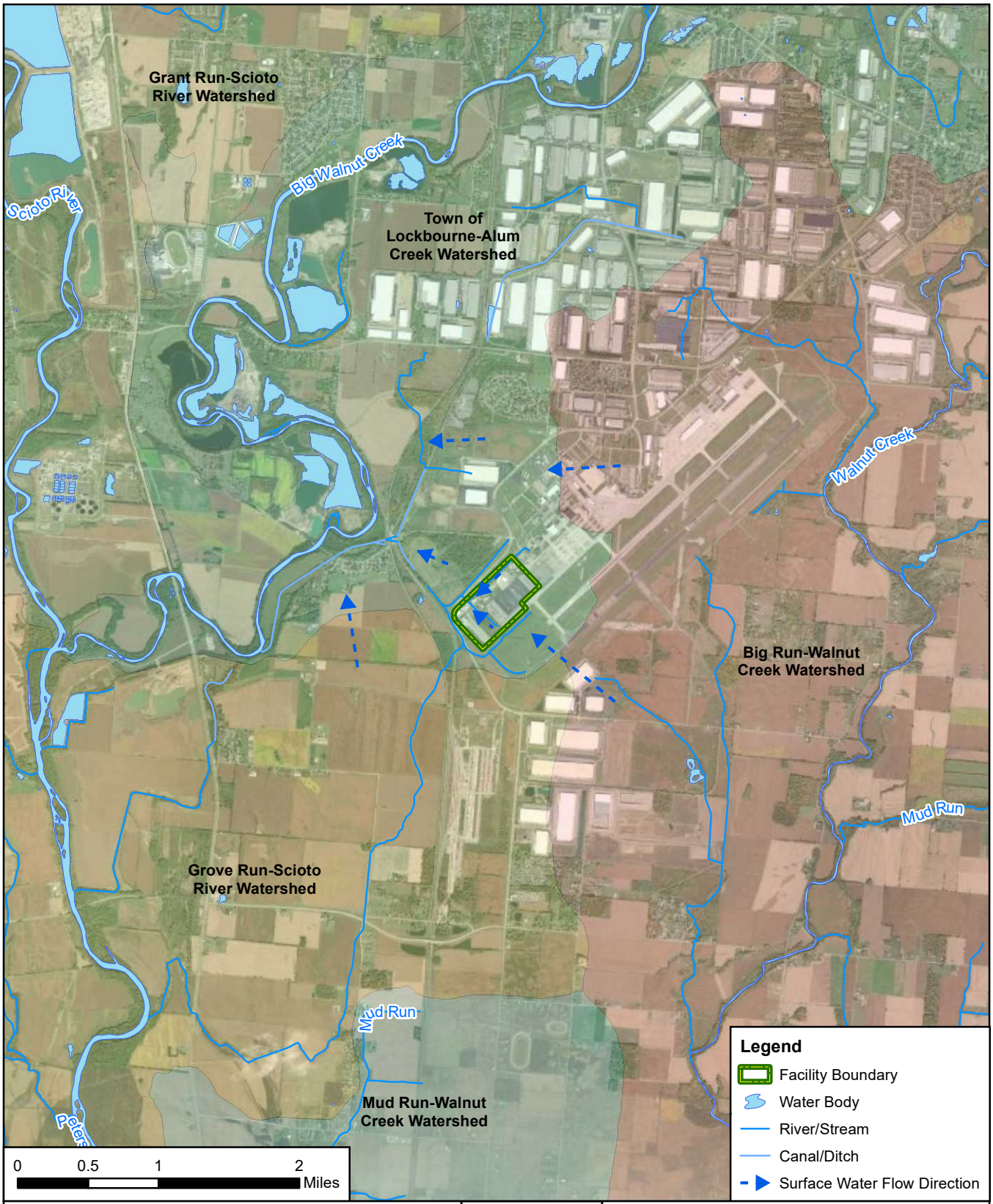

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Rickenbacker Army Enclave, OH			
REVISED	11/19/2021	GIS BY	MS	11/19/2021
SCALE	1:63,360	CHK BY	EG	11/19/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	11/19/2021

Surface Water Features

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Figure 2-5

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3. Summary of Areas of Interest

This section presents a summary of each potential PFAS release area by AOI. Based on the PA findings, three potential PFAS release areas, the C26 Hangar, Drainage Ditch, and Helicopter Ramp Area, were identified at RAE and grouped into three separate AOIs (AECOM, 2019). The potential PFAS release areas are shown on **Figure 3-1**.

3.1 AOI 1

AOI 1 consists of one potential PFAS release area. This potential release area is described below.

3.1.1 C26 Hangar

AOI 1 is the C26 Hangar. The C26 Hangar is located on the northeast side of RAE and was constructed in 2003. The hangar is primarily used for the storage of small aircraft and various equipment. Minor aircraft maintenance also occurs within this building.

The C26 Hangar included a fire suppression system with 2.75% Jet-X high expansion foam (HEF) installed between 2007 and 2008. The Jet-X holding tank has a capacity of approximately 900 gallons. According to interviewees, a test of the system that involved a release of an unknown amount of Jet-X foam from the fire suppression system was conducted following installation (AECOM, 2019). The hangar doors were closed during this initial testing, and all material from the suppression system dissipated into the floor drains of the hangar that leads to the sanitary sewer. RAE and the surrounding airport are connected to the Big Walnut Augmentation/Rickenbacker Interceptor sewer that drains to the City of Columbus' Southerly Wastewater Treatment Plant (WWTP). The Southerly WWTP is located approximately 12 miles west of RAE. All waste treated at the Southerly WWTP is discharged to the Scioto River, west of RAE, which is commonly used for recreational activities. No other spills or releases have been reported from this hangar.

3.2 AOI 2

AOI 2 consists of one potential PFAS release area. This potential release area is described below.

3.2.1 Drainage Ditch

AOI 2 is a stormwater drainage ditch that originates on OHANG property. The ditch enters OHARNG property from the north and runs parallel to the northwest boundary of the facility. Upgradient of RAE, stormwater runoff from OHANG hangars and ramp areas discharges into this ditch, which then flows through the OHARNG property. The drainage ditch flows southwest, eventually exiting the facility boundary near the Lockbourne Air Force Base Landfill. Two small detention ponds along the southwest edge of the OHARNG pavement, and two small drainage channels north of the helicopter ramp area connect to this stormwater drainage ditch. Any potential spills or discharges on either ramp area or near these drainage channels would eventually flow into the stormwater drainage ditch.

A second drainage ditch originates in the southern portion of the facility and flows northwest, where it converges with AOI 2 and exits the facility on the northwest boundary. As mentioned above, any releases between the two properties would likely be captured in the storm drain system, which then discharges to AOI 2, and eventually conveys runoff to Big Walnut Creek, approximately 1.4 miles from the property boundary.

An SI performed at the OHANG facility by Aerostar in 2017 showed several potential AFFF releases that could have impacted this stormwater drainage system (Aerostar, 2018). Additionally,

any potential release from RAE would be captured in surrounding storm drains and discharged into AOI 2.

3.3 AOI 3

AOI 3 consists of one potential PFAS release area. This potential release area is described below.

3.3.1 Helicopter Ramp Area

AOI 3 is a helicopter ramp area south of Building 918 that contained between nine to eleven mobile Tri-Max™ tanks from approximately 2002 to 2013. While exact specifications for these Tri-Max™ tanks, including concentration and quantity, were not available, they were likely PFAS-containing AFFF tanks. Based on interviewee knowledge, these tanks were never used or deployed for fire training purposes or emergency response incidents. Interviewees confirmed that these tanks remained outside during their storage on the ramp, but they could not confirm if the tanks were regularly maintained.

The north and southwest corners of AOI 3 each contain one drainage channel that eventually discharges into AOI 2. Any potential spills or discharges on the helicopter ramp area or near the drainage channels would eventually flow into AOI 2. The drainage channels conveying runoff from AOI 3 to AOI 2 also drain ramp and flightline areas to the northeast on the adjacent ANG Base. Runoff from those adjacent areas are also ultimately conveyed to AOI 2.

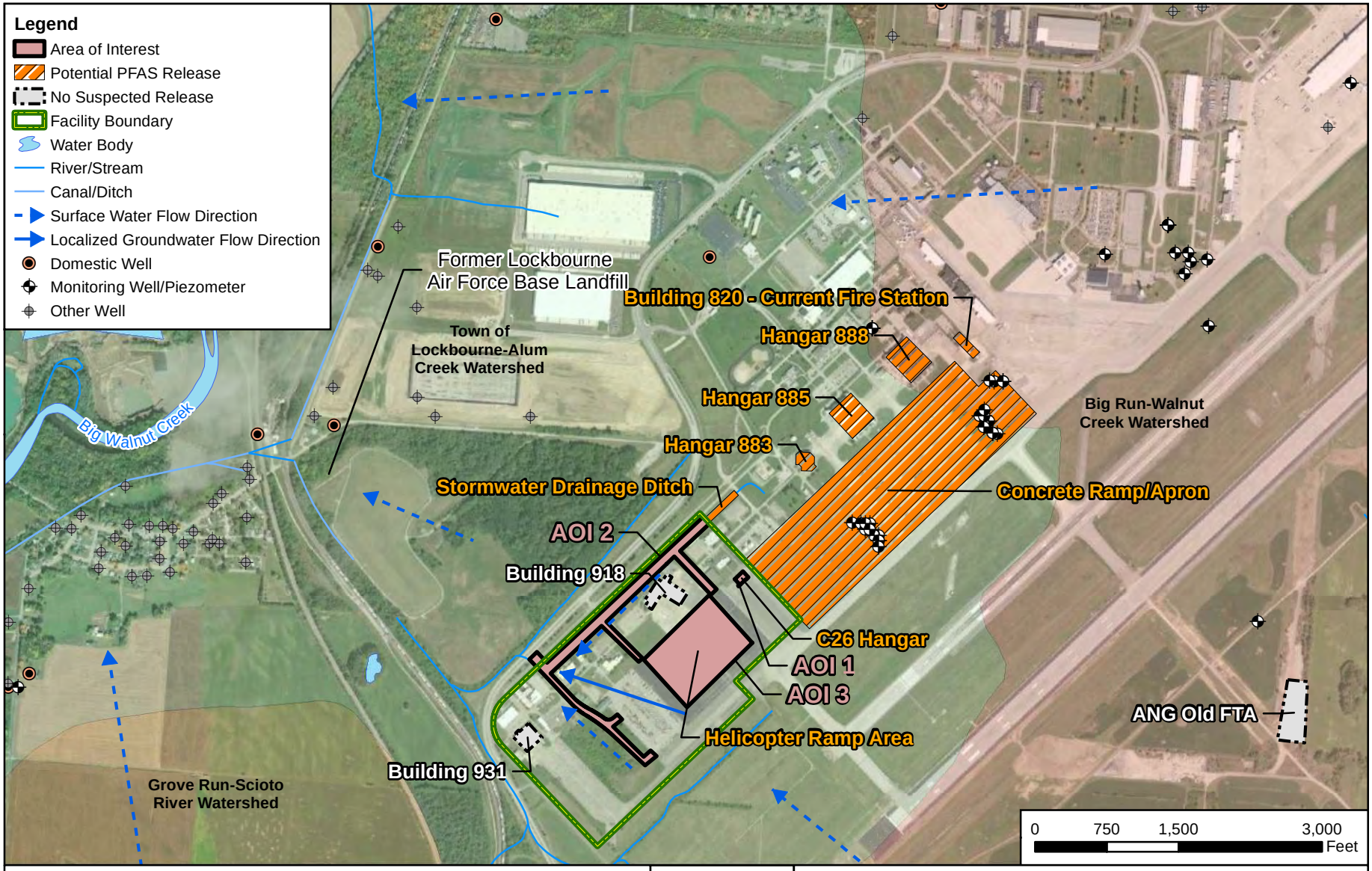
3.4 Facility Boundary

The Facility Boundary consists of one potential PFAS release area. This potential release area is described below.

