FINAL
Site Inspection Report
Army Aviation Support Facility #2,
St. Cloud, Minnesota

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

March 2022

Prepared for:

Army National Guard Bureau
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Table of Contents

Appendices

Figures

Tables

Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
6:2 FTS	6:2 Fluorotelomer sulfonate acid
8:2 FTS	8:2 Fluorotelomer sulfonate acid
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AOI	area of interest
ARNG	Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CoC	chain of custody
CSM	conceptual site model
DA	United States Department of the Army
DO	dissolved oxygen
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	Engineers Manual
ERB	equipment rinsate blank
FedEx	Federal Express
FRB	field reagent blank
GPS	global positioning system
HA	Health Advisory
HDPE	high-density polyethylene
HEF	high expansion foam
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography mass spectrometry
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MDL	method detection limit

MDH	Minnesota Department of Health
MNARNG	Minnesota Army National Guard
MNDNR	Minnesota Department of Natural Resources
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
ORP	oxidation-reduction potential
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	perfluoroheptanoic 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
PPE	personal protective equipment
PQAPP	Programmatic UFP-QAPP
PVC	poly-vinyl chloride
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
RPD	relative percent differences
RSL	regional screening level
SI	Site Inspection
SL	screening level
SOP	Standard Operating Procedure
TOC	total organic carbon
TPP	Technical Project Planning

US	United States
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

Executive Summary

The Army National Guard (ARNG) G9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at per- and polyfluoroalkyl substances (PFAS)-impacted facilities 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). This SI was performed at the Army Aviation Support Facility (AASF) #2 in St. Cloud, Minnesota. AASF #2 will be referred to as the "facility" throughout this document.

AASF #2 was constructed in 2007 on approximately 55 acres of land adjacent to the St. Cloud Regional Airport, owned by the City of St. Cloud, and leased to the Minnesota ARNG (MNARNG). The lease agreement expires on 14 April 2104. AASF #2 facility includes an 80,000 square foot hangar for the operation, maintenance, and repair of MNARNG rotary-winged aircraft, administrative offices, and classrooms. The PA report (AECOM, 2019a) identified three potential PFAS releases areas grouped together into AOI 1. The release of Jet-X high expansion foam (HEF) had occurred from the fire suppression system at AASF #2 in 2009, 2011, and 2013. After the releases in 2009 and 2011, HEF was washed to the sanitary sewer and is, therefore, not suspected to have impacted AOI 1. However, after the release in June 2013, HEF was washed out of both sides of the hangar and plowed into the northeast and southwest detention ponds by the MNARNG. In addition, rotary-winged aircraft were washed on the northeast side of the hangar following the release, and the wash water was allowed to dissipate in the northeast detention pond. Furthermore, without knowledge of the precise chemical constituents of the HEF used at the facility, the ARNG decided to investigate AASF#2 as if the released HEF contained PFAS.

To fulfill the project Data Quality Objectives (DQOs) set forth in the approved SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2019b), samples were collected and analyzed for a subset of 18 PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.1 Table B-15. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.9** of this Report.

The Department of Defense (DoD) has adopted a policy to retain facilities in the Comprehensive Environmental Response, Compensation, and Liability Act (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 October 2019 (Assistant Secretary of Defense, 2019). The ARNG PFAS SIs follow this DoD policy and, should the maximum facility concentration for sampled media exceed the SLs, the facility will proceed to a Remedial Investigation (RI), the next phase under CERCLA. The SLs apply to three compounds, PFOA, PFOS, and PFBS, for both soil and groundwater, as presented in **Table ES-1**. All other results presented in this report are considered informational in nature and serve as an indication as to whether soil, groundwater, sediment, and surface water 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:

- PFOA and PFOS were detected in groundwater in AOI 1 near the facility boundary, with maximum detected concentrations of 2.74 J ng/L and 1.85 J ng/L, respectively. PFOA and PFOS detection in groundwater were below the SLs. PFBS was not detected in groundwater at AOI 1.
- PFOA, PFOS, and PFBS were not detected in soil at AOI 1.

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 limited potential for

exposure to residential 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, no further action is recommended for AOI 1 at AASF #2 at this time.

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	130,000	1,600,000	40,000

Notes:

a.) Assistant Secretary of Defense, 2019. 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 (RSL) Calculator with Hazard Quotient (HQ)=0.1. 15 October 2019.

Table ES- 2: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	St. Cloud AASF #2	○	◐	◐

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

Table ES- 3: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	St. Cloud AASF #2	Detections in groundwater and surface water. No exceedances of the SLs in soil or groundwater.	No further action

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1.0 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 facilities, 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 Army Aviation Support Facility (AASF) #2, in St. Cloud, Minnesota. AASF #2 will be 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 the US Department of the Army 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 poly-fluoroalkyl 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 AASF #2 (AECOM, 2019a) that identified three potential PFAS release areas which were grouped into one Area of Interest (AOI). 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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2.0 Facility Background

2.1 Facility Location and Description

AASF #2 is along US Highway 10, in Haven Township, Sherburne County, Minnesota (**Figure 2-1**), approximately 4 miles southeast of St. Cloud, Minnesota, and 60 miles northwest of Minneapolis-St. Paul.

AASF #2 was constructed in 2007 on approximately 55 acres of land adjacent to the St. Cloud Regional Airport, owned by the City of St. Cloud, and leased to the Minnesota ARNG (MNARNG). The lease agreement expires on 14 April 2104. AASF #2 facility includes an 80,000 square foot hangar for the operation, maintenance, and repair of MNARNG rotary-winged aircraft, administrative offices, and classrooms

2.2 Facility Environmental Setting

AASF #2 lies within the Upper Mississippi River Basin, which encompasses several land tributaries to the Mississippi River. The area is relatively flat, with small variations in elevation. The elevation of the facility is approximately 1,030 feet above mean sea level. The surrounding area is covered by cropland, wooded area, and wetlands.

2.2.1 Geology

AASF #2 is situated in the Anoka Sand Plain Subsection of the Eastern Broadleaf Forest Province as defined by the Minnesota Department of Natural Resources (MNDNR) Ecological Classification System (Sherburne County Planning & Zoning Department, 2011). The Anoka Sand Plain is a sandy lake plain formed from runoff and repeated incursions of the sea (Cummins and Grigal, 1981). Bedrock in the area consists of gently dipping layers of sandstone, shale, and carbonate rocks that range in thickness from 50 feet to greater than 200 feet (MNDNR, 2017). The bedrock ranges in age from Archean granites to Upper Mesozoic Cretaceous sediments (Cummins and Grigal, 1981). The bedrock is underlain by sedimentary rock formed by volcanism from the Precambrian Age to the Ordovician Age, including the Hinckley Sandstone and Fond du Lac Formation (MNDNR, 2017). Granite plutons from the East-Central Batholith are abundant in the region and are quarried for buildings and monuments (Cummins and Grigal, 1981). At the surface, the area is aggregate and defined by remnants of glaciation including moraine, drumlins, eskers, kames, and outwash plains with deposited deep layers of glacial till. Glacier-formed depressions have formed wetlands and many of the state's modern lakes and rivers.

2.2.2 Hydrogeology

AASF #2 is within the Central Groundwater Province as defined by the MNDNR (Sherburne County Planning & Zoning Department, 2011) and drained on the northeast side by the Town of Parent-Elk Watershed and on the southwest side by the County Ditch Number Three Watershed. Groundwater is drawn from sand and gravel aquifers and from deeper fractured and weathered bedrock or sedimentary rock. Depth to groundwater in the area ranges from 7 to 28 feet below ground surface (bgs), although wells that are closer to lakes, streams, rivers, and wetlands are shallower (Sherburne County Planning & Zoning Department, 2011). Groundwater flow is generally to the south and laterally toward larger creeks and rivers (**Figure 2-3**). Aquifer recharge is predominantly through infiltration of precipitation, although some recharge occurs from open water sources (MNDNR, 2017).

No potable water wells are located within the boundary of AASF #2; however, several domestic and irrigation wells are located within 4 miles downgradient of the facility (**Figure 2-3**). These wells also include private and residential wells observed during the visual site inspection. The

majority of groundwater use in the area is for irrigation (MNDNR 2017). Drinking water for AASF #2 is supplied by the City of St. Cloud, which uses the Mississippi River as its drinking water source (City of St. Cloud, 2011).

2.2.3 Hydrology

Sherburne County has 125 lakes, most of which are less than 20 feet deep and 493 miles of rivers and streams (Sherburne County Planning & Zoning Department, 2011). The largest lake near AASF #2 is Donovan Lake, approximately 2 miles to the north, and the largest river is the Mississippi River, located approximately 5 miles west of AASF #2 (**Figure 2-4**).

AASF #2 has detention ponds on both the northeastern and southwestern sides of the ramps that are flanked by wetlands and collect runoff from AASF #2. The detention ponds are approximately 3 feet deep and seeded with vegetation. Swales in both detention ponds carry intermittent surface water to storm sewers and the Elk River. The Elk River runs parallel to the Mississippi River before converging at the city of Elk River. Other regional surface water features include small lakes, tributaries, and wetlands.

2.2.4 Climate

The climate of St. Cloud consists of hot, humid summers, and cold winters with moderate to heavy snowfall. Seasonally, temperatures vary from summer highs of 82 degrees Fahrenheit (°F) to winter lows of 2°F (World Climate, 2018). The average temperature is 42.85°F. Average precipitation is 27.72 inches of rain and 47 inches of snow (World Climate, 2018). The area is subject to severe storms and occasional tornadoes. The prevailing wind varies from north to south, averaging 8 to 12 miles per hour.

2.2.5 Current and Future Land Use

AASF #2 is a controlled access facility with public roads and is adjacent to the St. Cloud Regional Airport. The St. Cloud Regional Airport is owned and operated by the City of St. Cloud and provides private, commercial, corporate, cargo, and military air service. Future infrastructure improvements, land acquisitions, and land use controls are anticipated in the area, as significant urban development along the Interstate-94/Highway 10 corridor continues due to the migration of businesses and residents from the Twin Cities (MnDot, 2006).

