FINAL
Site Inspection Report
Bismarck Army Aviation Support Facility #1
Bismarck, North Dakota

Site Inspection for Perfluorooctanoic Acid (PFOA), Perfluorooctanesulfonic Acid (PFOS), Perfluorohexanesulfonic Acid (PFHxS), Perfluorononanoic Acid (PFNA), Hexafluoropropylene Oxide Dimer Acid (HFPO-DA), and Perfluorobutanesulfonic Acid (PFBS)
ARNG Installations, Nationwide

September 2023

Prepared for:

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

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
°F	Degrees Fahrenheit
%	Percent
µg/kg	Microgram(s) per kilogram
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
btoc	Below top of casing
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain-of-custody
CSM	Conceptual site model
DA	Department of the Army
DoD	Department of Defense
DPT	Direct-push technology
DQI	Data quality indicator
DQO	Data quality objective
DUA	Data Usability Assessment
EA	EA Engineering, Science, and Technology, Inc., PBC
EDR	Environmental Data Resources, Inc.
EIS	Extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
EB	Equipment Blank
FB	Field blank
FedEx	Federal Express
ft	Foot (feet)
GIS	Geographic information systems
GPR	Ground-penetrating radar
HEF	High Expansion Foam
HDPE	High-density polyethylene
HFPO-DA	Hexafluoropropylene oxide dimer acid
HQ	Hazard Quotient

IDW	Investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	Liquid chromatography tandem mass spectrometry
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LOQ	Limit of quantification
MIL-SPEC	military specification
MS	Matrix spike
MSD	Matrix spike duplicate
msl	Mean sea level
ND	North Dakota
NDDEQ	North Dakota Department of Environmental Quality
NELAP	National Environmental Laboratory Accreditation Program
ng/L	Nanogram(s) per liter
No.	Number
OSD	Office of the Secretary of Defense
PA	Preliminary assessment
PFAS	Per- and polyfluoroalkyl substances
PFBS	Perfluorobutanesulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PID	Photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	Polyvinyl chloride
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
QSM	Quality Systems Manual
RI	Remedial investigation
RPD	Relative percent difference
SI	Site Inspection
SL	Screening level
TOC	Total organic carbon
TPP	Technical Project Planning

UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
Wood	Wood Environment & Infrastructure Solutions, Inc.
WSP	WSP USA Environment and Infrastructure, Inc.

EXECUTIVE SUMMARY

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

The PA identified Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for AOI locations). The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on SLs for the relevant compounds. This SI was completed at the Bismarck Army Aviation Support Facility (AASF) #1 in Bismarck, North Dakota and determined that further investigation is warranted for AOI 1: Main Hangar, AOI 2: Fuel Point, AOI 3: Fuel Truck Parking, and potential upgradient PFAS sources. The Bismarck AASF #1 will also be referred to as the "Facility" throughout this document.

The Facility, operated by North Dakota ARNG (NDARNG), encompasses approximately 33.65 acres in Bismarck, North Dakota. The Facility is in Burleigh County, approximately 3 miles south of Bismarck, North Dakota. The Facility is located on the Bismarck Municipal Airport. The Facility is constructed on a parcel of land that has been leased and operated by the NDARNG since 1996. The term of the lease began in 1996 with a 50-year duration (AECOM, 2020).

The PA identified one AOI for investigation during the SI phase, AOI 1: Main Hangar. SI sampling results from AOI 1 were compared to OSD SLs. After the SI fieldwork was completed, two additional potential PFAS release areas were identified: AOI 2: Fuel Point and AOI 3: Fuel Truck Parking. **Table ES-2** summarizes the SI results for the AOIs. Based on the results of this SI, further evaluation under CERCLA is warranted in a Remedial Investigation (RI) for AOI 1: Main Hangar. As the identification of AOI 2 and AOI 3 did not occur until after the SI fieldwork,

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

investigation of these AOIs was not completed during the SI. AOI 2: Fuel Point, and AOI 3: Fuel Truck Parking will be assessed during the RI.