3.4.1 Off-Facility/ Upgradient Potential Release Area

A former ANG Fire Training Area (FTA) sits approximately 5,000 feet east of RAE, on Rickenbacker International Airport property. A spill or release from this off-facility source has the potential to migrate onto RAE and subsequently impact RAE groundwater. This potential off-facility PFAS source was not identified as an AOI during the PA. After further review of aerial photographs and inferred groundwater flow direction, the area located approximately 5,000 feet east of the facility boundary may present a potential source of PFAS migrating onto RAE.

A 2018 BRAC Report for the ANG Base projects groundwater flowing to the southwest across the southern portion of the airport, including the RAE facility (Aerostar, 2018). Based on this groundwater flow projection, the area identified as the Upgradient Facility Boundary may not be upgradient of all RAE AOIs. There is a level of uncertainty with respect to the interpreted groundwater flow direction observed in onsite temporary wells. This uncertainty will be acknowledged as a data gap that will need to be addressed in the next phase of work. The Upgradient Facility Boundary is conservatively considered potentially downgradient from AOI 3 for the purpose of conceptual site model (CSM) evaluation in this report.



CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Rickenbacker Army Enclave, OH			
REVISED	4/11/2022	GIS BY	MS	4/11/2022
SCALE	1:18,000	CHK BY	EG	4/11/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS,		PM	CM	4/11/2022

N

Areas of Interest

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Figure 3-1

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4. Project Data Quality Objectives

Project Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data and define the level of certainty required to support project decision-making process. The specific DQOs established for this facility are described below. These DQOs were developed in accordance with the USEPA's seven-step iterative process (USEPA, 2006).

4.1 Problem Statement

The following problem statement was developed during project planning:

The presence of PFAS, which may pose a risk to human health or the environment, in environmental media at the facility is currently unknown. PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. The regulatory framework for managing PFAS at both the federal and state level continues to evolve.

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 Office of the Secretary of Defense (OSD) dated 15 September 2021 (Assistant Secretary of Defense, 2021). 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 three compounds: PFOS, PFOA, and PFBS.

The following quotes from the DA policy documents form the basis for this project (DA, 2016; DA, 2018):

- "The Army will research and identify locations where PFOS- and/or PFOA-containing products, such as AFFF, are known or suspected to have been used. Installations shall coordinate with installation/facility fire response or training offices to identify AFFF use or storage locations. The Army will consider FTAs, AFFF storage locations, hangars/buildings with AFFF suppression systems, fire equipment maintenance areas, and areas where emergency response operations required AFFF use as possible source areas. In addition, metal plating operations, which used certain PFOS-containing mist suppressants, shall be considered possible source areas."
- "Based on a review of site records…determine whether a CERCLA PA is appropriate for identifying PFOS/PFOA release sites. If the PA determines a PFOS/PFOA release may have occurred, a CERCLA SI shall be conducted to determine presence/absence of contamination."
- "Identify sites where perfluorinated compounds are known or suspected to have been released, with the priority being those sites within 20 miles of the public systems that tested above USEPA HA levels." (USEPA, 2016a; USEPA, 2016b).

4.2 Goals of the Study

The following goals were established for this SI:

1. Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs at RAE.
2. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.

3. Determine the potential need for a Time Critical Removal Action (TCRA) (applies to drinking water only). The primary actions that will be considered include provision of alternative water supplies or wellhead treatment.
4. Collect data to better characterize the release areas for more effective and rapid initiation of a RI (if determined necessary).
5. If PFOA, PFOS, and PFBS are determined to be present, aim to evaluate whether the concentrations can be attributed to on-facility or off-facility sources that were identified within 4 miles of the installation as part of the PA (e.g., fire stations, major manufacturers, other DoD facilities).
6. Determine whether a potentially complete pathway exists between the source and potential receptors and whether ARNG is the likely source of the contamination.

4.3 Information Inputs

Primary information inputs included:

- The PA for RAE (AECOM, 2019);
- The AFFF SI for the Base Realignment and Closure (BRAC) portion of the ANG base (Aerostar, 2018);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2021a); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.4 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-1**). 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).

4.5 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the 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 and decision rules as defined in the SI QAPP Addendum (AECOM, 2021a). These rules governed response actions based on the results of the SI sampling effort.

The decision rules described in the **Worksheet #11** of the SI QAPP Addendum identify actions based on the following:

Groundwater:

- Is there a human receptor within 4 miles of the facility?
- What is the concentration of PFOA, PFOS, and PFBS at the potential release areas?

- What is the concentration of PFOA, PFOS, and PFBS at the facility boundary upgradient and downgradient of the potential release areas?
- What does the CSM suggest in terms of source, pathway and receptor?

Soil:

- What is the concentration of PFOA, PFOS, and PFBS in shallow surface soil (0 to 2 feet bgs)?
- What is the concentration of PFOA, PFOS, and PFBS in deep soil (i.e., capillary fringe)?
- What does the CSM suggest in terms of source, pathway, and receptor?

Soil and groundwater samples were collected from each of the potential release areas. Groundwater was encountered at approximately 4.64 to 7.30 feet bgs at AOI 2 and AOI 3, respectively. Positive hydraulic head was observed at RAE-01, where groundwater was measured at 3.65 feet above ground surface (water level measured from temporary monitoring well casing stick-up extending above the ground surface at RAE-01).

4.6 Data Usability Assessment

The Data Usability Assessment (DUA) 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.

Data Quality Indicators (DQIs) (Precision, Accuracy, Representativeness, Comparability, Completeness and Sensitivity) are important components in assessing data usability. These DQIs were evaluated in the subsequent sections and demonstrate that the data presented in this SI report are of high quality. Although the SI data are considered reliable, some degree of uncertainty can be associated with the data collected. Specific factors that may contribute to the uncertainty of the data evaluation are described below. The Data Validation Report (DVR) (**Appendix A**) presents explanations for all qualified data in greater detail.

4.6.1 Precision

Precision is the degree of agreement among repeated measurements of the same characteristic on the same sample or on separate samples collected as close as possible in time and place. Field sampling precision is measured with the field duplicate relative percent differences (RPD); laboratory precision is measured with calibration verification, internal standard recoveries, laboratory control spike (LCS) and matrix spike (MS) duplicate RPD.

Injection internal standards (IIS) were added by the laboratory after sample extraction and prior to analysis as a legacy requirement of DoD QSM 5.1 to measure relative responses of target analytes. Even though not required under DoD QSM 5.3, the IIS are still added to the sample after extraction as an additional quality control (QC) measure. The IIS percent recoveries were within the established precision limits presented in the QAPP Addendum (AECOM, 2021a).

LCS/LCS duplicate (LCSD) pairs were prepared by addition of known concentrations of each analyte in a matrix-free media known to be free of target analytes. LCS/LCSD pairs were analyzed for every analytical batch to demonstrate the ability of the laboratory to detect similar concentrations of a known quantity in matrix-free media. The LCS/LCSD samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a).

MS/MS duplicate (MSD) samples were prepared, analyzed, and reported for all preparation batches. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested with limited exceptions. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. The MS/MSDs samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a).

Field duplicate samples were collected at a rate of 10% to assess the overall sampling and measurement precision for this sampling effort. The field duplicate samples were analyzed for PFAS and general chemistry parameters. The field duplicate samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a) with limited exceptions. Three separate field duplicate pairs displayed positive results in one sample and non-detect results in the other sample. The positive associated field duplicate pair results were qualified “J”, while non-detects were qualified “UJ”. The qualified field duplicate pair results should be considered usable as estimated values.

4.6.2 Accuracy

Accuracy is a measure of confidence in a measurement. The smaller the difference between the measurement of a parameter and its “true” or expected value, the more accurate the measurement. The more precise or reproducible the result, the more reliable or accurate the result. Accuracy is measured through percent recoveries in the LCS/LCSD, MS/MSD, and surrogates.

LCS/LCSD samples were prepared by addition of known concentrations of each analyte in a matrix free media known to be free of target analytes. LCS/LCSD samples were analyzed for every analytical batch and demonstrated that the analytical system was in control during sample preparation and analysis. The LCS/LCSD samples were within the project established accuracy limits presented in the QAPP Addendum (AECOM, 2021a).

Extraction internal standards (EIS) were added by the laboratory during sample extraction to measure relative responses of target analytes and used to correct for bias associated with matrix interferences and sample preparation efficiencies, injection volume variances, mass spectrometry ionization efficiencies, and other associated preparation and analytical anomalies. The EIS area counts were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a) with several exceptions. The field sample result associated with low EIS area counts were non-detect and were qualified as estimate and should be considered usable as qualified.

MS/MSD samples were prepared, analyzed, and reported at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested.

Calibration verifications were performed routinely to ensure that instrument responses for all calibrated analytes were within established QC criteria. The calibration verifications performed during the laboratory analyses were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a).

4.6.3 Representativeness

Representativeness qualitatively expresses the degree to which data accurately reflect site conditions. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences.

Relating to the use of standard analytical methods, the laboratory followed the method as established in PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) Compliant with Quality Systems Manual (QSM) 5.3 Table B-15, including the specific preparation requirements (i.e. ENVI-Carb or equivalent used), mass calibration, spectra, all the ion transitions identified in Table B-15 were monitored, standards that contained both branch and linear isomers when available were used, and isotopically labeled standards were used for quantitation.

Field QC samples were collected to assess the representativeness of the data collected. Field duplicates were collected at a rate of 10% for all field samples, while MS/MSD samples were collected at a rate of 5%. All preservation techniques were followed by the field staff, and all technical and analytical holding times were met by the laboratory. The laboratory used approved standard methods in accordance with the QAPP Addendum (AECOM, 2021a) for all analyses.

Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control. Several laboratory and method blanks displayed concentrations for multiple target analytes greater than the detection limits. Five investigative field samples (RAE-AOI01-02-SB-8-10, RAE-AOI03-01-SB-0-2, RAE-AOI03-01-SB-4-6, RAE-AOI03-02-SB-0-2, and RAE-AOI03-02-SB-13-15 DUP) had a field sample result for PFOS qualified as a likely false positive due to a blank detection.

Equipment blanks and field blanks were also collected for groundwater and soil samples. The field sample results associated to these blanks were non-detect or displayed concentrations greater than five times the blank detections; no impact on the data is anticipated.

A sample of the water used for decontamination of the drill rig was collected in advance of the field effort. The drill rig decontamination sample RAE-PW-01 displayed concentrations greater than the detection limit for several target analytes. The associated field sample results were greater than five times the concentration found in the decontamination sample; no impact on the data is anticipated.

Field samples were extracted and analyzed within the appropriate holding time in order to qualitatively express the degree to which data accurately reflect site conditions with limited exceptions. Three PFAS field samples were re-extracted and reanalyzed outside of technical holding time due to QC failures. For all samples with re-extracted results, the data reviewer recommended one usable result from either the initial or re-extracted analysis based on professional judgement of data quality. Additionally, the holding time for pH analysis is “immediate”, all field samples analyzed for pH were qualified “J” and should be considered usable as estimated values.

Overall, the data are usable for evaluating the presence or absence of PFAS at the facility. Sufficient usable data were obtained to meet the objectives of the SI.

4.6.4 Comparability

Comparability is the extent to which data from one study can be compared directly to either past data from the current project or data from another study. Using standardized sampling and analytical methods, units of reporting, and site selection procedures help ensure comparability. Standard field sampling and typical laboratory protocols were used during the SI and are considered comparable to ongoing investigations.