2.2.6 Critical Habitat and Threatened/Endangered Species

The following species are listed as federally endangered, threatened, proposed, and/or candidate species in Sherburne County, Minnesota (US Fish and Wildlife Service [USFWS], 2019):

- **Insects**: Rusty patch bumble bee, *Bombus affinis* (endangered), and
- **Mammal**: Northern Long-Eared bat, *Myotis septentrionalis* (threatened).

No critical habitats were identified within the boundary of the facility.

2.3 History of PFAS Use

Releases of Jet-X high expansion foam (HEF) have occurred from the fire suppression system at AASF #2 in 2009, 2011, and 2013. After the releases in 2009 and 2011, HEF was washed to the sanitary sewer and is, therefore, not suspected to have impacted AOI 1. However, after the release in June 2013, HEF was washed out of both sides of the hangar and plowed into the northeast and southwest detention ponds by the MNARNG. In addition, rotary-winged aircraft were washed on the northeast side of the hangar following the release, and the wash water was

allowed to dissipate in the northeast detention pond. Photographs provided by the MNARNG show HEF on the ground surface throughout the entire facility boundary and on the AASF #2 building following the June 2013 release.

Drinking water for the facility is supplied by the City of St. Cloud; however, domestic water supply wells and private, residential wells are present to the southwest and northeast of the facility. Groundwater flow at AASF #2 is predominantly to the south-southwest. A description of the AOI is presented in **Section 3**.

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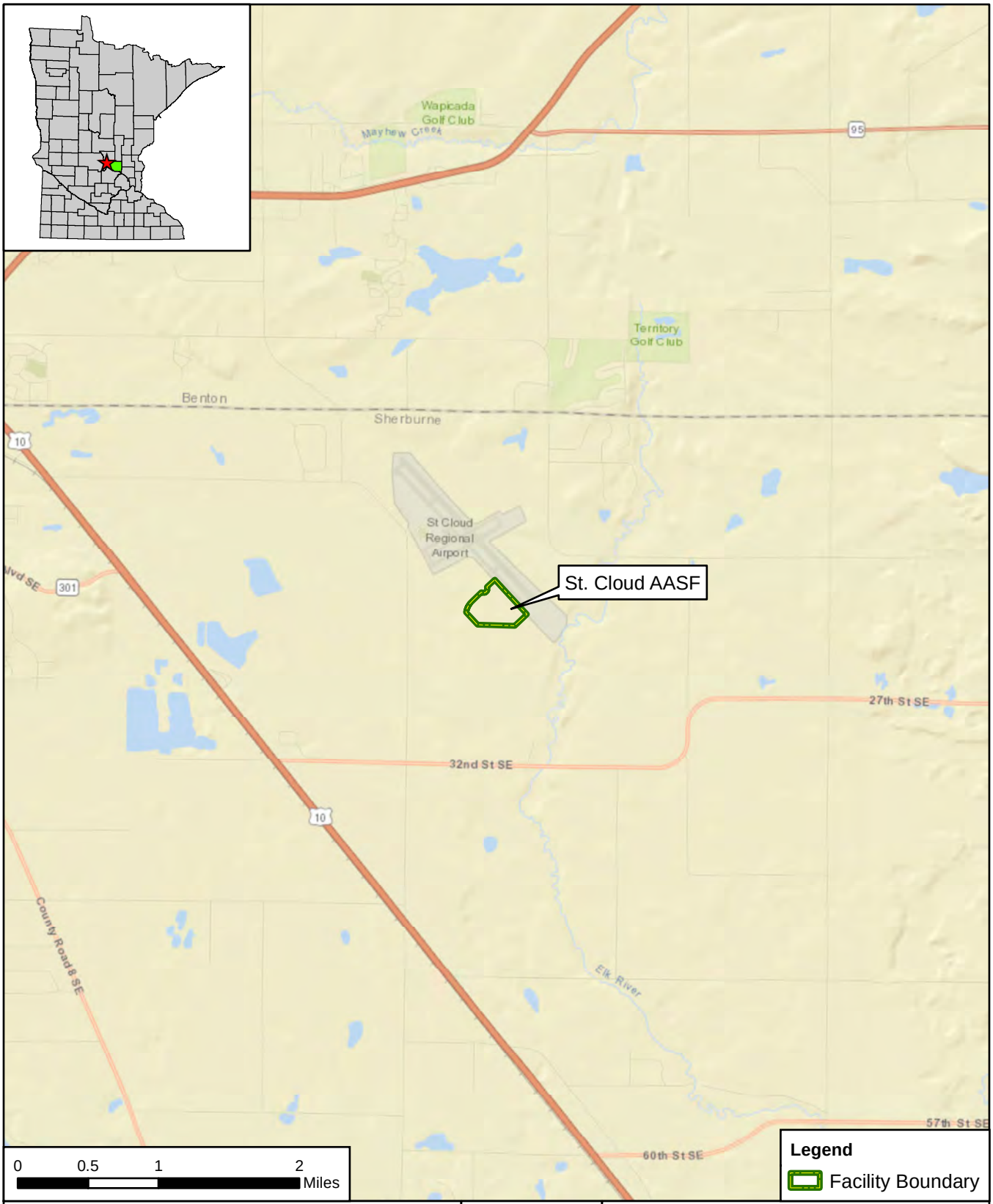

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Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	5/27/2021

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Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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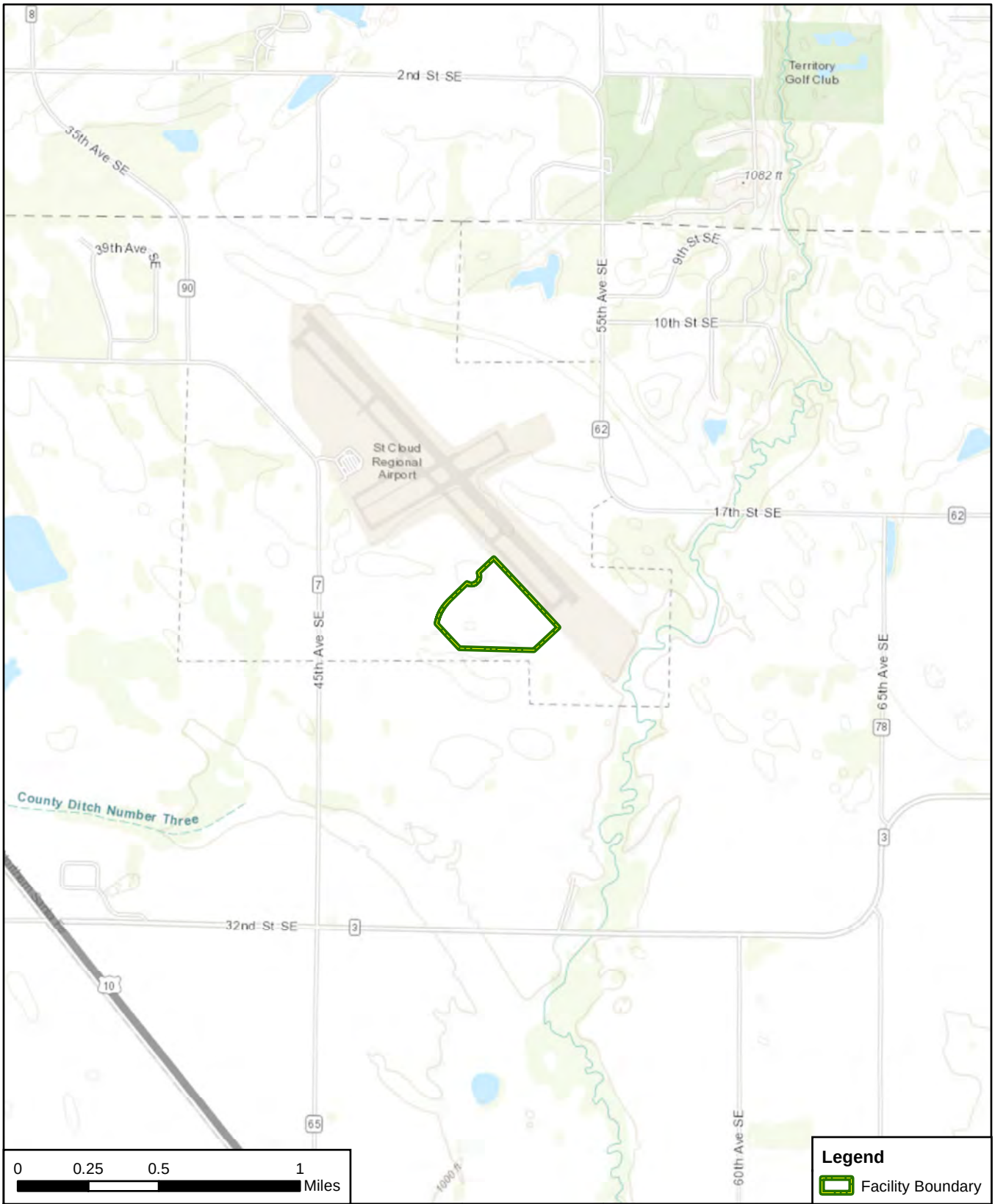

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Base Map: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN,		PM	CM	5/27/2021

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Site Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2