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

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

Notes:
1. Assistant Secretary of Defense. July 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Abbreviations:
µg/kg = microgram(s) per kilogram
ng/L = nanogram(s) per liter
bgs = below ground surface

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Main Hanger	●	●	●	Proceed to RI
2	Fuel Point	TBD	TBD	TBD	Proceed to RI
3	Fuel Truck Parking	TBD	TBD	TBD	Proceed to RI

Legend:
● = Detected; exceedance of screening levels
◐ = Detected; no exceedance of screening levels
○ = Not detected

1. INTRODUCTION

1.1 PROJECT AUTHORIZATION

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (Pas) and Site Inspections (SIs) at ARNG facilities nationwide based on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum regarding Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program (Assistant Secretary of Defense, 2022) from the Office of the Secretary of Defense (OSD) dated 6 July 2022. The six compounds listed in the OSD memorandum are referred to as "relevant compounds" throughout this document and include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA)[1]. The ARNG performed this SI at the Bismarck Army Aviation Support Facility (AASF) #1 in Bismarck, North Dakota. The Bismarck AASF #1 is also referred to as the "Facility" throughout this report.

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

1.2 SITE INSPECTION PURPOSE

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

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

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2. FACILITY BACKGROUND

2.1 FACILITY LOCATION AND DESCRIPTION

The Facility is in Burleigh County, approximately three miles south of Bismarck, North Dakota and located on the Bismarck Municipal Airport property (**Figure 2-1**). The Facility is accessible from Yegen Road from the south off of Airway Avenue. The Facility is constructed on a parcel of land that has been leased and operated by the North Dakota Army National Guard (NDARNG) since 1996. The Facility comprises approximately 33.65 acres of land owned by the City of Bismarck. The term of the lease began in 1996 with a 50-year duration (AECOM, 2020).

2.2 FACILITY ENVIRONMENTAL SETTING

The Bismarck AASF #1 is completely surrounded by the Bismarck Municipal Airport property. The areas beyond the airport property are mostly agricultural areas to the west, south, and east; light industrial areas directly south and to the north; a heavy industrial area to the northeast; and residential areas to the west (approximately 0.5 mile) and to the southwest (approximately 1.1 miles). The Facility sits at an elevation of approximately 1,650 feet (ft) above mean sea level (msl) and is located approximately 2.5 miles east of the Missouri River.

The following sections include information on geology, hydrogeology, hydrology, climate, and current and future land use. The topography at the Facility is shown on **Figure 2-2.** The regional geology and groundwater features are shown on **Figure 2-3**. The regional surface water features and drainage basins are shown on **Figure 2-4**. Groundwater elevations and contours are presented on **Figure 2-5**.

2.2.1 Geology

The Facility is located within the Apple Creek Uplands subdistrict of the Coteau Slope physiographic region. The Apple Creek Uplands subdistrict is known for having steep dissected valley walls and uplands. These valley walls and uplands have a thin sheet of drift over the bedrock. The glacial drift in the area is almost non-existent and typically just contains boulders and scattered patches of till, from the Wisconsin glaciation. In the Lake McKenzie Basin, alluvial sand and gravel primarily cover the floodplain deposits. Lake McKenzie Basin also contains moraine landforms that were created from the buildup of drift and till deposition from glacial ice. The sheet moraine that is located in the Apple Creek Uplands subdistrict has a thin layer of drift composed of till that lies over the stream-eroded bedrock. The layer of drift comprises outwash plain, end moraine, dead-ice moraine, ground moraine, and sheet moraine (AECOM, 2020).

During the SI, seven borings were advanced between 11.5 to 15 ft below ground surface (bgs). The soil was classified as poorly graded sand overlying clay (at approximately 10 to 11 ft bgs) at all boring locations. The grain size analysis conducted on the soil sample collected from the AOI confirms the field observation of poorly graded sand.