4.6.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data expected under normal conditions. The laboratory provided data that met system QC acceptance criteria for all samples tested. Project completeness was

determined by evaluating the planned versus actual quantities of data. Percent completeness per parameter is as follows, if applicable:

- PFAS in groundwater by DoD QSM Table B-15 at 100%
- PFAS in soil by DoD QSM Table B-15 at 100%
- pH in soil by USEPA Method 9045D at 100%
- Total organic carbon (TOC) by USEPA Method 9060 at 100%

Certain soil samples were unable to be collected due to groundwater elevation being higher than anticipated at one soil boring location. Three groundwater samples were unable to be collected due to the absence of surficial groundwater at boring locations. These deviations from the SI QAPP Addendum are described further in **Section 5.8**.

4.6.6 Sensitivity

Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory fortified blanks, a method detection limit (MDL) study, and calibration standards at the limit of quantitation (LOQ). In order to meet the needs of the data users, project data must meet the measurement performance criteria for sensitivity and project LOQs specified in the QAPP Addendum (AECOM, 2021a). The laboratory provided the requested MDL studies and provided applicable calibration standards at the LOQ. In order to achieve the DQOs for sensitivity outlined in the QAPP Addendum (AECOM, 2021a), the laboratory reported all field sample results at the lowest possible dilution. Additionally, any analytes detected below the LOQ and above the MDL were reported and qualified “J” as estimated values by the laboratory.

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, Rickenbacker Army Enclave, Columbus, Ohio* dated March 2019 (AECOM, 2019);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Rickenbacker Army Enclave, Columbus, Ohio* dated May 2021 (AECOM, 2021a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b); and
- *Final Site Safety and Health Plan, Rickenbacker Army Enclave, Columbus, Ohio* dated June 2021 (AECOM, 2021b).

The SI field activities were conducted from 14 to 16 June and 25 August 2021 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, 2021a), except as noted in **Section 5.8**.

The following samples were collected during the SI and analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 to fulfill the project DQOs:

- Fifteen (15) soil samples from six boring locations;
- Three grab groundwater samples from three temporary well locations;
- Sixteen (16) quality assurance (QA)/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**, Nonconformance and Corrective Action Reports are provided in **Appendix B3**, land survey data are provided in **Appendix B4**, and investigation-derived waste (IDW) logs 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 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 quantitative and qualitative DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 16 November 2020 and was conducted in general accordance with EM 200-1-2, prior to SI field activities. The stakeholders for this SI include the

ARNG, OHARNG, USACE, Ohio EPA, and representatives familiar with the facility, the regulations, and the community. 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, 2021a).

Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM's drilling subcontractor, Cascade Technical Services, LLC, placed a ticket with Ohio811 "Call Before You Dig" utility clearance provider to notify them of intrusive work on 7 June 2021. However, because the RAE is a private facility, the participating "Call Before You Dig" locators did not clear utilities at the entire facility. Therefore, AECOM contracted Ground Penetrating Radar Services, LLC (GPRS), a private utility location service, to complete the on-facility utility clearance. GPRS performed utility clearance of the proposed boring locations on 11 June 2021 with input from the AECOM field team and RAE 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 soils where utilities would typically be encountered.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

The potable water source used for decontamination of drilling equipment was confirmed to be acceptable for use in a PFAS investigation prior to the start of field activities. A sample from a potable water source at RAE was collected on 5 January 2021, prior to mobilization, and analyzed for PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water sample are provided in **Appendix F**. A discussion of the results is presented in **Section 4.6.3**.

Materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 2021a). Prior to the start of field work each day, a PFAS 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

Soil samples were collected via direct push technology (DPT), in accordance with the SI QAPP Addendum (AECOM, 2021a). A GeoProbe® 7822DT dual-tube sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top five feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1** and depths are provided **Table 5-1**.

In general, three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 2 feet above the groundwater table, and one subsurface soil sample at the mid-point between the surface and the groundwater table. In borings where groundwater was encountered at 6 feet bgs or shallower, only one to two soil samples were collected per boring, in accordance with the QAPP Addendum (AECOM, 2021a). Specifically, only two soil samples were collected at location RAE-01, and only one soil sample was collected at AOI02-01 due to shallow groundwater.

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

Soil borings completed during the SI found lean clay with sand and fat clay with sand as the dominant lithology of the unconsolidated sediments below RAE. The borings were completed at depths between 5 and 25 feet bgs. Many of the logs reported varying percentages of gravel and sand included in the clay layers, with sediment size generally increasing with depth. These facility observations are consistent with the understood land fill material and glaciofluvial depositional environment.

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 for PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15), TOC (USEPA Method 9060A) and pH (USEPA Method 9045D) and grain size (ASTM Method D-422) in accordance with the SI QAPP Addendum (AECOM, 2021a).

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. In instances when non-dedicated sampling equipment was used, such as a hand auger for the shallow soil samples, equipment rinsate blanks (ERBs) 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, 2021a) using wetted 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, wherever conditions allowed, 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**.

At proposed temporary monitoring well locations AOI01-01, AOI01-02, and AOI03-02 groundwater was not encountered at total boring depths of 20 feet bgs, 20 feet bgs, and 25 feet bgs, respectively. After multiple attempts at step-off borings for each location, further boring advancement was not advised by ARNG and temporary monitoring wells were not completed at these locations.

Where groundwater was encountered, temporary wells were allowed to recharge after installation before collection of groundwater samples. After the recharge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. 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 [DO], and oxidation-reduction potential [ORP]) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) after 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 for PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2021a).

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 (FRB) was collected in accordance with the Programmatic UFP-QAPP (PQAPP) (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6°C during shipment.

Temporary wells were abandoned in accordance with the SI QAPP Addendum (AECOM, 2021a) by removing the PVC and backfilling the hole with bentonite chips. Temporary wells were installed in grass areas to avoid disturbing concrete or asphalt.

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 15-16 June 2021. Groundwater elevation measurements were collected from the three temporary monitoring wells installed during the SI. 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 Ohio-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2021a). Survey data from the newly installed wells on the facility were collected on 16 June 2021 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 B4**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of PFAS investigation-derived waste (IDW) is not regulated federally. PFAS IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the SI QAPP Addendum (AECOM, 2021a) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) generated during the SI activities was containerized in one properly labeled 55-gallon drum. The soil IDW was not sampled and assumes the PFAS characteristics of the associated soil samples collected from that source location. The IDW is currently stored on-facility at a location designated by the OHARNG Environmental Office. ARNG will coordinate proper disposal of the solid IDW in accordance with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Liquid IDW generated during SI activities (i.e. purge water, development water, and decontamination fluids) was containerized in one properly-labeled 55-gallon drum (see SOP 3-05). The liquid IDW was not sampled and assumes the PFAS characteristics of the associated groundwater samples collected from that source location. The containerized IDW is currently stored on-facility at a location designated by OHARNG. Liquid IDW drums were only filled 75% full to account for freeze/thaw cycles. ARNG will manage and dispose of the liquid IDW under a separate contract in accordance with SOP No. 042A for Treating Liquid Investigation-Derived Material (purge water, drilling water, and decontamination fluids) (EA Engineering, Science, and Technology, Inc., 2021). ARNG will coordinate proper disposal in accordance with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018). The IDW logs describing the storage location and relative volume of soil and liquid IDW are documented 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 for a subset of 18 PFAS 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. The 18 PFAS analyzed as part of the ARNG SI program include the following:

- 6:2 fluorotelomer sulfonic acid (6:2 FTS)
- 8:2 fluorotelomer sulfonic acid (8:2 FTS)
- N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
- N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
- Perfluorobutyrate (PFBA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexanoic acid (PFHxA)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS)
- Perfluoropentanoic acid (PFPeA)
- Perfluorotetradecanoic acid (PFTeDA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluoroundecanoic acid (PFUdA)

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. These deviations are noted below and are documented in a Field Change Request Form (**Appendix B3**) and Nonconformance and Corrective Action Reports (**Appendix B4**):

- During the SI utility clearance and field reconnaissance, the field team determined that the original scoped location for RAE-01 was not located within the property boundary. Upon discussion with the client group, the sampling location was moved to a location on-facility that would still meet SI DQOs. This action was documented in a field change request provided in **Appendix B3**.

- During the installation of temporary monitoring wells, three borings (AOI01-01, AOI01-02, and AOI03-02) were advanced to 20 feet bgs, 20 feet bgs, and 25 feet bgs, respectively, without encountering groundwater. Multiple attempts at step-off borings were made under the supervision of the ARNG project manager who was on-facility during the SI field event. After repeated attempts to reach groundwater, these locations were abandoned since groundwater could not be collected. This action was documented in a nonconformance and corrective action report provided in **Appendix B4**.

- Upon review of field documentation, it was discovered that one surface soil sample, AOI02-01-SB-0-2, was not collected from the hand auger used to collect the surface soil samples (0 to 2 feet below ground surface) during the field effort. As a result, the field team re-mobilized to the facility on 25 August to collect this surface soil sample and shipped it to the laboratory for analysis. This action was documented in a nonconformance and corrective action report provided in **Appendix B4**.

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Rickenbacker Army Enclave, Ohio

Sample Identification	Sample Collection Date, Time	Sample Depth (feet bgs)	PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
RAE-AOI01-01-SB-0-2	6/15/2021 9:55	0 - 2	x	x	x		
RAE-AOI01-01-SB-0-2-DUP	6/15/2021 10:00	0 - 2		x	x		FD
RAE-AOI01-01-SB-2-5	6/15/2021 10:05	2 - 5	x			x	
RAE-AOI01-01-SB-2-5-MS	6/15/2021 10:05	2 - 5	x				MS/MSD
RAE-AOI01-01-SB-2-5-MSD	6/15/2021 10:05	2 - 5	x				MS/MSD
RAE-AOI01-01-SB-5-7	6/15/2021 10:10	5 - 7	x				
RAE-AOI01-02-SB-0-2	6/15/2021 13:30	0 - 2	x				
RAE-AOI01-02-SB-8-10	6/15/2021 14:10	8 - 10	x				
RAE-AOI01-02-SB-8-10-DUP	6/15/2021 14:12	8 - 10	x				FD
RAE-AOI01-02-SB-13-15	6/15/2021 14:15	13 - 15	x	x	x		
RAE-AOI02-01-SB-0-2	8/25/2021 14:10	0 - 2	x				
RAE-AOI03-01-SB-0-2	6/15/2021 10:55	0 - 2	x				
RAE-AOI03-01-SB-4-6	6/15/2021 11:00	4 - 6	x			x	
RAE-AOI03-01-SB-8-10	6/15/2021 11:10	8 - 10	x	x	x		
RAE-AOI03-02-SB-0-2	6/15/2021 11:50	0 - 2	x				
RAE-AOI03-02-SB-8-10	6/15/2021 12:30	8 - 10	x				
RAE-AOI03-02-SB-13-15	6/15/2021 12:35	13 - 15	x				
RAE-AOI03-02-SB-13-15-DUP	6/15/2021 12:40	13 - 15	x				FD
RAE-01-SB-0-2	6/15/2021 14:30	0 - 2	x	x	x		
RAE-01-SB-0-2-MS	6/15/2021 14:30	0 - 2					MS/MSD
RAE-01-SB-0-2-MSD	6/15/2021 14:30	0 - 2		x	x		MS/MSD
RAE-01-SB-2-4	6/15/2021 14:45	2 - 4	x			x	
Groundwater Samples							
RAE-01-GW	6/15/2021 12:40	NA	x				
RAE-AOI02-01-GW	6/16/2021 9:30	NA	x				
RAE-AOI02-01-GW-DUP	6/16/2021 9:35	NA	x				FD
RAE-AOI03-01-GW	6/16/2021 12:10	NA	x				
RAE-AOI03-01-GW-MS	6/16/2021 12:10	NA	x				MS
RAE-AOI03-01-GW-MSD	6/16/2021 12:10	NA	x				MSD

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Rickenbacker Army Enclave, Ohio