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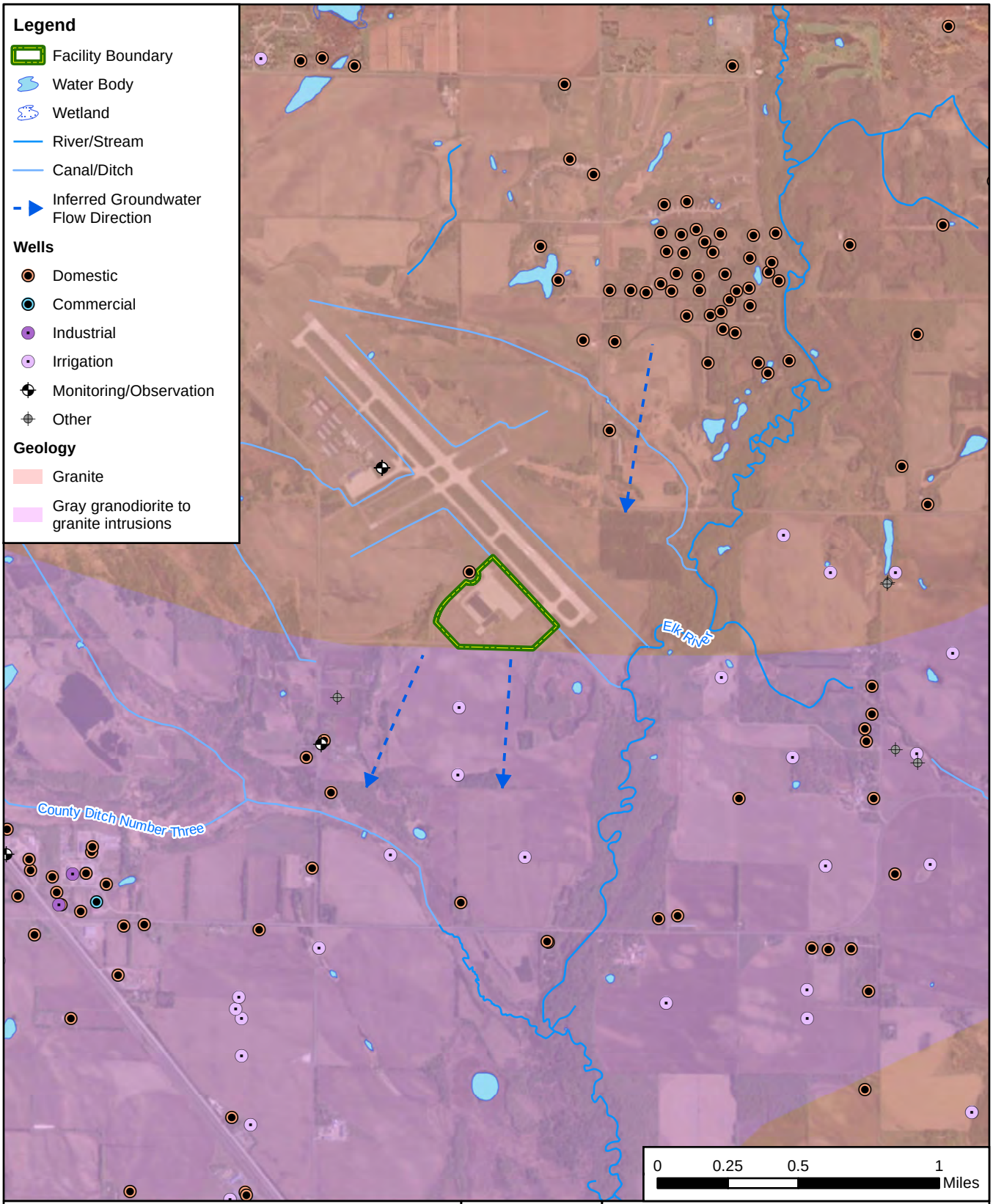

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Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	5/27/2021

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Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

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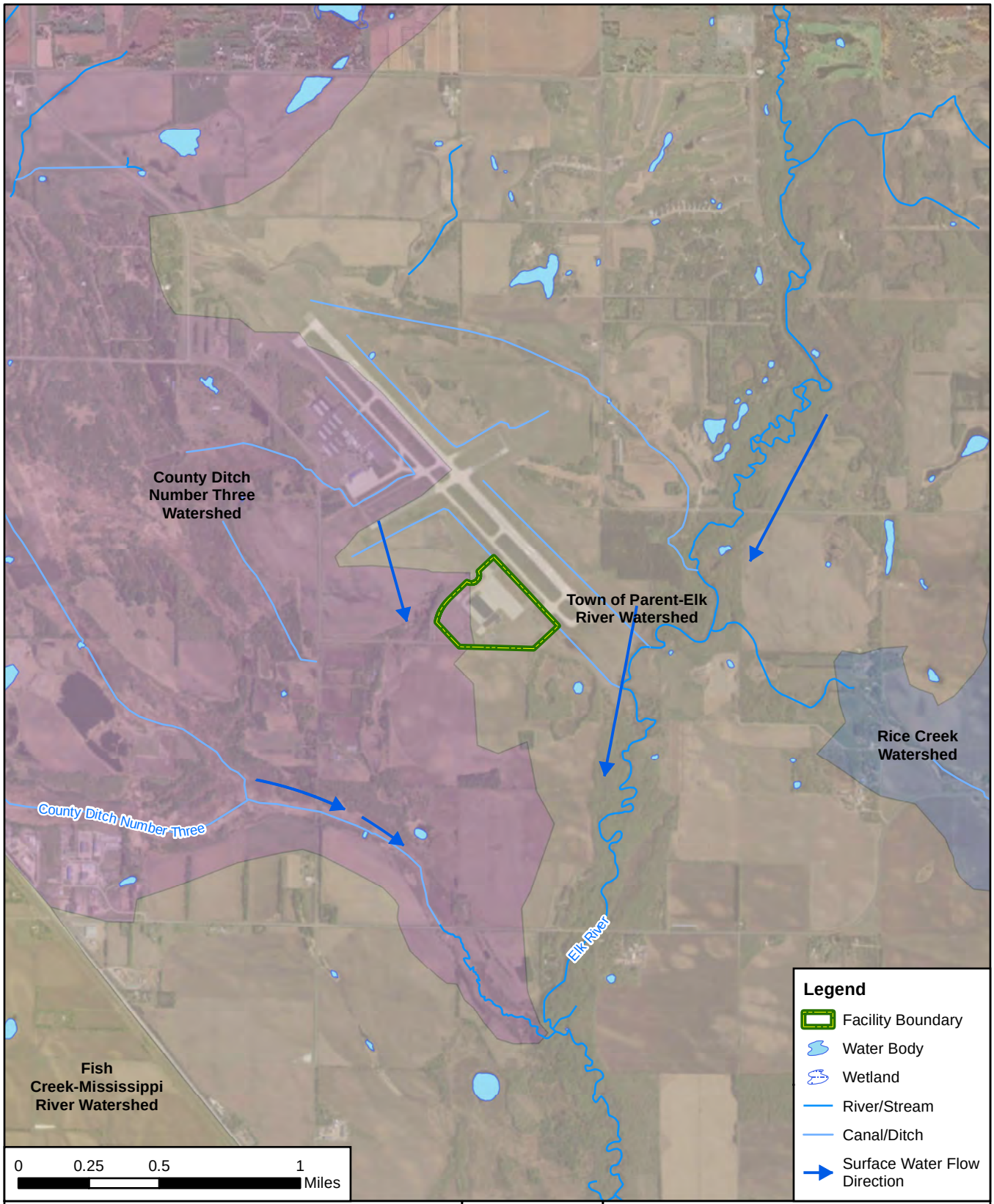

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Surface Water Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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3.0 Summary of Area of Interest

This section presents a summary of each potential PFAS release area by AOI. Based on the PA findings, one AOI was identified at the facility. AOI 1 encompasses the entire area within the AASF #2 boundary (**Figure 3-1**). A summary of the AOI is presented below.

3.1 AOI 1 – St. Cloud AASF #2

AOI 1 encompasses the entire area within the AASF #2 property boundary. Releases of HEF occurred from the fire suppression system at AASF #2 in 2009, 2011, and 2013. The HEF from the 2009 and 2011 releases was washed to the sanitary sewer and is not suspected to have impacted AASF #2. The sanitary sewer flows to the St. Cloud Wastewater Treatment Facility in St. Cloud, Minnesota. However, after the release in June 2013, HEF was washed out of both sides of the hangar and plowed into the northeast and southwest detention ponds by the MNARNG. In addition, rotary-winged aircraft were washed on the northeast side of the hangar following the release, and the wash water was allowed to dissipate in the northeast detention pond. There was a low probability of the HEF containing PFAS, however, absent knowledge of the precise chemical constituents of the HEF used at the facility, the ARNG decided to investigate St Cloud AASF#2 as if aqueous film forming foam (AFFF) containing PFAS had been used and released. Photographs provided by the MNARNG show HEF on the ground surface throughout the entire facility boundary and on the AASF #2 building following the June 2013 release. No remediation activities have occurred at this location (AECOM, 2019a).