2.2.2 Hydrogeology

As part of the PA, a search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR™), which included a well search within a one-mile radius surrounding the Facility. Additionally, online resources, such as state and local Geographic Information Systems (GIS) databases were used to expand the well search to a four-mile radius around the Facility. No potable water wells are located within the boundary of the AASF. Two domestic, seven irrigation, 13 monitoring, and four wells of unknown use are located within a two-mile radius of the Facility (AECOM, 2020). The regional groundwater flow direction within the surficial aquifer was inferred to be easterly based on the location of surficial water bodies, namely Apple Creek located east of the facility. From a review of the North Dakota Department of Water Resources MapServices there are four wells (one domestic well, two irrigation wells, and an unknown well) that are within approximately one mile of the facility and potentially downgradient (**Figure 2-3**). According to the North Dakota Department of Water Resources MapServices, the domestic well is screened from 0 to 163 ft bgs, one irrigation well is screened from 77 to 87 ft bgs, the second irrigation well is screened from 0 to 81 ft bgs, and the unknown well is screened from 0 to 87 ft bgs (North Dakota, 2022). All other wells located within a two-mile radius of the Facility are located upgradient and cross-gradient of the Facility.

Depths to groundwater at the Facility as measured in November 2021 during the SI ranged from 8.5 to 11 ft bgs. Synoptic water level measurements taken from temporary wells during the SI fieldwork (see **Section 5.4**) indicated that the local groundwater flow is northeasterly. Groundwater elevation contours from the SI are presented on **Figure 2-4.** Drinking water for the Facility is supplied by the City of Bismarck Public Works, which sources water from the Missouri River (AECOM, 2020).

The Apple Creek Uplands subdistrict, which encompasses the Facility, is known for its stream-eroded bedrock and is covered with sheet moraine. In the drainage basin of Apple Creek, there are notable areas of sand dunes. This drainage valley carries some outwash but typically carries meltwater. The meltwater channels flow on high bedrock drainage divides and combines with other meltwater locations into the Missouri River. The valley fill ranges from depths of 4 to 20 ft (North Dakota Geological Survey, 1965; AECOM, 2020).

2.2.3 Hydrology

The Facility is located just to the east of the Missouri River, within the drainage basin of Apple Creek, which is part of the Missouri River Basin. Apple Creek is located approximately 0.5 miles to the east of the Facility, which flows to the south and discharges to the Missouri River. The Facility is connected to the Bismarck City Sewer System which leads to the Bismarck City wastewater treatment plant. At the Facility, surface runoff flows toward the catch basins located throughout the Facility (**Figure 2-4**). Surface runoff at the Facility exits to the northeast and enters the shared airport stormwater system and then ultimately discharges into Apple Creek located east of the Facility (AECOM, 2020).

2.2.4 Climate

The climate at the AASF consists of warm summers, freezing dry windy winters, and is partly cloudy year-round. The average temperature is 42.8 degrees Fahrenheit (°F), with warmer temperatures to at least 84°F and colder temperatures to at least -1.6°F. The annual average precipitation is 17.82 inches (AECOM, 2020).

2.2.5 Current and Future Land Use

The AASF is located on the Bismarck Municipal Airport. The Facility consists of an administration building, office areas, and hangars. Exterior features are vehicle parking areas and roads. Infrastructure improvements, land acquisitions, land use controls, and reasonably anticipated future land use is not anticipated to change (AECOM, 2020). The facility is fenced and has restricted access areas.

2.2.6 Sensitive Habitat and Threatened/Endangered Species

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

The following species are listed as federally endangered, threatened, proposed, and/or candidate species in Burleigh County, North Dakota (U.S. Fish and Wildlife Services, 2021):

Birds: Whooping Crane, *Grus americana* (endangered); Piping Plover, *Charadrius melodus* (threatened); Red Knot, *Calidris canutus rufa* (threatened)

Insects: Dakota Skipper, *Hesperia dacotae* (threatened); Monarch Butterfly, *Danaus plexippus* (candidate)

Mammals: Northern Long-eared Bat, *Myotis septentrionalis* (threatened).