Sample Identification	Sample Collection Date, Time	Sample Depth (feet bgs)	PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Quality Control Samples							
RAE-FRB-01	6/16/2021 10:25	NA	x				
RAE-FRB-02	8/25/2021 14:05	NA	x				
RAE-ERB-01	6/15/2021 9:15	NA	x				from DPT shoe
RAE-ERB-02	6/16/2021 10:00	NA	x				from DPT shoe
RAE-ERB-03	6/16/2021 10:30	NA	x				from DPT shoe
RAE-ERB-04	8/25/2021 14:00	NA	x				from hand auger

Notes:
ASTM = American Society for Testing and Materials
bgs = below ground surface
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
PFAS = per- and polyfluoroalkyl substances
QSM = Quality Systems Manual
RAE = Rickenbacker Army Enclave
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, Rickenbacker Army Enclave, Ohio

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)
Upgradient Facility Boundary	RAE-01	5	0 - 5	729.006	724.02	1.33	-3.65	722.69
AOI 2	AOI02-01	10	5 - 10 [1]	719.96	719.40	5.20	4.64	714.20
AOI 3	AOI03-01	20	10 - 20 [1]	NA	725.37	NA	7.30	718.07

Notes:

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

bgs = below ground surface
btoc = below top of casing
NA = not applicable
NAVD88 = North American Vertical Datum 1988

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CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Rickenbacker Army Enclave, OH			
REVISED	4/11/2022	GIS BY	MS	4/11/2022
SCALE	1:6,000	CHK BY	EG	4/11/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	4/11/2022

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

C:\Users\stankevichm\OneDrive - AECOM Directory\ARNG_PFAS_GIS_60552172\MXDs\OH\Rickenbacker_Figures\Rickenbacker_SI_Figures\SI_Report\Fig_5-1_Rickenbacker_SI_Sample_Locations.mxd

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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** and **Table 6-1**. A discussion of the results for each AOI is provided in **Section 6.3** through **Section 6.6**. **Table 6-2**, **Table 6-3**, and **Table 6-4** present PFAS results for samples with detections in soil and groundwater; only constituents detected in one or more samples are included. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix D**.

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 15 September 2021 (Assistant Secretary of Defense, 2021). 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 three compounds: PFOS, PFOA, and PFBS.

The SLs are presented on **Table 6-1** below. All other results presented in this report are considered informational in nature and serve as an indication as to whether soil and groundwater contain or do not contain PFAS within the boundaries of the facility.

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

Analyte	Residential (Soil) (µg/kg)[a,b] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a,b] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a,b]
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	1,900	25,000	600

Notes:

a.) Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 15 September 2021.

b.) USEPA. 2016a. Drinking Water HA for PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. USEPA Document Number: 822-R-16-005. May 2016. / USEPA. 2016b. Drinking Water HA for PFOS. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. USEPA Document Number: 822-R-16-004. May 2016.

The data in the subsequent sections are compared against 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 site: 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 and grain size, which are important for evaluating transport through the soil medium. **Appendix F** contains the results of the TOC and pH and grain size sampling.

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport of PFAS contaminants. According to the Interstate Technology Regulatory Council (ITRC), several important PFAS 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 in comparison to SLs for AOI 1, which includes one potential PFAS release area, the C26 Hangar. The detected compounds in soil are summarized on **Table 6-2** and **Table 6-3**. The detections of PFOA, PFOS, and PFBS in soil are presented on **Figure 6-1** through **Figure 6-3**.

6.3.1 AOI 1 Soil Analytical Results

PFOA, PFOS, and PFBS did not exceed the SLs in soil at AOI 1. Soil was sampled at two soil boring locations surrounding the C26 Hangar; AOI01-01 and AOI01-02. Three soil samples were collected at each AOI 1 boring location: the shallow surface interval (0 to 2 feet bgs), the deep interval (5 to 7 feet bgs at AOI01-01 and 13 to 15 feet bgs at AOI01-02), and the intermediate interval (2 to 5 feet bgs at AOI01-01 and 8 to 10 feet bgs at AOI01-02). Depths of the intermediate and deep soil sample intervals varied between locations depending on the observed depth of saturated soil in the boring.

PFOA and PFOS were not detected in soil at AOI 1. PFBS was detected in subsurface soil at AOI01-02 in the intermediate sampling interval (8 to 10 feet bgs), at a concentration of 0.023 J micrograms per kilogram (µg/kg), several orders of magnitude lower than the SL. PFBS was not detected in soil at AOI01-01.

6.3.2 AOI 1 Conclusions

Based on the results of the SI, PFBS was detected in soil at AOI 1; however, the detected concentration was several orders of magnitude lower than the soil SL. PFOA and PFOS were not detected in soil at AOI 1. Based on these findings, further evaluation of soil at AOI 1 is not warranted. No groundwater samples were collected at AOI 1 because groundwater was not encountered at soil boring locations AOI01-01 and AOI01-02; temporary monitoring wells were not installed at these locations during the SI. Based on these findings, further evaluation of groundwater at AOI 1 may be warranted to make site-related remedial decisions.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2, which includes one potential PFAS release area, the drainage ditch. The detected compounds in soil and groundwater are summarized on **Table 6-2** and **Table 6-4**. The detections of PFOA, PFOS, and PFBS in soil and groundwater are presented on **Figure 6-1** through **Figure 6-4**.

6.4.1 AOI 2 Soil Analytical Results

PFOA, PFOS, and PFBS did not exceed the SLs in soil at AOI 2. Soil was sampled at one boring location, AOI02-01, at the surface interval (0 to 2 feet bgs). AOI02-01 is located adjacent to the drainage ditch where stormwater runoff discharged from RAE flows off the facility. No soil samples at the subsurface intervals were collected at AOI 2 due to shallow groundwater.

PFBS was the only compound detected in surface soil at AOI02-01, at a concentration of 0.028 J µg/kg, which is several orders of magnitude lower than the SL. PFOA and PFOS were not detected in surface soil at AOI 2.

6.4.2 AOI 2 Groundwater Analytical Results

PFOA, PFOS, and PFBS did not exceed the SLs in groundwater at AOI 2. Groundwater samples were collected at the temporary well installed at soil boring location AOI02-01, located adjacent to the drainage ditch where stormwater runoff discharged from RAE flows off the facility.

PFOA, PFOS and PFBS were detected in groundwater at AOI 2. PFOA and PFOS were detected in groundwater, at maximum concentrations of 11.8 nanograms per liter (ng/L) and 13.1 ng/L, respectively. PFBS was detected at a maximum concentration of 5.78 ng/L, two orders of magnitude lower than the SL.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFBS was detected in surface soil at AOI 2; however, the detected concentration was several orders of magnitude lower than the soil SL. PFOA and PFOS were not detected in surface soil at AOI 2. PFOA, PFOS, and PFBS were detected in groundwater at AOI 2, at concentrations lower than the SLs. Although no PFAS analytes exceeded their respective SLs at AOI 2, the shallow depth to groundwater encountered and fat clays observed at location AOI02-01 indicate that it is possible groundwater was sampled from a perched water bearing unit. Therefore, further evaluation of groundwater at AOI 2 is recommended since there is insufficient information to make a remedial decision at this time..

6.5 AOI 3

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 3, which includes one potential PFAS release area, the Helicopter Ramp Area outside of building 918, where Tri-Max™ tanks were known to be stored. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOA, PFOS, and PFBS in soil and groundwater are presented on **Figure 6-1** through **Figure 6-4**.

6.5.1 AOI 3 Soil Analytical Results

PFOA, PFOS, and PFBS did not exceed the SLs in soil at AOI 3. Soil was sampled at two soil boring locations surrounding the Helicopter Ramp Area; AOI03-01 and AOI03-02. Three soil samples were collected at each AOI 3 boring location: the shallow surface interval (0 to 2 feet bgs), the deep interval (8 to 10 feet bgs at AOI03-01, 13 to 15 feet bgs at AOI03-02), and the

intermediate interval (4 to 6 feet bgs at AOI03-01 and 8 to 10 feet bgs at AOI03-02). Depths of the intermediate and deep soil sample intervals varied between locations depending on the observed depth of saturated soil in the boring.

PFOA was not detected in soil at AOI 3. PFOS was detected in subsurface soil at AOI03-01, at the deep interval (8 to 10 feet bgs), at a concentration of 0.136 J µg/kg, which is two orders of magnitude lower than the SL. PFBS was detected in shallow subsurface soil at AOI03-01, at the intermediate interval (4 to 6 feet bgs), at a concentration of 0.025 J µg/kg, which is several orders of magnitude lower than the SL. PFOA, PFOS, and PFBS were not detected in soil at boring location AOI03-02 or in surface soil at AOI03-01.

6.5.2 AOI 3 Groundwater Analytical Results

PFOA, PFOS, and PFBS did not exceed the SLs in groundwater at AOI 3. During the SI, groundwater was not encountered at AOI03-02; therefore, a temporary monitoring well was not installed. One groundwater sample was collected at the temporary monitoring well installed at soil boring location AOI03-01, located adjacent to the Helicopter Ramp Area. PFOA, PFOS and PFBS were not detected in groundwater at AOI03-01.

6.5.3 AOI 3 Conclusions

Based on the results of the SI, PFOS and PFBS were detected in soil at AOI 3; however, the detected concentrations were at least two orders of magnitude lower than the soil SLs. PFOA, PFOS, and PFBS were not detected in groundwater at AOI 3. The facility boundary location, RAE-01, had an exceedance of PFOS in groundwater, and although the observed groundwater flow direction in onsite wells is to the west, the 2018 BRAC Report for the ANG Base projects groundwater to flow southwest across the RAE facility (Aerostar, 2018). If groundwater flow is to the southwest, location RAE-01 would be considered downgradient from AOI 3. Due to this uncertainty, further evaluation of groundwater at AOI 3 is recommended since there is insufficient information to make a remedial decision at this time. .

6.6 Facility Boundary

This section presents the analytical results for soil and groundwater in comparison to SLs for the facility boundary location, RAE-01, which is located near the southeastern facility boundary. The facility is downgradient of a former ANG FTA on the eastern adjacent ANG property. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOA, PFOS, and PFBS in soil and groundwater are presented on **Figure 6-1** through **Figure 6-4**.

6.6.1 Facility Boundary Soil Analytical Results

PFOA, PFOS, and PFBS did not exceed the SLs in soil at the facility boundary. Soil was sampled at one soil boring location along the southeastern facility boundary, RAE-01. Two soil samples were collected at the boring location: the shallow surface interval (0 to 2 feet bgs) and the shallow subsurface interval (2 to 4 feet bgs). No deep soil sample was collected at RAE-01 due to shallow groundwater.

PFOA, PFOS, and PFBS were detected in soil at RAE-01. PFOA was detected in surface soil, at a concentration of 0.282 J µg/kg, which is two orders of magnitude lower than the SL. PFOS and PFBS were also detected in surface soil at RAE-01, at concentrations of 1.13 µg/kg and 0.140 J µg/kg, respectively. PFOS and PFBS were detected in shallow subsurface soil at RAE-01, at concentrations of 0.085 J µg/kg and 0.024 J µg/kg, respectively.

6.6.2 Facility Boundary Groundwater Analytical Results

PFOS in groundwater exceeded the SL at the facility boundary location. Detected concentrations of PFOA and PFBS did not exceed their respective SLs for groundwater. Groundwater samples were collected from a temporary monitoring well installed at soil boring location RAE-01, located near the southeastern facility boundary.

PFOA, PFOS and PFBS were detected in groundwater at RAE-01. PFOS was detected at a concentration of 75.1 ng/L, exceeding the OSD SL of 40 ng/L. PFOA and PFBS were detected at concentrations of 13.3 ng/L and 7.34 ng/L, which are below their respective SLs.