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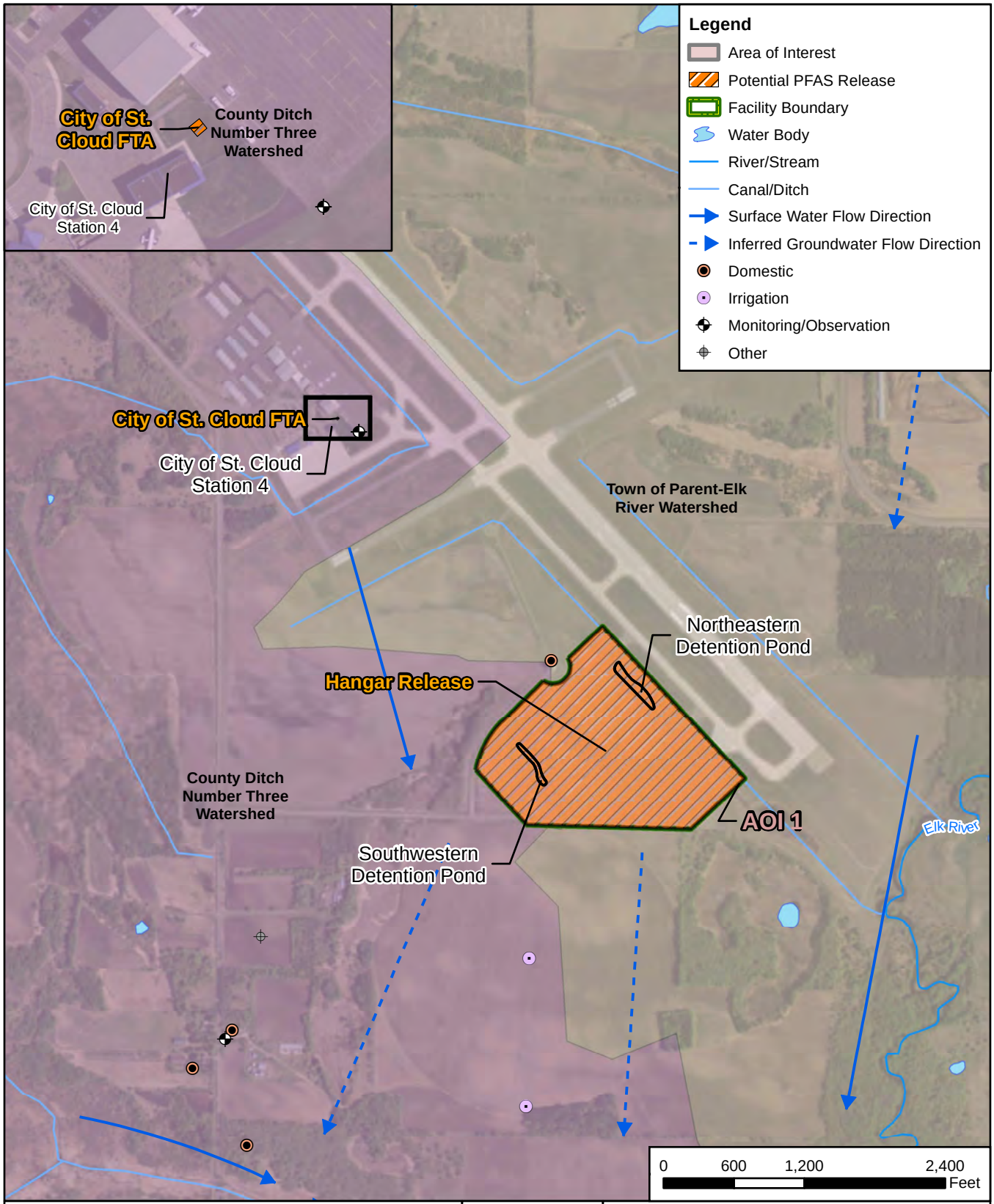

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Area of Interest

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

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4.0 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 the 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. As such, without knowledge of the precise chemical constituents of the HEF used at the facility, the ARNG decided to investigate AASF#2 as if the released HEF contained PFAS.

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 October 2019 (Assistant Secretary of Defense, 2019). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum facility 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 in **Section 6.1** of this Report.

The following quotes from the US Department of the Army (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 fire training areas, 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 facility 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 (PFCs) 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.

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 removal action.
4. Collect data to better characterize the release areas for more effective and rapid initiation of a RI.
5. Identify within 4 miles of the installation other potential PFAS sources (fire stations, major manufacturers, other DoD facilities) and receptors, including both groundwater and surface water receptors, to determine whether the ARNG is the likely source of PFAS, or whether there is an off-facility source of PFAS responsible for installation detections of PFAS (USEPA, 2005).
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 for the SI include the following:

- The PA for AASF #2 (AECOM, 2019a);
- Analytical data from groundwater, soil, surface water, and sediment samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2019b); 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 2-2**). Off-site sampling was not included in the scope of this SI. If future off-site 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 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, 2019b). Decision rules were developed for groundwater and soil, and then applied to all data collected. These rules governed response actions based on the results of the SI sampling effort.

The decision rules described in the **Worksheet #11** of the 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 conceptual site model (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, groundwater, surface water, and sediment samples were collected from the potential PFAS release areas within AOI 1. Depth to groundwater was observed to range from 3.45 to 13.22 feet bgs.

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.

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. Several field samples displayed EIS area counts less than the QC limit of 50%. The positive field sample results associated with EIS area counts less than the QC limit were qualified “J+”, while non-detects were qualified “UJ”. The qualified results should be considered usable as estimated values with a positive bias. The results associated with EIS recoveries less than 20% were included in the data set because the PFAS compounds are quantitated based on a normalized internal standard recovery, and in the site matrix spike pairs with low area counts the target compounds were shown to display acceptable recoveries. The qualified field sample results associated with EIS area counts less than 20% were not applied to compounds PFOA, PFOS, and PFBS in any media and were treated in the data set as true negatives.

Calibration verifications were performed routinely to ensure that instrument responses for all calibrated analytes were within established QC criteria. All calibration verifications were within the project established precision limits presented in the QAPP Addendum (AECOM, 2019b).

Laboratory control spike/laboratory control spike duplicate (LCS/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, 2019b).

Matrix spike/matrix spike duplicate (MS/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. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. The MS/MSD performed on parent sample AOI1-SB05 displayed a RPD greater than the upper QC limit of 30% for PFTrDA. The parent sample result associated with this positive bias was non-detect, therefore, no data qualifying action was required.

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, 2019b).

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, with one exception. The LCS/LCSD pairs prepared in batch 669971 displayed a percent recovery greater than the upper QC limit of 130% for NEtFOSAA and PFTrDA. The associated field sample results were non-detect, therefore, no data qualifying action was required.

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, with a limited number of exceptions. The MS/MSD performed on field sample AOI1-SB05 displayed percent recoveries greater than the upper QC limit of 130% for PFTrDA. The associated field sample results were non-detect, therefore, no data qualifying action was required.

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 LC/MS/MS Compliant with QSM 5.1 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 branched 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, 2018e) for all analyses.

Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control. A limited number of PFAS instrument blanks and method blanks displayed detections greater than the detection limit for multiple target analytes. In total, one field sample result for PFOS was qualified “U” during data validation due to a detection in the associated method blank. The reported field sample result value was adjusted to be equal to the limit of detection (LOD). The result is usable as qualified but should be considered a false positive and treated as non-detect.

Field blanks and equipment blanks were also collected for groundwater and soil samples. All equipment blanks and field blanks were non-detect for all target analytes.

A sample of the water used for decontamination of the drill rig was collected in advance of the field effort. The decontamination sample, “POTABLE WATER”, displayed a detection for PFBA greater than the detection limit at 4.27 ng/L. The positive associated field sample results that displayed concentrations less than five times the detection found in the decontamination sample were qualified “U.” The results are usable as qualified but should be considered false positives and treated as non-detect.

Overall, the data are usable for evaluating the presence or absence of PFAS at the Site. 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 meeting 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:

- PFAS in groundwater by USEPA Method 537 Modified at 100%
- PFAS in soil by USEPA Method 537 Modified at 100%
- PFAS in surface water by USEPA Method 537 Modified at 100%
- PFAS in sediment by USEPA Method 537 Modified at 100%

- pH in soil by USEPA Method 9045D at 100%
- Total Organic Carbon (TOC) by USEPA Method 9060 at 100%

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, 2018e). 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, 2018e), the laboratory reported all field sample results at the lowest possible dilution. Additionally, any analytes detected below the LOQ and above the DL were reported and qualified “J” as estimated values by the laboratory.

5.0 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 was implemented in accordance with the following approved documents:

- *Final Preliminary Assessment Report, Army Aviation Support Facility, St. Cloud, Minnesota* dated April 2019 (AECOM, 2019a);
- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan* dated October 2019 (AECOM, 2018a);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Army Aviation Support Facility, St. Cloud, Minnesota* dated July 2019 (AECOM, 2019b);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b); and
- *Final Site Safety and Health Plan, Army Aviation Support Facility, St. Cloud, Minnesota* dated October 2019 (AECOM, 2019c).

The SI field activities were conducted from 15-17 October 2019 and 11-12 May 2020 and consisted of direct push boring and soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and surface water and sediment sample collection. Field activities were conducted in accordance with the QAPP Addendum (AECOM, 2019b), except as noted in **Section 5.7**.

The following samples were collected during the SI and analyzed for PFAS via LC/MS/MS compliant with QSM 5.1 Table B-15 to fulfill the project DQOs:

- Eighteen (18) soil samples from six locations;
- Six grab groundwater samples from six temporary well locations;
- Five sediment samples; and
- Four surface water samples, which were co-located with sediment 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, which is provided in **Appendix B1**, was completed throughout the SI field activities. Sampling Forms are provided in **Appendix B2**, Nonconformance and Corrective Action Reports are provided in **Appendix B3**, and Investigation-Derived Waste (IDW) Polygons are provided as **Appendix B4**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

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

5.1.1 Technical Project Planning

The USACE TPP Process, (Engineers 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 2 October 2019, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2.

The stakeholders for this SI include ARNG, MNARNG, USACE, St. Cloud AASF #2 personnel, Minnesota Department of Health (MDH), the Minnesota Pollution Control Agency, 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, 2019b).

A TPP Meeting 3 was held on 17 August 2021 after the field event to discuss the results of the SI. Meeting minutes for TPP 3 are included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM's drilling subcontractor, Dakota Technical Services, contacted "Gopher State" one-call utility clearance to notify them of intrusive work. Additionally, the first 5 feet of each boring were advanced using hand auguring methods to verify utility clearance in shallow subsurface 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 PFAS-free prior to the start of field activities. The results of the potable well 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 Programmatic UFP-QAPP (PQAPP) (AECOM, 2018a). 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 *Standard Operating Procedure 3-17 Direct Push Sampling Techniques*. A GeoProbe® 6610DT dual-tube sampling system was used to collect continuous soil cores to the target depth. Three discrete soil samples were collected for chemical analysis from each soil boring. A hand auger was used to collect samples from 0 to 2 feet bgs to be compliant with utility clearance procedures. One subsurface soil sample approximately 1 foot above the groundwater table and one subsurface soil sample at the mid-point between the surface and the groundwater table were collected at each boring using DPT.