2.3 HISTORY OF PFAS USE

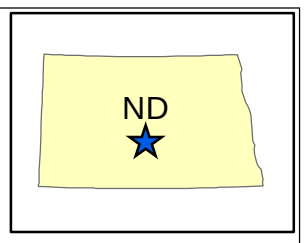
Aqueous film forming foam (AFFF), a firefighting agent, was commonly used by the U.S. military to extinguish petroleum fires, for firefighting training, and for the suppression of fires in uncontained areas. Military use of AFFF began in the 1970s and was most widely used at Department of Defense (DoD) installations with airfields. The Main Hangar was identified as a potential PFAS release area at the Facility during the PA (AECOM, 2020). A fire suppression system for the Main Hangar was installed in 2006 by the NDARNG during the construction of the northern section of the Main Hangar. The Main Hangar fire suppression system consists of one 300-gallon tank filled with two percent (%) C2 High Expansion Foam (HEF), although it is unknown whether two percent C2 HEF contains fluorinated compounds. Approximately 100 gallons of bulk 6% AFFF, for use during overland firefighting response, was stored in the Hazardous Materials Room which is located in the northern section of the Main Hangar. There were also 14 TriMax30^{TM} fire extinguishers filled with AFFF stored inside the Main Hangar, some of which were taken out on the ramp for very short durations for operations. While there

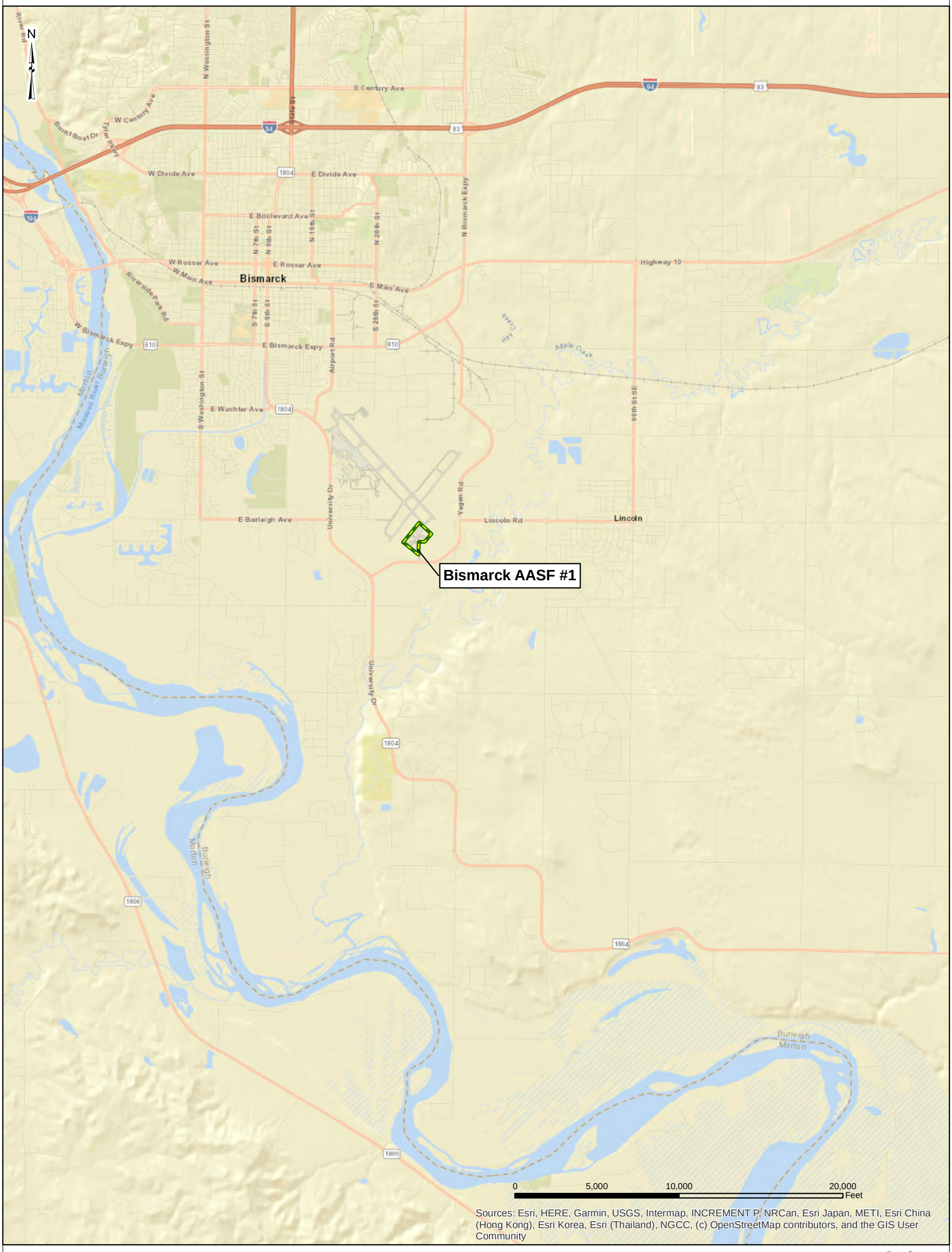
were no known releases noted in the PA, the Main Hangar was identified as an AOI due to the storage of PFAS at the Facility. During preparation of the SI Report, it was discovered that TriMax30™ fire extinguishers had occasionally been stored at the Fuel Point and the Fuel Truck Parking since at least 2011. Based on this information, the Fuel Point and the Fuel Truck Parking were identified as AOIs and will also be investigated as part of the RI. A description of each AOI is presented in **Section 3**.

Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

wood.

Figure 2-1
Facility Location





Facility Data

Facility Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:.....JANUARY 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:.....NAD 1983 StatePlane

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Army National Guard Site Inspections
Site Inspection Report
Bismark AASF #1, North Dakota

Figure 2-2
Facility Topography

Facility Data

- Building
- Potential PFAS Release
- Area of Interest
- Facility Boundary

Topography

- Elevation Contour (10 ft. interval, NAVD88 datum)

Data Sources:
ESRI 2020
AECOM 2020

Date:.....APRIL 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:.....NAD 1983 StatePlane

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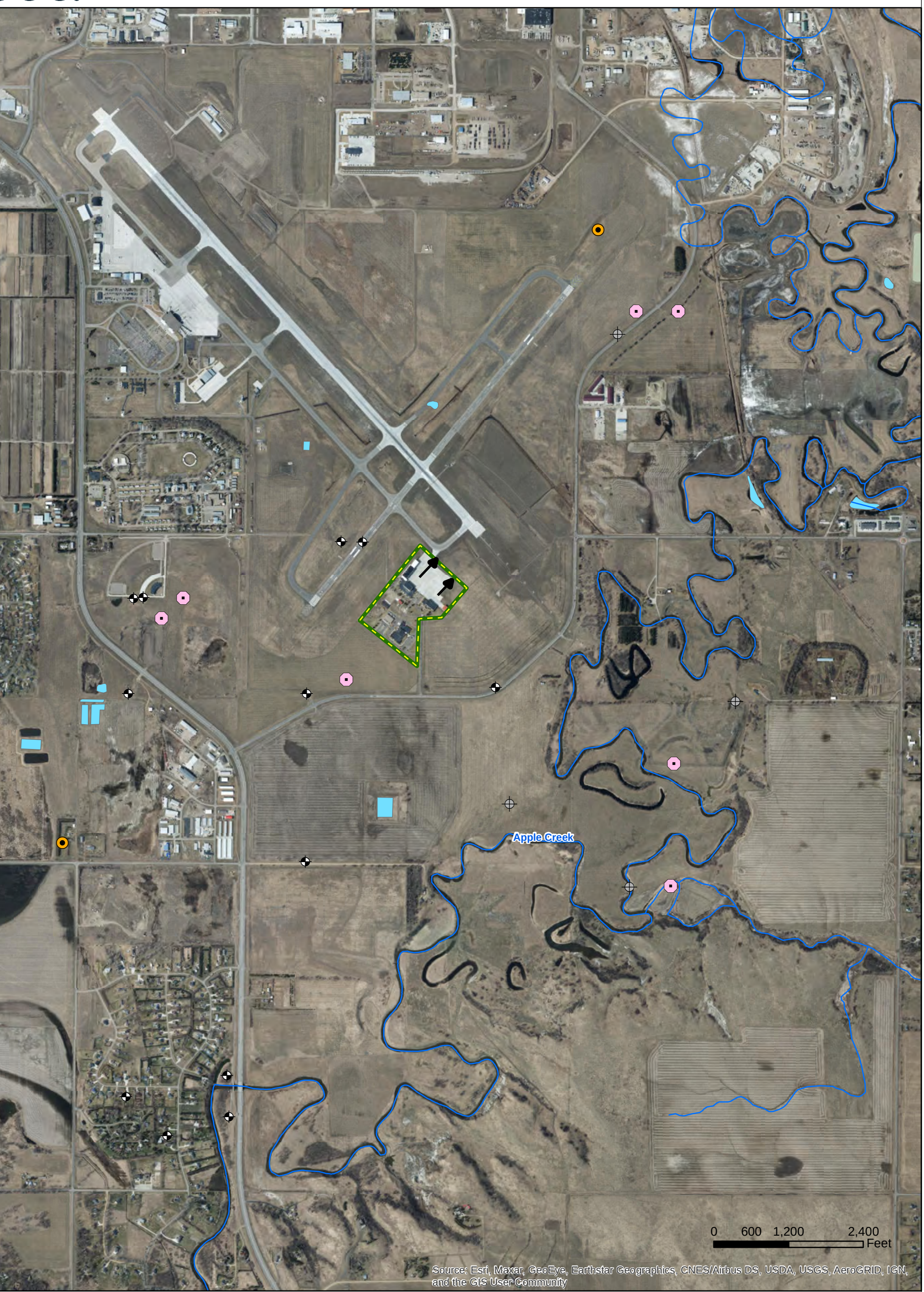
Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