6.6.3 Facility Boundary Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were detected in soil at the facility boundary; however, the detected concentrations were at least two orders of magnitude lower than the soil SLs. PFOA, PFOS, and PFBS were detected in groundwater at the facility boundary. PFOS was detected in groundwater at a concentration exceeding the OSD SL of 40 ng/L. PFOA and PFBS were detected in groundwater at concentrations lower than the SLs. Additionally, the 2018 BRAC Report for the ANG Base indicates that groundwater flows southwest across the southern portion of the airport, including the RAE facility (Aerostar, 2018). Although groundwater in onsite wells was interpreted as flowing to the west, there is a level of uncertainty with respect to the interpreted groundwater flow direction observed in onsite temporary wells. This uncertainty will be acknowledged as a data gap that will need to be addressed in the next phase of work. The uncertainty presented by the groundwater flow direction in the 2018 BRAC Report indicates that location RAE-01 may not be upgradient of facility AOI sampling locations. Based on exceedance of the OSD SL for PFOS in groundwater, further evaluation at the facility boundary location is recommended.

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Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Rickenbacker Army Enclave, Ohio

Area of Interest		AOI 1				AOI 2		AOI 3				Upgradient Facility Boundary	
Sample ID		RAE-AOI01-01-SB-0-2		RAE-AOI01-02-SB-0-2		RAE-AOI02-01-SB-0-2		RAE-AOI03-01-SB-0-2		RAE-AOI03-02-SB-0-2		RAE-01-SB-0-2	
Sample Date		06/15/2021		06/15/2021		08/25/2021		06/15/2021		06/15/2021		06/14/2021	
Depth		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**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)													
6:2 FTS	-	ND		ND		ND		0.392	J	ND		ND	
PFBA	-	ND		0.062	J	ND		ND		ND		0.084	J
PFBS	1900	ND		ND		0.028	J	ND		ND		0.140	J
PFHpA	-	ND		0.028	J	ND		ND		ND		0.095	J
PFHxA	-	ND		0.290	J	0.038	J	0.029	J	ND		0.580	J
PFHxS	-	0.145	J	ND		0.039	J	ND		ND		4.49	
PFNA	-	ND		ND		ND		ND		ND		0.022	J
PFOA	130	ND		ND		ND		ND		ND		0.282	J
PFOS	130	ND		ND		ND		ND		ND		1.13	
PFPeA	-	ND		0.135	J	ND		ND		ND		0.263	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFBS, PFOS, and PFOA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 September 2021. Soil screening levels based on residential scenario for direct ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
ft	feet
HQ	hazard quotient
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
RAE	Rickenbacker Army Enclave
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram
-	not applicable

Table 6-3
PFAS Detections in Shallow Subsurface Soil
Site Inspection Report, Rickenbacker Army Enclave, Ohio

Area of Interest		AOI 1										AOI 3					
Sample ID		RAE-AOI01-01-SB-2-5		RAE-AOI01-01-SB-5-7		RAE-AOI01-02-SB-8-10		RAE-AOI01-02-SB-8-10-DUP		RAE-AOI01-02-SB-13-15		RAE-AOI03-01-SB-4-6		RAE-AOI03-01-SB-8-10		RAE-AOI03-02-SB-8-10	
Sample Date		06/15/2021		06/15/2021		06/15/2021		06/15/2021		06/15/2021		06/15/2021		06/15/2021		06/15/2021	
Depth		2 - 5 ft		5 - 7 ft		8 - 10 ft		8 - 10 ft		13 - 15 ft		4 - 6 ft		8 - 10 ft		8 - 10 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																	
PFBS	25000	ND		ND		ND	UJ	0.023	J	ND		0.025	J	ND		ND	
PFHxA	-	ND		ND		ND		ND		ND		0.035	J	ND		ND	
PFHxS	-	ND		ND		0.039	J	ND	UJ	0.042	J	0.179	J	ND		ND	
PFOS	1600	ND		ND		ND		ND	UJ	ND		ND		0.136	J	ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFBS, PFOS, and PFOA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 September 2021. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

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

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	duplicate
ft	feet
HQ	hazard quotient
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
RAE	Rickenbacker Army Enclave
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram
-	not applicable

Table 6-3
PFAS Detections in Shallow Subsurface Soil
Site Inspection Report, Rickenbacker Army Enclave, Ohio

Area of Interest		AOI 3				Upgradient Facility Boundary	
Sample ID		RAE-AOI03-02-SB-13-15		RAE-AOI03-02-SB-13-15 DUP		RAE-01-SB-2-4	
Sample Date		06/15/2021		06/15/2021		06/14/2021	
Depth		13 - 15 ft		13 - 15 ft		2 - 4 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)							
PFBS	25000	ND		ND		0.024	J
PFHxA	-	ND		ND		ND	
PFHxS	-	0.070	J	ND	UJ	0.039	J
PFOS	1600	ND	UJ	ND		0.085	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFBS, PFOS, and PFOA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 September 2021. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

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

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	duplicate
ft	feet
HQ	hazard quotient
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
RAE	Rickenbacker Army Enclave
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram
-	not applicable

Table 6-4
PFAS Detections in Groundwater
Site Inspection Report, Rickenbacker Army Enclave, Ohio

Area of Interest			AOI 2				AOI 3		Upgradient Facility Boundary	
Sample ID			RAE-AOI02-01-GW		RAE-AOI02-01-GW-DUP		RAE-AOI03-01-GW		RAE-01-GW	
Sample Date			06/16/2021		06/16/2021		06/16/2021		06/15/2021	
Analyte	OSD Screening Level [a]	USEPA HA [b]	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (ng/L)										
6:2 FTS	-	-	2.58	J	ND		ND		22.5	
8:2 FTS	-	-	ND		ND		ND		15.9	
PFBA	-	-	17.6		13.2		2.49	J	15.0	
PFBS	600	-	5.78		3.95	J	ND		7.34	
PFHpA	-	-	4.35		2.79	J	ND		5.86	
PFHxA	-	-	9.55		5.60		ND		11.9	
PFHxS	-	-	5.35		2.95	J	ND		55.5	
PFNA	-	-	2.50	J	1.58	J	ND		1.07	J
PFOA	40	70	11.8		6.73		ND		13.3	
PFOS	40	70	13.1		5.96		ND		**75.1**	
PFPeA	-	-	14.3		10.00		ND		10.1	
Total PFOA+PFOS	-	70	24.9		12.7		ND		**88.4**	

Grey Fill	Detected concentration exceeded OSD Screening Levels
Bold Font	Detected concentration exceeded USEPA HA Screening Levels

References

a. Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFBS, PFOS, and PFOA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 September 2021. Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

b. USEPA, 2016. Drinking Water Health Advisory for PFOA. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-005. May 2016. / EPA. 2016. Drinking Water Health Advisory for PFOS. Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004. May 2016.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	duplicate
GW	groundwater
HA	Health Advisory
HQ	hazard quotient
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
RAE	Rickenbacker Army Enclave
USEPA	United States Environmental Protection Agency
ng/L	nanogram per liter
-	not applicable

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Rickenbacker Army Enclave, OH			
REVISED	11/1/2021	GIS BY	MS	11/1/2021
SCALE	1:8,400	CHK BY	EG	11/1/2021
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	11/1/2021

Legend

Facility Boundary

River/Stream

0 350 700 1,400 Feet

N

PFOA Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-1

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CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Rickenbacker Army Enclave, OH			
REVISED	11/1/2021	GIS BY	MS	11/1/2021
SCALE	1:8,400	CHK BY	EG	11/1/2021
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	11/1/2021

Legend

Facility Boundary

River/Stream

0 350 700 1,400 Feet

N

PFOS Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-2

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CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Rickenbacker Army Enclave, OH			
REVISED	11/1/2021	GIS BY	MS	11/1/2021
SCALE	1:8,400	CHK BY	EG	11/1/2021
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	11/1/2021

Legend

Facility Boundary

River/Stream

0 350 700 1,400 Feet

N

PFBS Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-3

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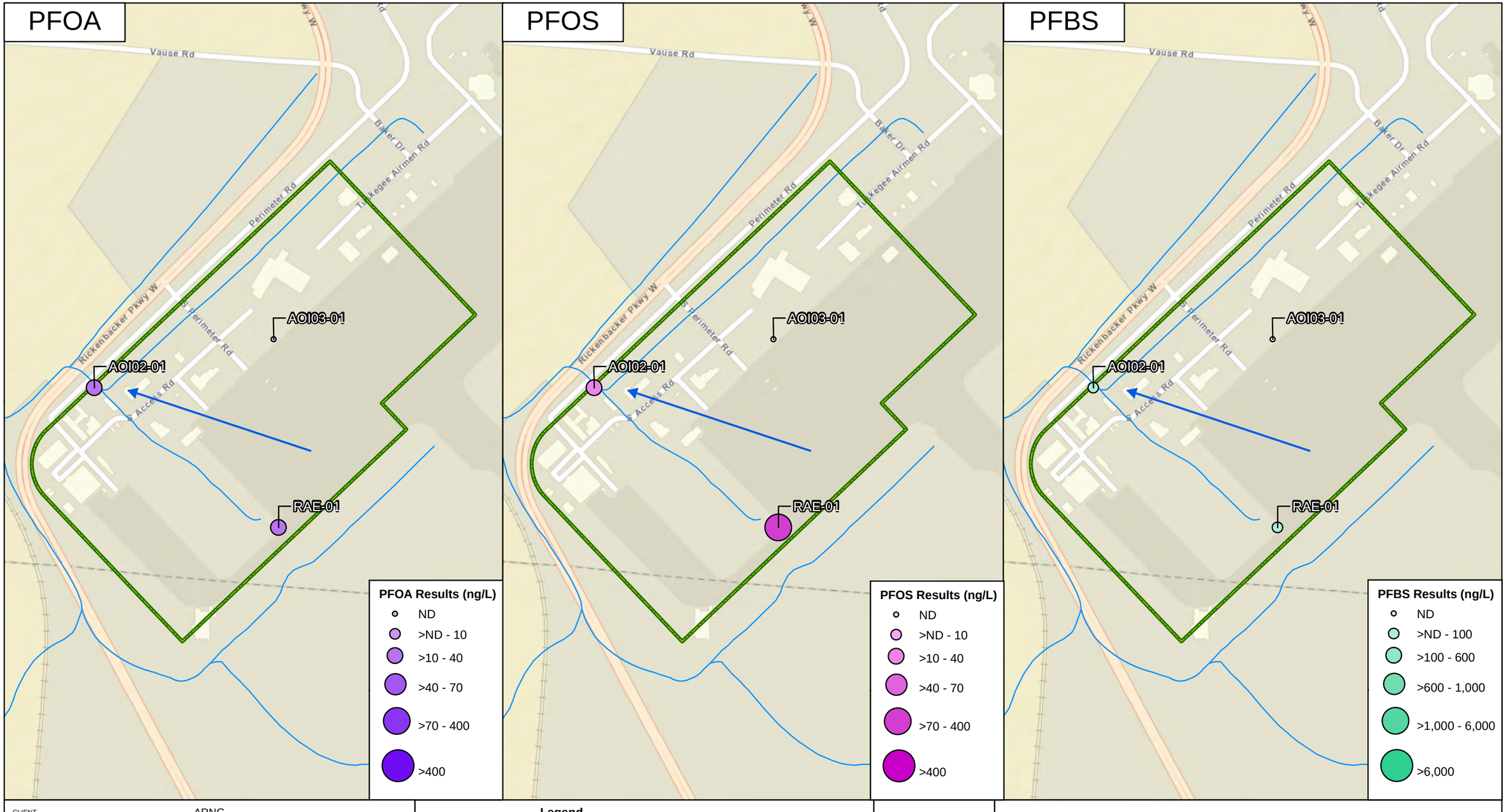

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Rickenbacker Army Enclave, OH			
REVISED	4/11/2022	GIS BY	MS	4/11/2022
SCALE	1:8,400	CHK BY	EG	4/11/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	4/11/2022

Legend

- Facility Boundary
- River/Stream
- Localized Groundwater Flow Direction

0 350 700 1,400 Feet

N

PFOA, PFOS, and PFBS Detections in Groundwater

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-4

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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 7-4**. 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 PFOA, PFOS, or PFBS 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 PFOA, PFOS, or PFBS above the SLs. Areas with an identified potentially complete pathway that have detections of PFOA, PFOS, and PFBS above the SLs may warrant further investigation.