Soil boring locations are shown on **Figure 5-1,** and depths are provided in **Table 5-1**. The soil boring locations were selected based on the AOI information as agreed on through TPP and QAPP Addendum review.

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**.

Each 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 by LC/MS/MS Compliant with QSM 5.1 Table B-15, TOC (USEPA Method 9060A), and pH (USEPA Method 9045D) in accordance with the QAPP Addendum (AECOM, 2019b).

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, 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 4 degrees Celsius (°C) during shipment.

DPT borings were converted to temporary wells, which were subsequently abandoned in accordance with the QAPP Addendum (AECOM, 2019b) using bentonite chips at completion of sampling activities. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 Temporary Well Installation and Groundwater Grab Sampling

Temporary wells were installed using a GeoProbe® 6610DT dual-tube sampling system. Temporary wells were installed at all six boring locations. Once the borehole was advanced to the desired depth, a temporary well was constructed of 5- or 10-feet sections of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. New PVC pipe and screen were used at each location to avoid cross contamination between locations. The screen intervals for the temporary wells are provided on **Table 5-2**.

The temporary wells were allowed to recharge for a minimum of 24 hours 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 5.1 Table B-15 in accordance with the QAPP Addendum (AECOM, 2019b).

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 FRB was collected in accordance with the

PQAPP (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 4°C during shipment.

Temporary wells were abandoned in accordance with the QAPP Addendum (AECOM, 2019b) 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 Surface Water and Sediment Sampling

Sediment samples were co-located with surface water, and sediment samples were collected from stormwater drains on AASF #2 boundary that discharge to the Elk River. The Elk River runs parallel to the Mississippi River before converging at the city of Elk River, Minnesota.

Surface water samples were collected from a single point in the waterbody by dipping the laboratory-supplied bottle into the water, approximately two-thirds up from the bottom of the water body. For the co-located surface water and sediment samples, the surface water sample was collected before the co-located sediment sample. Sampling was performed deliberately and methodically to minimize disturbance of bottom sediments and as quickly as possible to ensure a representative sample was collected. Additionally, a subsample of each surface water sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted on any of the surface water samples.

After collection of the surface water sample, a sediment coring device (hand auger) was used to collect the sediment sample from the first 1 foot of sediment. The sediment was transferred to a Ziploc bag, where the sample was homogenized, and stones in excess of 1 centimeter were removed. The surface water and sediment sample locations are shown on **Figure 5-1**, and sample depths are provided in **Table 5-1**.

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 for analysis of PFAS (USEPA Method 537 Compliant with QSM 5.1 Table B-15). Sediment samples were also analyzed for TOC (USEPA Method 9060A) and pH (USEPA Method 9045D), in accordance with the QAPP Addendum (AECOM, 2019b).

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, ERB samples 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 4°C during shipment.

5.5 Investigation-Derived Waste

As of the date of this report, the disposal of PFAS IDW is not regulated federally. PFAS IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the QAPP Addendum (AECOM, 2019b) and with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) generated during the SI activities were left in place at the point of the source. The soil cuttings were distributed on the ground surface on the downgradient side of the boring. The soil IDW was not sampled and assumes the PFAS characteristics of the associated soil samples collected from that source location.

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

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

Other solids such as spent personal protective equipment (PPE), 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.

5.6 Laboratory Analytical Methods

Samples were analyzed for PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15 at Pace Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP-certified laboratory. The 18 PFAS compounds 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 and sediment samples were also analyzed for TOC using USEPA Method 9060A and pH by USEPA Method 9045D.

5.7 Deviations from QAPP Addendum

Deviations from the QAPP Addendum occurred based on field conditions and discussion between AECOM, ARNG, MNARNG, and USACE. One deviation from the QAPP Addendum is noted below and is documented in the Nonconformance and Corrective Action Report (**Appendix B.3**):

- The QAPP Addendum stated that five surface water and five sediment samples were to be collected soil samples; however, surface water at SD/SW05 was not present at the time of the investigation. Although, surface water was not present, a sediment sample was collected and analyzed from SD/SW05.
- The QAPP stated all samples were to be collected within the facility boundary. Soil and groundwater samples from AOI1-SB04 and surface water and sediment samples SW/SD03 were not collected in the proper locations. An additional mobilization to the Site

was conducted to collect the above samples from the correct locations. Information presented in this report was collected in accordance with the approved UFP QAPP.

Table 5-1
Samples by Medium
Site Inspection Report, St. Cloud AASF #2

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS (USEPA Method 537 Modified)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Comments
Soil Samples						
AOI 1-SB01	10/16/2019	0.5 - 1	x	x	x	
AOI 1-SB01 DUP	10/16/2019	0.5 - 1	x	x	x	Field Duplicate
AOI 1-SB01 MS	10/16/2019	0.5 - 1	x			MS/MSD
AOI 1-SB01 MSD	10/16/2019	0.5 - 1	x			MS/MSD
AOI 1-SB01	10/16/2019	2.5 - 5	x	x	x	
AOI 1-SB01	10/16/2019	5 - 7.5	x	x	x	
AOI 1-SB02	10/15/2019	0.5 - 1	x	x	x	
AOI 1-SB02 DUP	10/15/2019	0.5 - 1	x	x	x	Field Duplicate
AOI 1-SB02	10/15/2019	5 - 10	x	x	x	
AOI 1-SB02	10/15/2019	12.5 - 15	x	x	x	
AOI 1-SB03	10/15/2019	0.5 - 1	x	x	x	
AOI 1-SB03	10/15/2019	5 - 7.5	x	x	x	
AOI 1-SB03	10/15/2019	7.5 - 10	x	x	x	
AOI 1-SB04	5/11/2020	0.5 - 1.5	x			
AOI 1-SB04 DUP	5/11/2020	0.5 - 1.5	x			Field Duplicate
AOI 1-SB04 MS	5/11/2020	0.5 - 1.5	x			MS/MSD
AOI 1-SB04 MSD	5/11/2020	0.5 - 1.5	x			MS/MSD
AOI 1-SB04	5/11/2020	5 - 7.5	x			
AOI 1-SB04	5/11/2020	10 - 12.5	x	x	x	
AOI 1-SB05	10/15/2019	0.5 - 1	x	x	x	
AOI 1-SB05	10/15/2019	5 - 7.5	x	x	x	
AOI 1-SB05	10/15/2019	10 - 12.5	x	x	x	
AOI 1-SB06	10/15/2019	0.5 - 1	x	x	x	
AOI 1-SB06	10/15/2019	2.5 - 5	x	x	x	
AOI 1-SB06	10/15/2019	5 - 7.5	x	x	x	
Sediment Samples						
SD01	10/15/2019	0 - 1	x	x	x	
SD02	10/15/2019	0 - 1	x	x	x	
SD03	5/12/2020	0 - 1	x	x	x	
SD04	10/15/2019	0 - 1	x	x	x	
SD05	10/16/2019	0 - 1	x	x	x	
Groundwater Samples						
AOI 1-SB01	10/17/2019	10 - 15	x			
AOI 1-SB02	10/16/2019	10 - 15	x			

Table 5-1
Samples by Medium
Site Inspection Report, St. Cloud AASF #2

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS (USEPA Method 537 Modified)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Comments
AOI 1-SB03	10/16/2019	10 - 15	x			
AOI 1-SB03 DUP	10/16/2019	10 - 15	x			Field Duplicate
AOI 1-SB04	5/12/2020	10 - 15	x			MS/MSD
AOI 1-SB04 DUP	5/12/2020	10 - 15	x			Field Duplicate
AOI 1-SB05	10/17/2019	10 - 15	x			
AOI 1-SB06	10/17/2019	10 - 15	x			
Surface Water Samples						
SW01	10/15/2019	0 - 1	x			
SW02	10/15/2019	0 - 1	x			
SW03	5/12/2020	0 - 1	x			
SW04	10/15/2019	0 - 1	x			
Blank Samples						
EB-101719-GW	10/17/2019	---	x			Equipment Blank
ERB-01	5/12/2020	---	x			Equipment Blank
FRB-01	5/12/2020	---	x			Field Blank

Notes:
ft = feet
MS/MSD = matrix spike/ matrix spike duplicate
PFAS = per- and polyfluoroalkyl substances
pH = potential for hydrogen
TOC =total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring, Temporary Well, and Gauging Data
Site Inspection Report, St. Cloud AASF #2

Area of Interest	Soil Boring ID	Soil Boring Depth (ft bgs)	Temporary Well Screen Interval (ft bgs)	Depth to Water (ft btoc)
AOI 1	AOI 1-SB01	15	10 - 15	3.45
	AOI 1-SB02	22.5	10 - 20	11.10
	AOI 1-SB03	15	10 - 15	4.45
	AOI 1-SB04	25	15 - 25	13.22
	AOI 1-SB05	20	10 - 15	11.05
	AOI 1-SB06	20	10 - 15	4.20