In general, the potential routes of exposure to PFAS 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 PFAS 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 (thought 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 for PFOA, PFOS, and PFBS in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at the AOI based on the aforementioned criteria.

7.1.1 AOI 1

Between 2007 and 2008, the C26 Hangar included a fire suppression system with 2.75% Jet-X HEF. A test of the system was conducted that involved a release of an unknown amount of Jet-X foam from the fire suppression system. All material from the suppression system dissipated into the floor drains of the hangar that lead to the sanitary sewer. PFBS was detected in subsurface soil at AOI 1 and confirms the release of PFAS to soil.

Based on the results of the SI at AOI 1, ground-disturbing activities could potentially result in future construction worker exposure to PFBS via inhalation or incidental ingestion of subsurface soil. No current or ongoing construction is occurring at AOI 1. Additionally, off-facility recreational users and residents may potentially be exposed to PFBS via inhalation of dust caused by on-facility ground disturbing activities, although this exposure is likely insignificant. PFOA, PFOS, and PFBS

were not detected in surface soil at AOI 1; therefore, the site worker, trespasser, off-facility recreational user, and resident exposure pathways are considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

On the southwest corner of the facility is a stormwater drainage ditch, which originates on the adjacent OHANG property and enters OHARNG property from the north. Stormwater runoff from OHANG hangars and ramp areas are discharged into this ditch, which then flows through OHARNG property and exits the property at the northwest facility boundary. Any potential spills or discharges on either ramp area or near these drainage channels would eventually flow into the stormwater drainage ditch. PFBS was detected in surface soil at AOI 2 and confirms the release of PFAS to soil.

Based on the results of the SI at AOI 2, ground-disturbing activities could potentially result in site worker, trespasser, and future construction worker exposure to PFBS via inhalation of dust or incidental ingestion of surface soil. Additionally, off-facility residents and recreational users may potentially be exposed to PFBS via inhalation of dust caused by on-facility ground disturbing activities, although this exposure is likely insignificant. No current or ongoing construction is occurring at AOI 2; however, future construction projects may impact the drainage ditch area. The CSM for AOI 2 is presented on **Figure 7-2**.

7.1.3 AOI 3

The Helicopter Ramp Area outside of Building 918 contained between nine to eleven likely PFAS-containing AFFF mobile Tri-Max™ tanks from approximately 2002 to 2013. It was noted that one tank did not properly work and was subsequently emptied of all AFFF, although the emptying date was not recorded. PFOS and PFBS were detected in subsurface soil at AOI 3 and confirm the release of PFAS to soil.

Based on the results of the SI at AOI 3, ground-disturbing activities could potentially result in future construction worker exposure to PFOS and PFBS via inhalation of dust or incidental ingestion of subsurface soil. No current or ongoing construction is occurring at AOI 3. The CSM for AOI 3 is presented on **Figure 7-3**.

7.1.4 Facility Boundary

A former ANG FTA is located approximately 5,000 feet east of RAE on the adjacent ANG property at the Rickenbacker International Airport property. A spill or release from this off-facility source has the potential to migrate onto RAE and subsequently impact RAE groundwater. PFOA, PFOS, and PFBS were detected in surface soil at the facility boundary and confirm the release of PFAS to soil.

Based on the results of the SI at the facility boundary, ground-disturbing activities could potentially result in site worker, construction worker, and trespasser exposure to PFOA, PFOS, and PFBS via inhalation of dust and incidental ingestion of surface soil. Additionally, off-facility residents and recreational users may potentially be exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities, although this exposure is likely insignificant. PFOS and PFBS were also detected in subsurface soil. Ground-disturbing activities could result in future construction worker exposure to PFOS and PFBS via ingestion and inhalation of dust. No current or ongoing construction is occurring at the facility boundary. The CSM for the Facility Boundary is presented on **Figure 7-4**.

7.2 Groundwater Exposure Pathway

The SI results for PFOA, PFOS, and PFBS in groundwater were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 2, AOI 3, and the Facility Boundary based on the aforementioned criteria. Due to conflicting information regarding groundwater across the airport and the RAE facility, groundwater flow direction is considered a data gap that will need to be addressed in future phases of work.

7.2.1 AOI 2

PFOA, PFOS, and PFBS were detected in groundwater at AOI 2, at concentrations below their respective SLs. Although no PFAS analytes exceeded their respective SLs at AOI 2, the shallow depth to groundwater encountered and fat clays observed at location AOI02-01 indicate that it is possible groundwater was sampled from a perched water bearing unit. Therefore, there is insufficient information to evaluate groundwater at AOI 2. Based on available SI sample data for AOI 2, the incidental ingestion exposure pathway is considered potentially complete for future construction workers during trenching activities deep enough to encounter shallow groundwater. Depth to water measured from temporary monitoring wells installed during the SI ranged from 4.64 to 7.30 feet bgs; therefore, groundwater may be encountered during construction activities. RAE is supplied with public water sourced from the City of Columbus public water system; therefore, the ingestion exposure pathway for site workers and trespassers is considered incomplete. While no potable water wells are located within RAE, potable water wells exist within 0.5 miles of the facility. Therefore, the ingestion exposure pathway for off-facility residents and off-facility recreational users is considered potentially complete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.2.2 AOI 3

PFOA, PFOS, and PFBS were not detected in groundwater at AOI 3; however, PFOS in groundwater exceeded the SL at facility boundary location, RAE-01. Although groundwater in onsite wells was interpreted as flowing to the west, there is a level of uncertainty with respect to the interpreted groundwater flow direction observed in onsite temporary wells. This uncertainty will be acknowledged as a data gap that will need to be addressed in the next phase of work. The uncertainty presented by the groundwater flow direction in the 2018 BRAC Report indicates that location RAE-01 may not be upgradient of facility AOI sampling locations. Therefore, based on the presence of PFOS in groundwater at location RAE-01, there is insufficient information to evaluate groundwater at AOI 3.

Based on available SI sample data for AOI 3, the incidental ingestion exposure pathway is considered incomplete for construction workers during trenching activities deep enough to encounter shallow groundwater. RAE is supplied with public water sourced from the City of Columbus public water system; therefore, the site worker and trespasser ingestion pathway are considered incomplete. While domestic drinking water wells exist within 0.5 miles of the facility, the ingestion exposure pathway for off-facility residents and off-facility recreational users is considered incomplete since PFOA, PFOS, and PFBS were non-detect at AOI 3. The CSM for AOI 3 is presented on **Figure 7-3**.

7.2.3 Facility Boundary

PFOS exceeded the SL in one temporary monitoring well at the facility boundary. PFOA and PFOS were detected in groundwater but did not exceed their respective SLs. PFOS detections at location RAE-01 indicate that offsite PFAS sources may be contributing to PFAS concentrations in environmental media at the facility; however, it is also possible that groundwater flows

southwest across the facility based on the 2018 BRAC Report for the ANG Base. If groundwater flows southwest across the facility, then location RAE-01 would be considered downgradient from AOI 3. While no potable water wells are located within RAE, domestic drinking water wells exist within 0.5 miles of the facility; therefore, the ingestion exposure pathway for off-facility residents and recreational users is considered potentially complete. RAE is supplied with public water sourced from the City of Columbus public water system; therefore, the site worker and trespasser ingestion pathway are considered incomplete. Depth to water measured at RAE-01 during the SI was 3.65 feet above ground surface. Therefore, groundwater may be encountered during construction activities, and the ingestion exposure pathway for construction workers is considered potentially complete. The CSM for the Facility Boundary is presented on **Figure 7-4**.

7.3 Surface Water and Sediment Exposure Pathway (Adjacent Sources and AOI 2)

Surface water and sediment samples were not collected at the OHARNG RAE facility during this SI; however, surface water and sediment samples were collected on the adjacent OHANG property as a part of the 2018 SI for AFFF at the Rickenbacker ANG Base (Aerostar, 2018). Three of the OHANG SI surface water and sediment sample locations (RICPSX007, RICPSX008, and RICPSX009) exist directly adjacent to the RAE facility. Samples from locations RICPSX007 and RICPSX008 were collected from a drainage ditch east of the RAE facility that runs parallel to the eastern facility boundary. This drainage ditch conveys runoff southwest before turning northwest parallel to the RAE facility's southwestern boundary. Samples from location RICPSX009 were collected from a drainage ditch near the northwest corner of the OHARNG RAE facility. This drainage ditch conveys runoff to the southwest, parallel with the RAE facility boundary, before turning northwest and ultimately discharges to Big Walnut Creek. Neither of the drainage ditches associated with sample locations RICPSX007, RICPSX008 or RICPSW009 traverse the RAE facility or drain AOIs at the RAE facility, but they do converge with drainage ditches The Rickenbacker ANG Base surface water and sediment samples were not collected from drainage ditches within the OHARNG property, but they do converge with drainage ditches draining OHARNG AOI areas west of the facility before discharging to Big Walnut Creek (Aerostar, 2018; Figure 3-13).

The maximum concentrations of PFOA, PFOS, and PFBS in sediment samples collected from the three adjacent sampling locations are 0.000679 J (estimated concentration) milligrams per kilogram (mg/kg), 0.0414 mg/kg, and 0.000233 J mg/kg, respectively. All maximum detected concentrations in sediment from the three locations were observed at location RICPSX009, which is located near the northwestern corner of the OHARNG RAE facility property. The maximum concentrations of PFOA, PFOS, and PFBS in surface water samples collected from the three adjacent sampling locations are 0.0182 micrograms per liter (µg/L), 0.182 µg/L, and 0.24 µg/L, respectively. All maximum detected concentrations in surface water from the three locations were also observed at location RICPSX009 (Aerostar, 2018).

PFAS detections in surface water and sediment in the adjacent ANG Base drainage ditches do not represent PFAS migration from OHARNG RAE facility AOIs because the OHANG sample locations are not in drainage ditches that drain the OHARNG AOI areas. It is possible; however, that PFAS is present in drainage ditches connecting to AOI 2 that were not sampled as a part of the 2018 SI for AFFF at the Rickenbacker ANG Base.

Based on OHANG SI results, the surface water and sediment ingestion exposure pathway for OHARNG site workers and construction workers is considered potentially complete. The presence of PFAS in surface water and sediment in adjacent drainage ditches also indicates that PFAS migration to Big Walnut Creek is possible. Therefore, the surface water and sediment

ingestion exposure pathway for off-facility recreational users of Big Walnut Creek is also considered potentially complete. The CSM is presented on **Figure 7-2**.