Notes:

btoc = below top of casing

bgs = below ground surface

ft = feet

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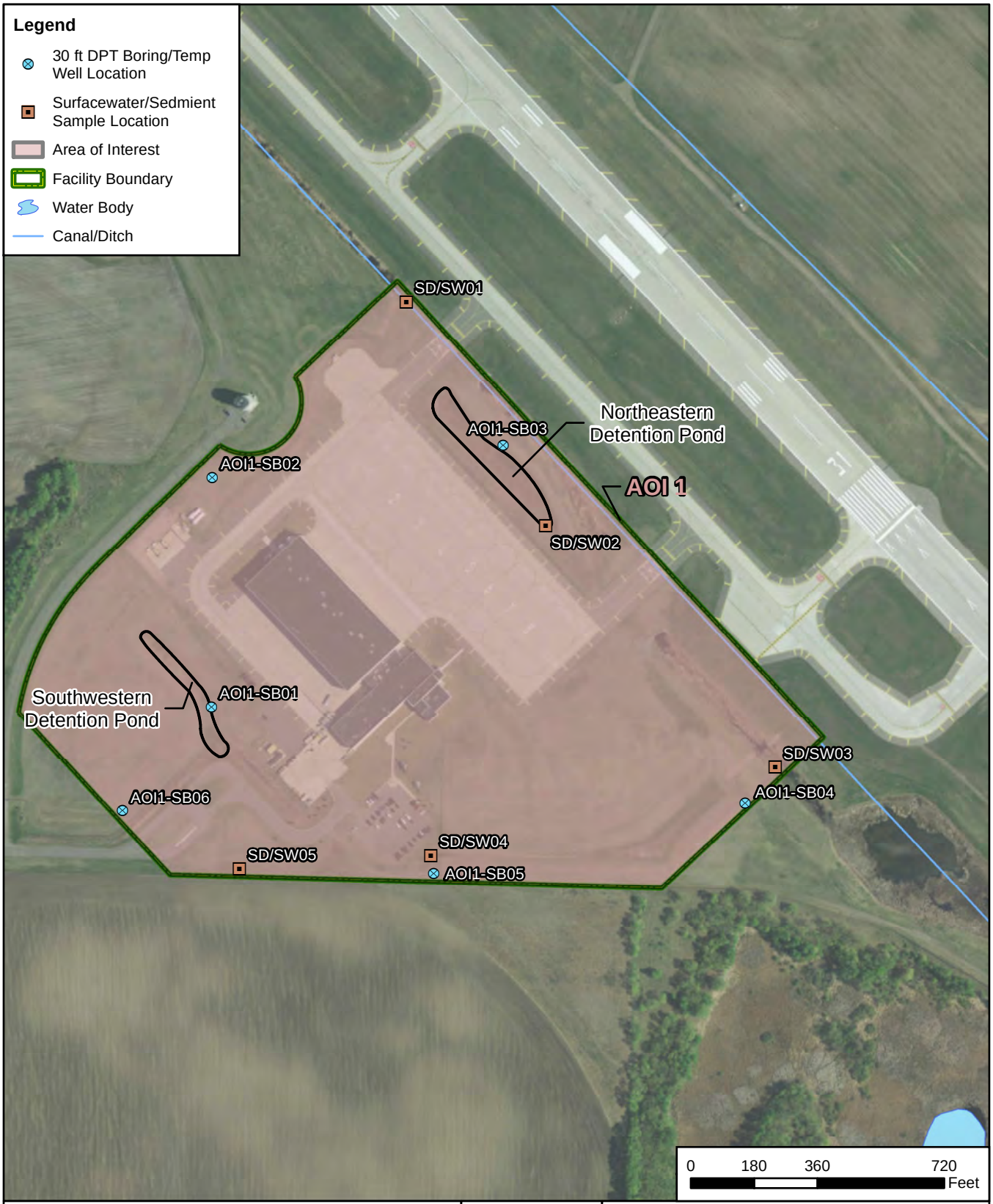

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at St. Cloud AASF #2, MN			
REVISED	5/27/2021	GIS BY	MS	5/27/2021
SCALE	1:4,800	CHK BY	SI	5/27/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	5/27/2021

N

Site Inspection Sampling Locations

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Figure 5-1

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6.0 Site Inspection Results

This section presents the analytical results of the SI for AOI 1. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for AOI 1 is provided in **Section 6.3**. **Table 6-2** through **Table 6-4** present PFAS results for samples with detections in soil, groundwater, and surface water; only constituents detected in one or more samples are included. No constituents were detected in sediment; therefore, a table of detections is not presented in this section. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the OSD dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to an RI, the next phase under CERCLA. The SLs apply to three compounds, PFOA, PFOS, and PFBS, for both soil and groundwater, as presented in **Table 6-1**.

All other results presented in this report are considered informational in nature and serve as an indication as to whether soil, groundwater, sediment, and surface water 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	130,000	1,600,000	40,000

Notes:
a.) Assistant Secretary of Defense, 2019. 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. HQ=0.1. 15 October 2019.

6.2 Soil Physicochemical Analyses

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

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport 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 – St. Cloud AASF #2

This section presents the analytical results for soil, groundwater, surface water, and sediment for AOI 1. The detected compounds are summarized in **Table 6-2** through **Table 6-4** and on **Figures 6-1** through **Figure 6-5**.

6.3.1 Soil Analytical Results

Soil samples were collected within the source area and perimeter of AOI 1 from the surface, shallow subsurface, and capillary fringe. PFOA, PFOS, and PFBS were not detected in the soil samples. **Figure 6-1** presents analytical results in soil for PFOS, and **Figure 6-2** presents the analytical results in soil for PFOA. The detected compounds from the soil sampling are summarized in **Table 6-2**.

6.3.2 Groundwater Analytical Results

PFOA and PFOS were detected in four of the eight groundwater samples collected from temporary wells. PFBS was not detected in groundwater. PFOA was detected in AOI1-SB03, AOI1-SB03 duplicate sample (DUP #1), and AOI1-SB06 at concentrations of 2.74 J ng/L, 1.80 J ng/L, and 1.76 J ng/L, respectively.

PFOS was detected in one of the eight groundwater samples collected from temporary wells. PFOS was detected at a concentration of 1.85 J ng/L in the duplicate sample collected from AOI1-SB04 (AOI01-04-GW-D).

PFBS was not detected in groundwater and the detected PFOA and PFOS concentrations of did not exceed the SLs. **Figure 6-3** presents analytical results for PFAS in groundwater. The detected compounds from groundwater sampling are summarized in **Table 6-3**.

6.3.3 Sediment Analytical Results

Sediment samples were collected from stormwater drains that flow east into the Elk River. The Elk River runs parallel to the Mississippi River before converging at the city of Elk River. PFOA, PFOS, and PFBS were not detected in sediment samples at the facility.

6.3.4 Surface Water Analytical Results

Surface water samples were collected from stormwater drains that flow east into the Elk River, downgradient of AOI 1. PFOA, PFOS, and PFBS were detected in the surface water sample collected at SW01 at concentrations of 2.58 J ng/L, 3.67 J ng/L, and 1.51 J ng/L, respectively. PFOS was detected at a concentration of 4.34 J ng/L in the surface water sample collected at AOI01-03-SW.

Figure 6-5 presents analytical results for surface water for PFOS and PFOA. **Table 6-4** summarizes the detected compounds in surface water and presents the ranges of detections for PFOS, PFOA, and PFBS in surface water.

6.3.5 Conclusions

Based on the results of the SI, PFOA and PFOS were detected in groundwater at concentrations below the SLs at AOI 1. PFBS was not detected in groundwater. PFOA, PFOS, and PFBS were

detected in surface water at AOI 1 but were not detected in soil or sediment. There are no established SLs for sediment and surface water; therefore, these results are presented for informational purposes only.

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Table 6-2
PFAS Detections in Shallow Subsurface Soil
Site Inspection Report, St. Cloud AASF #2

Area of Interest		AOI1																			
Sample ID		AOI1-SB01 (2.5-5)		AOI1-SB01 (5-7.5)		AOI1-SB02 (5-10)		AOI1-SB02 (12.5-15)		AOI1-SB03 (5-7.5)		AOI1-SB03 (7.5-10)		AOI01-04-SB-5-7.5		AOI01-04-SB-10-12.5		AOI1-SB05 (5-7.5)		AOI1-SB05 (10-12.5)	
Sample Date		10/16/2019		10/16/2019		10/15/2019		10/15/2019		10/15/2019		10/15/2019		05/11/2020		05/11/2020		10/15/2019		10/15/2019	
Depth		2.5 - 5 ft		5 - 7.5 ft		5 - 10 ft		12.5 - 15 ft		5 - 7.5 ft		7.5 - 10 ft		5 - 7.5 ft		10 - 12.5 ft		5 - 7.5 ft		10 - 12.5 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ug/Kg)																					
PFBA	-	ND		ND		ND		ND		ND		ND		0.200	J	ND		ND		ND	

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
D/DUP	Duplicate
ft	feet
HQ	Hazard quotient
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
USEPA	United States Environmental Protection Agency
ug/Kg	micrograms per Kilogram
-	Not applicable

Table 6-3
PFAS Detections in Groundwater
Site Inspection Report, St. Cloud AASF #2

Area of Interest		AOI1															
Sample ID		AOI1-SB01		AOI1-SB02		AOI1-SB03		DUP #1-20191016		AOI01-04-GW		AOI01-04-GW-D		AOI1-SB05		AOI1-SB06	
Sample Date		10/17/2019		10/16/2019		10/16/2019		10/16/2019		05/12/2020		05/12/2020		10/17/2019		10/17/2019	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS via PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)																	
6:2 FTS	-	ND		ND		ND		ND		ND		2.19	J	ND		ND	
PFHpA	-	ND		ND		ND		ND		ND		ND		ND		1.85	J
PFHxA	-	ND		ND		ND		1.73	J	ND		ND		ND		3.19	J
PFOA	40	ND		ND		2.74	J	1.80	J	ND		ND		ND		1.76	J
PFOS	40	ND		ND		ND		ND		ND		1.85	J	ND		ND	
PFPeA	-	ND		ND		ND		ND		ND		ND		ND		2.79	J
PFTeDA	-	ND		ND		ND		ND		ND		ND		ND		2.56	J+

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

J+ = Estimated concentration, biased high

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
D/DUP	Duplicate
ft	feet
HQ	Hazard quotient
LC/MS/MS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
USEPA	United States Environmental Protection Agency
ug/Kg	micrograms per Kilogram
-	Not applicable

Table 6-4
PFAS Detections in Surface Water
Site Inspection Report, St. Cloud AASF #2

Area of Interest	AOI1							
Sample ID	SW01		SW02		AOI01-03-SW		SW04	
Sample Date	10/15/2019		10/15/2019		05/12/2020		10/15/2019	
Analyte	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS via PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)								
6:2 FTS	111		ND		44.3		ND	
PFBA	ND		ND		11.9		ND	
PFBS	1.51	J	ND		ND		ND	
PFHpA	8.11	J	ND		5.10	J	ND	
PFHxA	36.9		ND		18.9		ND	
PFHxS	3.75	J	ND		2.92	J	ND	
PFOA	2.58	J	ND		ND		ND	
PFOS	3.67	J	ND		4.34	J	ND	
PFPeA	67.3		ND		37.3		ND	

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
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
LC/MS/MS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SW	Surface water
ng/L	nanogram per liter

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Shallow

Northeastern Detention Pond
AOI1-SB02
AOI1-SB03
AOI 1
Southwestern Detention Pond
AOI1-SB01
AOI1-SB06
AOI1-SB04
AOI1-SB05

Intermediate

Northeastern Detention Pond
AOI1-SB03
AOI 1
Southwestern Detention Pond
AOI1-SB01
AOI1-SB06
AOI1-SB04
AOI1-SB05

Deep

Northeastern Detention Pond
AOI1-SB02
AOI1-SB03
AOI 1
Southwestern Detention Pond
AOI1-SB01
AOI1-SB06
AOI1-SB04
AOI1-SB05

Area of Interest
Facility Boundary

PFOS Results (µg/Kg)

ND
>ND - 10
>10 - 130
>130 - 1,600
>1,600

0 210 420 840 Feet

PFOS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at St. Cloud AASF #2, MN			
REVISED	5/27/2021	GIS BY	MS	5/27/2021
SCALE	1:5,040	CHK BY	JP	5/27/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,		PM	CM	5/27/2021

AECOM
12420 Milestone Center Drive
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Figure 6-1

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Area of Interest
Facility Boundary

PFOA Results (µg/Kg)

- ND
- >ND - 10
- >10 - 130
- >130 - 1,600
- >1,600

0 210 420 840 Feet

PFOA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at St. Cloud AASF #2, MN			
REVISED	5/27/2021	GIS BY	MS	5/27/2021
SCALE	1:5,040	CHK BY	JP	5/27/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,		PM	CM	5/27/2021

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-2

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PFOA

AOI1-SB03
Northeastern Detention Pond
AOI1-SB02
AOI 1
Southwestern Detention Pond
AOI1-SB01
AOI1-SB06
AOI1-SB04
AOI1-SB05

PFOS

AOI1-SB03
Northeastern Detention Pond
AOI1-SB02
AOI 1
Southwestern Detention Pond
AOI1-SB01
AOI1-SB06
AOI1-SB04
AOI1-SB05

0 175 350 700 Feet

Area of Interest
Facility Boundary

PFOA Results (ng/L)	PFOS Results (ng/L)
ND	ND
>ND - 10	>ND - 10
>10 - 40	>10 - 40
>40 - 70	>40 - 70
>70 - 400	>70 - 400
>400	>400

PFOA & PFOS Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at St. Cloud AASF #2, MN			
REVISED	5/27/2021	GIS BY	MS	5/27/2021
SCALE	1:4,200	CHK BY	JP	5/27/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,		PM	CM	5/27/2021

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Figure 6-3

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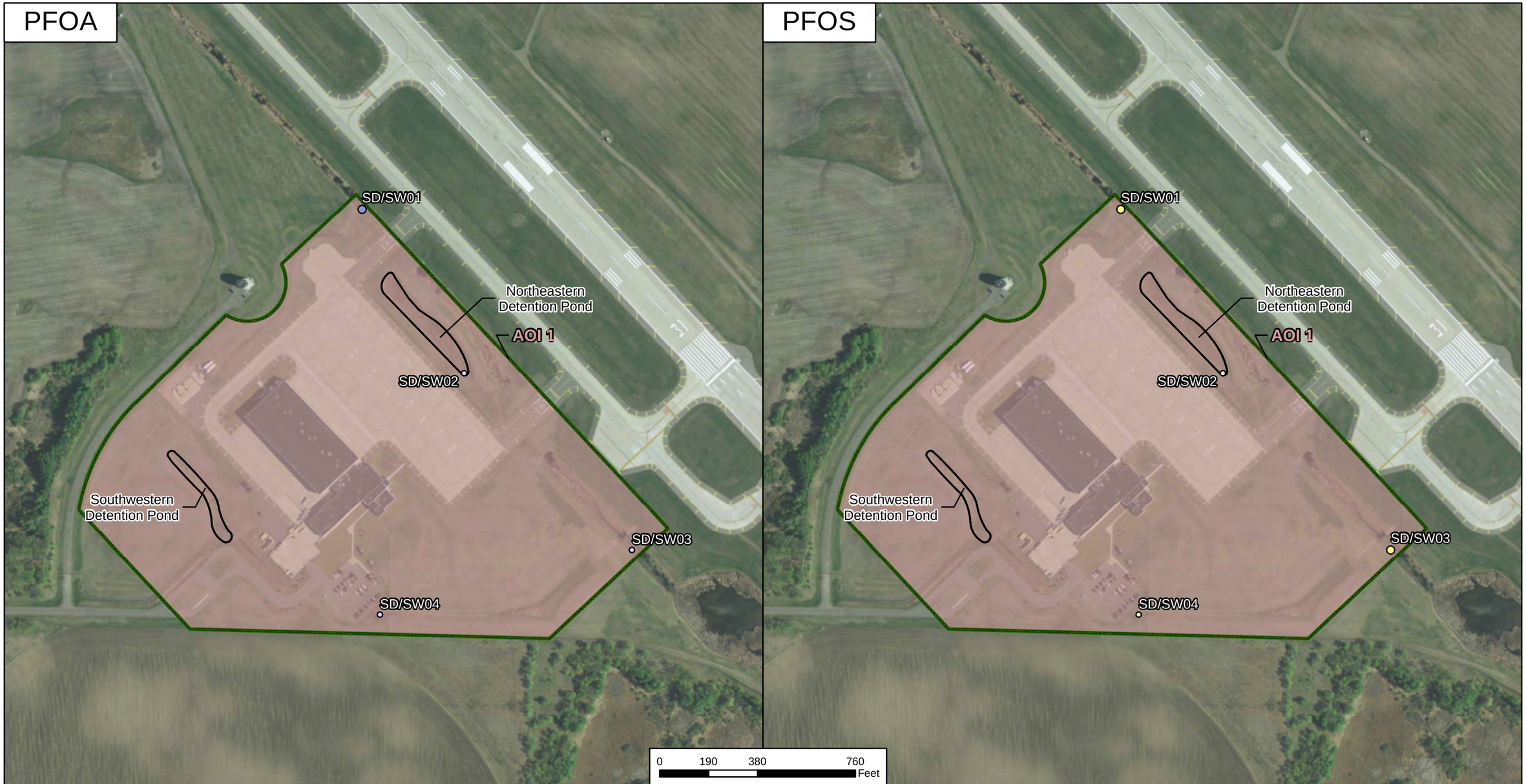

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at St. Cloud AASF #2, MN			
REVISED	5/27/2021	GIS BY	MS	5/27/2021
SCALE	1:4,560	CHK BY	JP	5/27/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	5/27/2021

Area of Interest
Facility Boundary

PFOA Results (ng/L)	PFOS Results (ng/L)
ND	ND
>ND - 10	>ND - 10
>10 - 100	>10 - 100
>100 - 1,000	>100 - 1,000
>1,000	>1,000

N

PFOA and PFOS Detections in Surface Water

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Figure 6-4

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PFOA

PFOS

SD/SW01
Northeastern Detention Pond
AOI 1
SD/SW02
Southwestern Detention Pond
SD/SW03
SD/SW04
SD/SW05

0 190 380 760 Feet

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at St. Cloud AASF #2, MN			
REVISED	5/27/2021	GIS BY	MS	5/27/2021
SCALE	1:4,560	CHK BY	JP	5/27/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	5/27/2021

Area of Interest
Facility Boundary

PFOA Results (µg/Kg)
- ND
- >ND - 10
- >10 - 100
- >100 - 1,000
- >1,000

PFOS Results (µg/Kg)
- ND
- >ND - 10
- >10 - 100
- >100 - 1,000
- >1,000

N

PFOA and PFOS Detections in Sediment

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Figure 6-5

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7.0 Exposure Pathways

The CSM for AOI 1, revised based on the SI findings, is presented on **Figure 7-1**. A CSM presents the current understanding of the facility 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 may warrant further investigation.

In general, the potential PFAS exposure pathways 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 facility workers, construction workers, trespassers, and nearby off-facility residents.

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 AOI 1 based on the aforementioned criteria.

7.1.1 AOI 1 – St. Cloud AASF #2

Releases of HEF occurred from the HEF fire suppression system at AASF #2 in 2009, 2011, and 2013. After the releases in 2009 and 2011, HEF was washed to the sanitary sewer and is, therefore, not suspected to have impacted AOI 1. However, after the release in June 2013, HEF was washed out of both sides of the hangar and plowed into the northeast and southwest detention ponds by the MNARNG. In addition, rotary-winged aircraft were washed on the northeast side of the hangar following the release, and the wash water could have dissipated in the northeast detention pond. Photographs provided by the MNARNG show HEF on the ground surface throughout the entire facility boundary and on the AASF #2 building following the June 2013 release.

PFOA, PFOS, and PFBS were not detected in soil at the facility. Based on the results of the SI, the exposure pathways via inhalation of dust and ingestion of soil are considered incomplete. The CSM is presented in **Figure 7-1**.

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 1 based on the aforementioned criteria.