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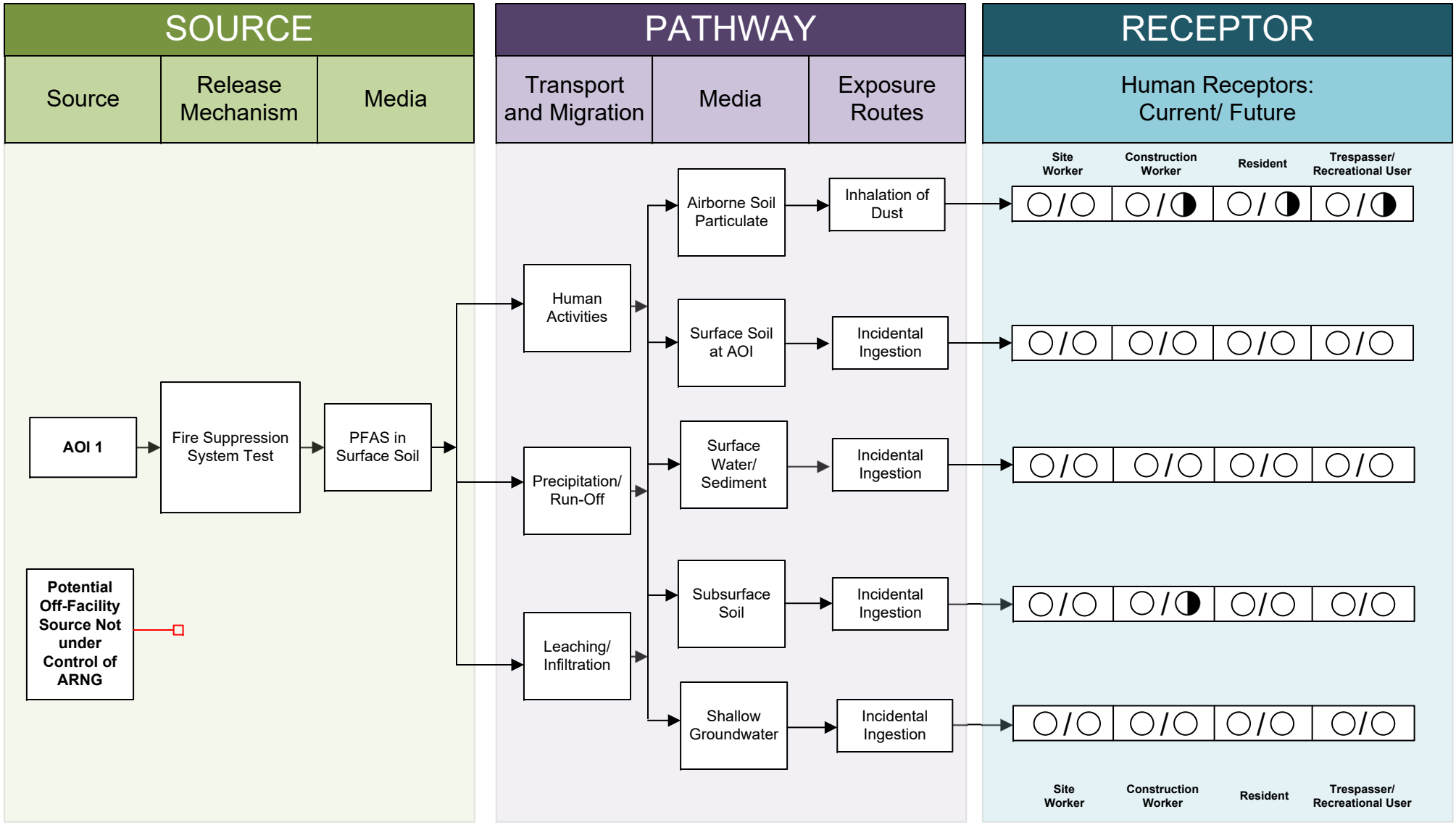
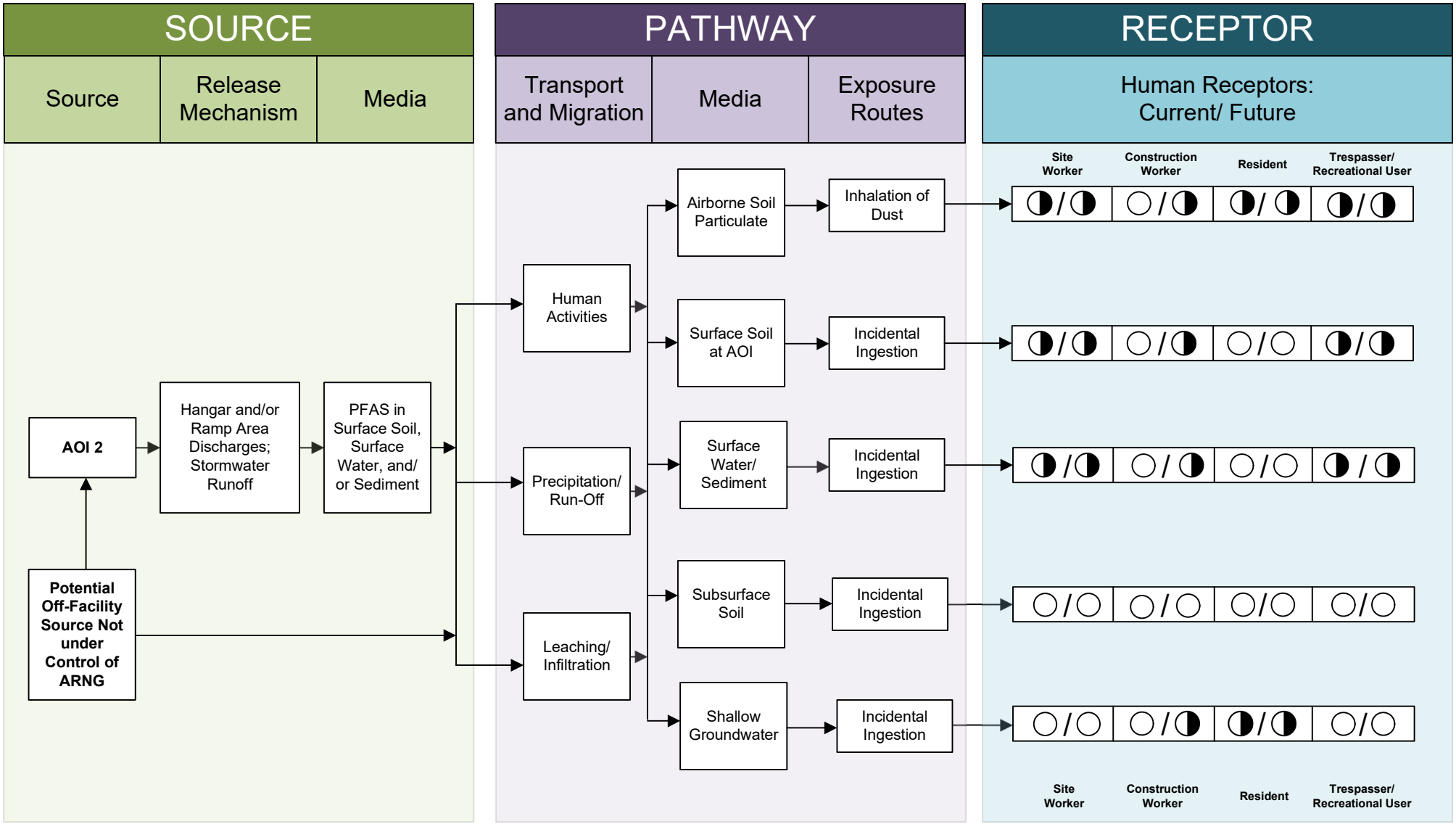


LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Complete Pathway

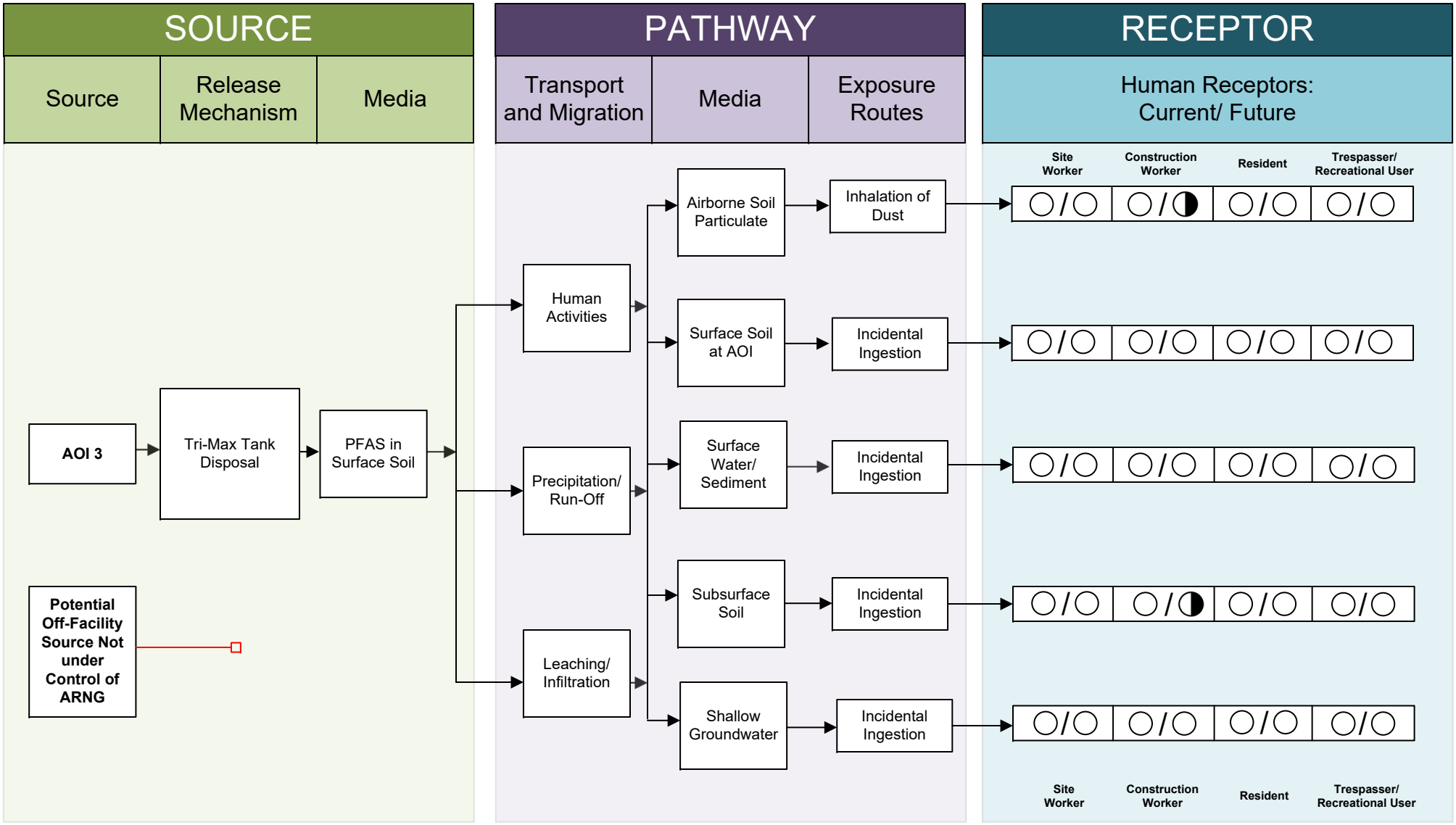
Figure 7-1
Conceptual Site Model
AOI 1
Rickenbacker Army Enclave Site Inspection Report



LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Complete Pathway

Figure 7-2
Conceptual Site Model
AOI 2
Rickenbacker Army Enclave Site Inspection Report