7.2.1 AOI 1 – St. Cloud AASF #2

PFOA and PFOS were detected in groundwater from temporary monitoring wells at low levels in the source area and at the facility boundary; however, the detections did not exceed the SLs. PFBS was not detected in groundwater at the facility. Drinking water for AASF #2 is supplied by the City of St. Cloud, which uses the Mississippi River as its drinking water source (City of St. Cloud, 2011). Therefore, the ingestion exposure pathway is considered incomplete for facility workers, and trespassers. Domestic wells exist within 4 miles of the facility, and private, residential wells were observed in the area during the visual site inspection. Therefore, the ingestion exposure pathway is considered potentially complete for downgradient, off-facility residents. Additionally, the ingestion exposure pathway for future construction workers is considered potentially complete due to the detection of PFOA and PFOS. No current construction is occurring at AOI 1. The CSM is presented on **Figure 7-1**.

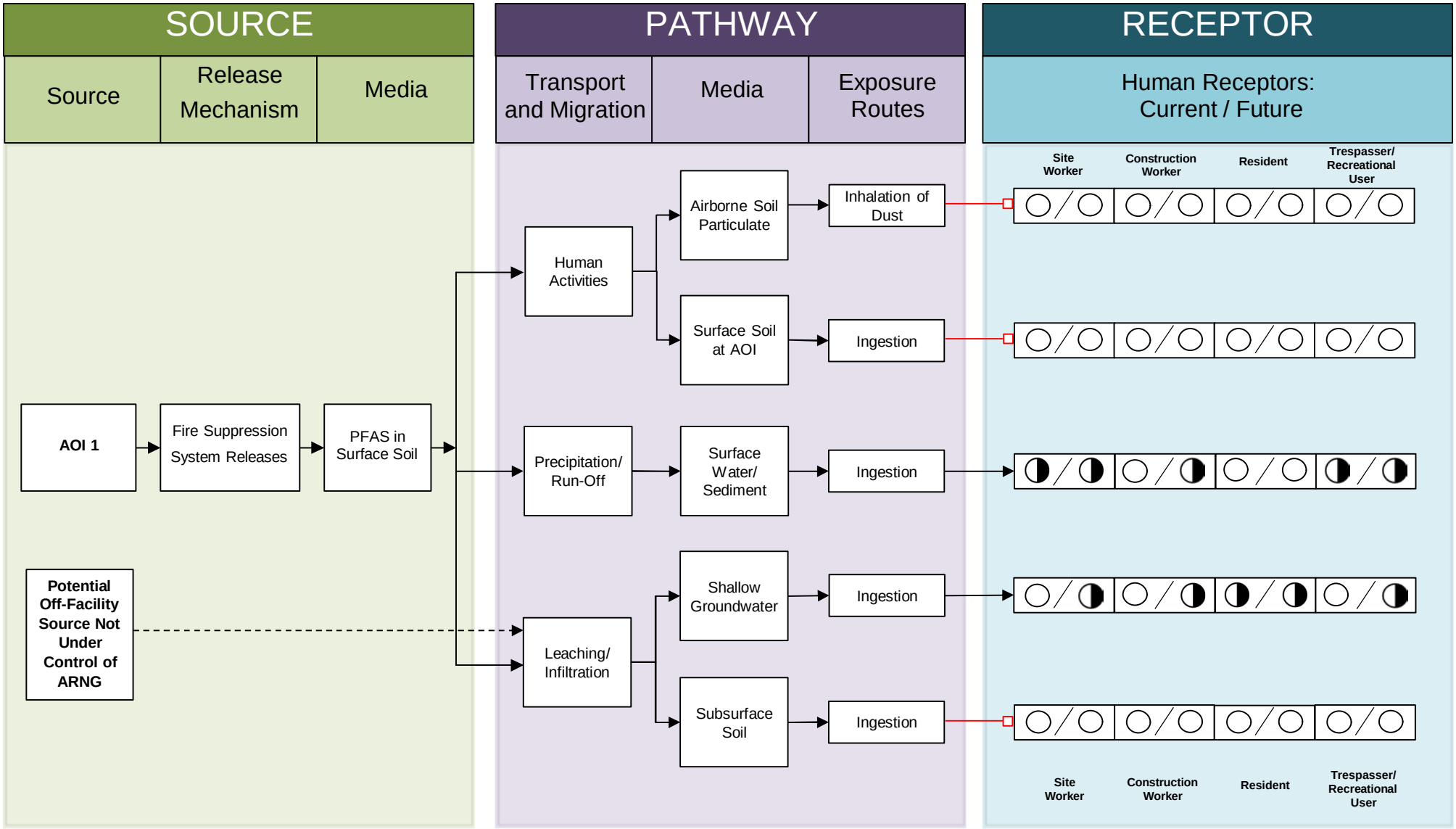
7.3 Surface Water and Sediment Exposure Pathways

The SI results for PFOA, PFOS, and PFBS in surface water and sediment were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 1 based on the aforementioned criteria.

7.3.1 AOI 1 – St. Cloud AASF #2

AASF #2 has detention ponds on both the northeastern and southwestern sides of the ramps that are flanked by wetlands that collect runoff from AASF #2. The detention ponds are approximately 3 feet deep and seeded with vegetation. Swales in both detention ponds carry intermittent surface water to storm sewers and the Elk River. The Elk River runs parallel to the Mississippi River before converging at the city of Elk River. Other regional surface water features include small lakes, tributaries, and wetlands.

PFOA, PFOS, and PFBS were detected in surface water samples collected from northeastern and southwestern detention ponds. These compounds were not detected in sediment at the facility. Based on the SI results, the ingestion pathway for surface water is considered potentially complete for facility workers, future construction workers, trespassers, and recreation users. The CSM is presented in **Figure 7-1**.



LEGEND

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

Notes:

1. The resident and recreational user receptors refer to an off-site resident or recreational user.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 7-1
Conceptual Site Model
AOI 1 St. Cloud AASF #2

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8.0 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 Summary

The SI field activities at AASF #2 were conducted from 15-17 October 2019 and 11-12 May 2020. The SI field activities included soil, groundwater, surface water, and sediment sampling. Field activities were conducted in accordance with the QAPP Addendum (AECOM, 2019b), except as previously noted in **Section 5.7**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2019b), samples were collected and analyzed for a subset of PFAS by LC/MS/MS QSM 5.1 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.

- Eighteen (18) soil samples from six locations;
- Six grab groundwater samples from the six temporary well locations;
- Five sediment samples; and
- Four surface water samples, which were co-located with sediment samples.

This information gathered during this investigation was used to determine if PFOA, PFOS, and/or PFBS were present at or above SLs. Additionally, the preliminary CSM was refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure to PFOA, PFOS, and PFBS at AOI 1, which are described in **Section 7.0**.

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.*

   PFAS contamination was confirmed to be present at the facility groundwater and surface water. PFAS were detected in the potential PFAS release areas, as well as near the facility boundary between source areas and potential drinking water receptors. However, detections in groundwater did not exceed the SLs for PFOA, PFOS, or PFBS.

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.*

   The AOI 1 PFAS release area was removed from further consideration based on the groundwater data collected during this SI. PFOA, PFOS, and PFBS were not detected in groundwater or soil above the SLs; therefore, AOI 1 poses no significant threat to human health or the environment.

3. *Determine the potential need for a removal action.*

   Based on the data collected during this SI, no need for a removal action was identified.

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 an environment with variable permeability and conductivity. Soils range from poorly graded sand with gravel (high conductivity) to sandy clays (low conductivity). Sand-dominated beds range up to 20 feet in thickness, whereas soils with lower conductivity are deposited in thicknesses ranging up to 12 feet.

   Based on the data collected during this SI, no further action is recommended for AOI 1 at this time.

5. *Identify within 4 miles of the installation other potential PFAS sources (fire stations, major manufacturers, other DoD facilities) and receptors, including both groundwater and surface water receptors, to determine whether the ARNG is the likely source of PFAS, or whether there is an off-facility source of PFAS responsible for installation detections of PFAS (USEPA, 2005).*

   Based upon the evaluation of groundwater and soil results in comparison to SLs, in combination with the qualitative, shallow groundwater flow direction determination to the south, the source of PFAS contamination at the facility may or may not be the result of historical DoD activities. Potential adjacent sources of PFAS include the St. Cloud Regional Airport. According to the PA (AECOM, 2019a), semiannual nozzle testing for the St. Cloud firetrucks is conducted at the airport, north of the airport's Aircraft Rescue and Fire Fighting Facility between the building and the ramp. During the nozzle testing, approximately 5 gallons of HEF mixture are released to the ground. No information was available on the type or concentration of foam used or stored at the facility, and no remediation activities are known to have occurred at this location. Additionally, the lack of monitoring wells between the St. Cloud Regional Airport and the AASF #2 make it difficult to determine the Airport as a potential upgradient source based on the perceived groundwater flow direction.

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 PFOA, PFOS, and PFBS in groundwater and surface water at source areas and near the facility boundary indicate there are potentially complete pathways for site workers, future construction workers, trespassers, and recreational users.

8.3 Outcome

Based on the preliminary CSM that was developed and revised based on the SI findings, there may be potential for exposure to residential drinking water receptors from sources at AASF #2 that resulted from historical DoD activities. Sample chemical analytical concentrations collected during this SI were compared against the SLs for PFOA and PFOS in groundwater and OSD screening levels for PFOS, PFOA, and PFBS in soil and groundwater. The results of the SI relative to the SLs are as follows:

- PFOA and PFOS were detected in groundwater in AOI 1 near the facility boundary with maximum detected concentrations of 2.74 J ng/L and 1.85 J ng/L, respectively. PFOA and PFOS detection in groundwater were below the SLs. PFBS was not detected in groundwater at AOI 1.
- PFOA, PFOS, and PFBS were not detected in soil at AOI 1.

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 limited potential for exposure to residential 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, no further action is recommended for AOI 1 at the AASF #2 at this time.

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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	St. Cloud AASF #2	○	◐	◐

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

Table 8-2: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	St. Cloud AASF #2	Detections in groundwater and surface water. No exceedances of the SLs in soil or groundwater.	No further action

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9.0 References

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