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- Flow-Chart Continues
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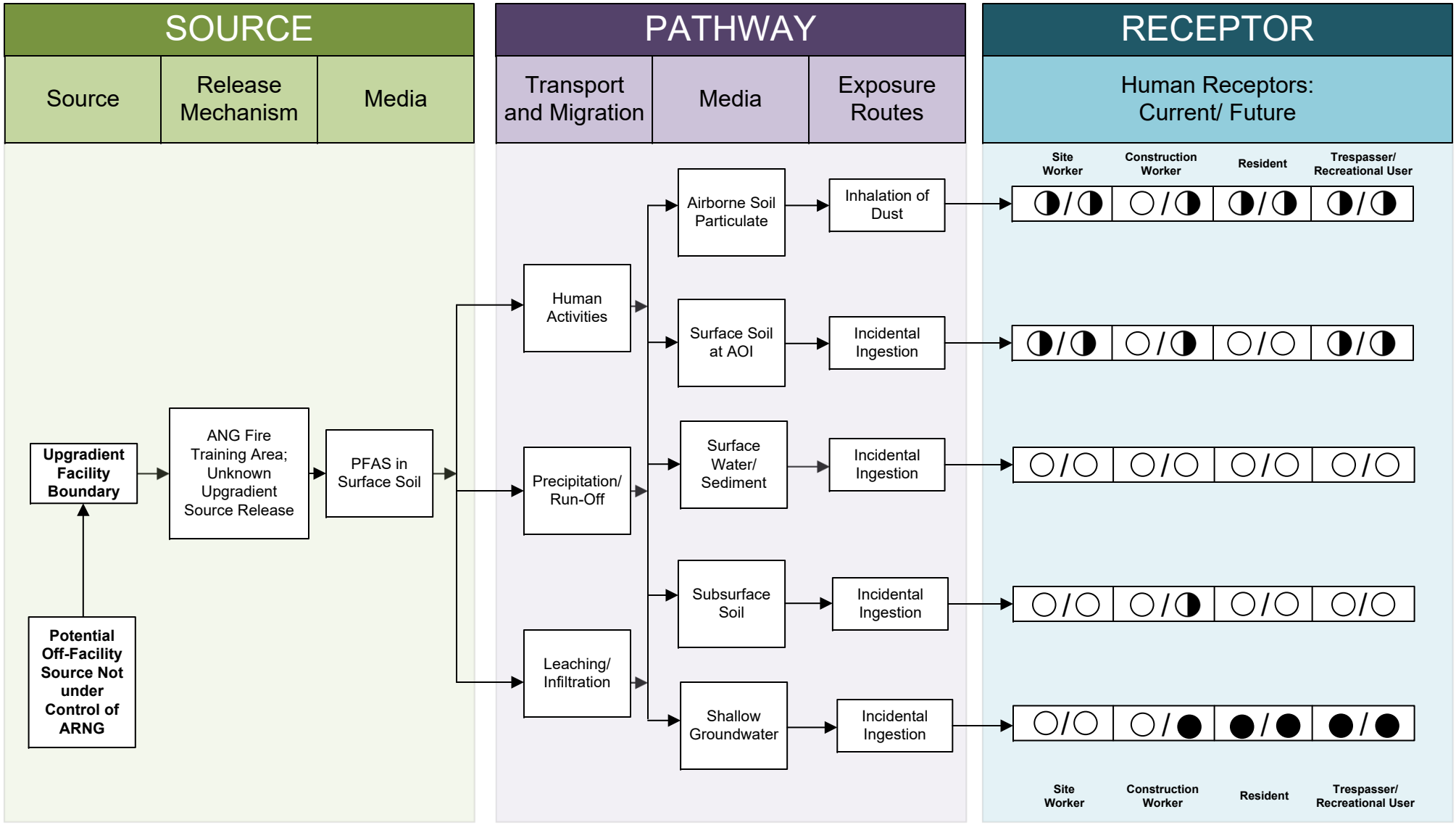
- Potentially Complete Pathway
- Complete Pathway

Figure 7-3
Conceptual Site Model
AOI 3
Rickenbacker Army Enclave Site Inspection Report



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- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Complete Pathway

Figure 7-4
Conceptual Site Model
Upgradient Facility Boundary
Rickenbacker Army Enclave Site Inspection Report

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 between 14 to 16 June 2021 and 25 August 2021, 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, 2021a), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2021a), samples were collected and analyzed for a subset of PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 as follows. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.7** of this Report.

- Fifteen (15) soil samples from six boring locations;
- Three grab groundwater samples from three temporary well locations;
- Sixteen (16) QA/QC samples

The information gathered during this investigation was used to determine if PFOA, PFOS, and/or PFBS were present at or above SLs. Additionally, the CSMs were refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure to PFOA, PFOS, and PFBS at the AOIs, which are described in **Section 7**.

8.2 SI Goals Evaluation

As described in **Section 4.2**, the SI activities were designed to achieve six main goals or DQOs. This section describes the SI goals and the conclusions that can be made for each based on the data collected during this investigation.

1. *Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs.*

   PFOA, PFOS, and PFBS were detected at the facility in soil and groundwater. PFOA, PFOS, and PFBS were detected both at the source areas, as well as at the facility boundary between potential upgradient PFAS release areas and RAE. PFOS in groundwater at the Facility Boundary exceeded the SL of 40 ng/L. The detected concentrations of PFOA, PFOS, and PFBS in soil samples from all AOIs were below the SLs.

2. *Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.*

   Insufficient information exists for the groundwater pathway at all AOIs, therefore, no AOI potential PFAS release areas were removed from further consideration.

3. *Determine the potential need for a TCRA (applies to drinking water only). The primary actions that will be considered include provision of alternative water supplies or wellhead treatment.*

Based on the data collected during this SI, there is not a complete pathway between source and on-facility drinking water receptors. Drinking water for RAE is supplied by the City of Columbus public drinking water system. Therefore, the exposure pathway to on-facility drinking water receptors is considered incomplete.

There is a potentially complete pathway between source and off-facility drinking water receptors. Surficial groundwater at the facility is very shallow, with depth to water ranging from approximately 4.6 to 7.3 feet bgs and is therefore not considered a proxy for drinking water, since downgradient wells are typically 30 to 200 feet bgs. Refusal encountered during the SI field effort at AOI 1 and AOI 3 revealed that there may be a low-permeability glacial till confining layer present on-facility; however, it is currently unknown if there is a defined confining layer thick enough to prevent vertical PFAS migration. Based on the CSM developed and revised in light of the SI findings, there is a potential for exposure to downgradient drinking water receptors caused by DoD activities at or adjacent to the facility; therefore, a TCRA is not warranted at this time.

4. *Collect data to better characterize the release areas for more effective and rapid initiation of a RI (if determined necessary).*

   The geological data collected as part of the SI indicate a somewhat permeable and conductive environment, with soils dominated by clays of varying plasticity and overlain by well-graded sand with varying gravel content.

   These facility observations are consistent with the known glacial depositional history present in the Columbus Lowland district of the Central Lowland physiographic province, where RAE is located. The lean and fat clay deposits that dominate the shallow subsurface at the facility are representative of the mapped low-permeability, medium-lime Wisconsinan-age clay glacial till and outwash unit (ODGS, 1998). Additionally, isolated lenses of cobble, coarse and angular gravel observed at thicknesses ranging from 1 to 2 inches are consistent with regional glacial till and outwash composition (Ohio Department of Natural Resources, n.d.).

   Depth to water at RAE measured from 7.30 feet bgs to 3.65 feet above ground surface (water level measured from temporary monitoring well casing stick-up extending above the ground surface at RAE-01). These geologic and hydrogeologic observations inform development of technical approach for the RI.

5. *If PFOA, PFOS, and PFBS are determined to be present, aim to evaluate whether the concentrations can be attributed to on-facility or off-facility sources that were identified within 4 miles of the installation as part of the PA (e.g., fire stations, major manufacturers, other DoD facilities)*

   Based upon the evaluation of groundwater and soil results in comparison to SLs, in combination with the groundwater flow direction analysis, the results of the SI indicate that the source of detected concentrations of PFOA, PFOS, and PFBS at the Site is likely attributable to ARNG activities. However, detected concentrations of PFOA, PFOS, and PFBS at the facility boundary indicate there may be a potential PFAS source upgradient of the facility. It is unclear whether the facility boundary location is upgradient from AOIs based on the southwestern groundwater flow direction presented in the 2018 BRAC Report for the ANG Base.

6. *Determine whether a potentially complete pathway exists between the source and potential receptors and whether ARNG is the likely source of the contamination.*

   Detections of PFOS and PFBS in soil and PFOA, PFOS, and PFBS in groundwater at source areas and the facility boundary indicate there is a potentially complete pathway between source and site workers, future construction workers, and trespassers. The

PFOS SL exceedance in surficial groundwater indicates there is a potentially complete exposure pathway between source and future construction workers, as well as off-facility drinking water receptors.

8.3 Outcome

Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure from sources on facility resulting from historical DoD activities. Sample analytical concentrations collected during the SI were compared against the project SLs for PFOA, PFOS, and PFBS 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, refusal was encountered, and groundwater was unable to be sampled at the C26 Hangar potential PFAS release area. Based on the results of the SI, further evaluation of groundwater at AOI 1 is recommended to make site-related remedial decisions.
- At AOI 2, PFOA, PFOS, and PFBS were detected in groundwater at the Drainage Ditch potential PFAS release area below the OSD SLs. Although no PFAS analytes exceeded their respective SLs at AOI 2, the shallow depth to groundwater encountered and fat clays observed at location AOI02-01 indicate that it is possible groundwater was sampled from a perched water bearing unit. Therefore, there is insufficient information to make a remedial decision and further evaluation of groundwater at AOI 2 is recommended.
- At AOI 3, PFOS, PFOA, and PFBS were non-detect in groundwater at the Helicopter Ramp Area potential PFAS release area; however, PFOS in groundwater exceeded the SL at facility boundary location, RAE-01. Although the groundwater flow direction observed in onsite temporary wells was to the west, a 2018 Base Realignment and Closure (BRAC) Report for the Rickenbacker Air National Guard (ANG) Base projects that groundwater across the southern portion of the airport flows southwest (Aerostar, 2018). If groundwater flows southwest across the eastern portion of the RAE, temporary well location RAE-01 may be considered downgradient of AOI 3. Therefore, based on the presence of PFOS in groundwater at location RAE-01, there is insufficient information to make a remedial decision and further evaluation of groundwater at AOI 3 is recommended.
- At the Facility Boundary location, RAE-01, PFOS was detected in exceedance of the OSD SL at 75.1 nanograms per liter (ng/L), and PFOA was detected at 13.3 ng/L. PFOS detections at location RAE-01 indicate that offsite PFAS sources may be contributing to PFAS concentrations in environmental media at the facility; however, it is also possible that groundwater flows southwest across the facility based on the 2018 BRAC Report for the ANG Base. If groundwater flows southwest across the facility, then location RAE-01 would be considered downgradient from AOI 3. Due to this uncertainty and the concentrations of PFOS in groundwater at location RAE-01 exceeding the SL, further evaluation of the Facility Boundary is recommended.
- The detected concentrations of PFOA, PFOS, and PFBS in soil at all AOIs were below the SLs.

Table 8-1 summarizes the SI results for soil and groundwater. Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to drinking water receptors caused by DoD activities at or adjacent to the facility.

Table 8-2 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, additional information is required to make remedial decisions for all AOIs at this facility.

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Table 8-1: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	C26 Hangar	◐	N/A(1)	N/A
2	Drainage Ditch	◐	◐	◐
3	Helicopter Ramp Area	◐	○	●
Facility Boundary	Off-Facility/ Upgradient	◐	●	●

Legend:
N/A = Not applicable
(1) Groundwater was not encountered at AOI 1; therefore, groundwater samples could not be collected.
● = PFOA, PFOS, and/ or PFBS detected; exceedance of the screening levels
◐ = PFOA, PFOS, and/ or PFBS detected; no exceedance of the screening levels
○ = PFOA, PFOS, and PFBS not detected

Table 8-2: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	C26 Hangar	Unable to collect groundwater samples. No exceedances of SLs in soil.	Consider further groundwater evaluation.
2	Drainage Ditch	Detections in groundwater at potential source area. Additionally, groundwater samples collected could possibly represent perched water, not water table. No exceedances of SLs in soil.	Consider further groundwater evaluation.
3	Helicopter Ramp Area	No detections in groundwater; however, exceedances are present in potential downgradient sample location. No exceedances of SLs in soil.	Consider further groundwater evaluation.
Facility Boundary	Off-Facility/ Upgradient	Exceedances of SL in groundwater at source area. No exceedances of SLs in soil.	Consider further groundwater evaluation.

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