Figure 2-3
Groundwater Features



ND

Facility Data
- Facility Boundary

Wells
- Domestic Well
- Irrigation Well
- Monitoring/Observation Well
- Other/Unknown Well

Hydrology/Hydrogeology
- Shallow Groundwater Flow Direction (November 2021)
- Rivers/Streams
- Water Body

Data Sources:
ESRI 2020
AECOM 2020

Date:.....JANUARY 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:....NAD 1983 StatePlane

G:\ANG\a_MXD\BismarkND\Figure 10-2 Groundwater Features.mxd - megan.cameron - 1/21/2022 - 10:38:42 AM

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Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

wood.

Figure 2-4
Surface Water Features

ND

Facility Data
- Facility Boundary
- Building
- Potential PFAS Release
- Area of Interest

Wells
- Irrigation Well
- Monitoring/Observation Well

Hydrology/Hydrogeology
- Surface Water Flow Direction
- Shallow Groundwater Flow Direction (November 2021)
- Watershed
- River/Stream
- Water Bodies

Utilities
- Stormwater Line
- Sewer Line
- Manhole (Stormwater Line)
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator

Data Sources:
ESRI 2020
AECOM 2020

Date:.....JANUARY 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:...NAD 1983 StatePlane

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Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

wood.

Figure 2-5
Groundwater Elevations, November 2021

ND

Facility Data

- Temporary Monitoring Well
- Manhole (Stormwater Line)
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator
- ContourGroundwater Elevation Contour Interval (.25 feet)
- Inferred Groundwater Elevation Contour Interval (.25 feet)
- Groundwater Flow Direction
- Stormwater Line
- Sewer Line
- RetentionBasin
- Building
- Potential PFAS Release
- Area of Interest
- Facility Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:.....JANUARY 2023
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:...NAD 1983 StatePlane

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3. SUMMARY OF AREAS OF INTEREST

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, one potential release area was identified at the Facility and identified as: AOI 1 Main Hanger. AOI 1 is the subject of this SI. During preparation of the SI Report, two additional potential release areas were identified and will be assessed during the RI: AOI 2 Fuel Point and AOI 3 Fuel Truck Parking. The AOIs are shown on **Figure 3-1**.

3.1 AOI 1 – MAIN HANGAR

The Main Hangar AOI is located in the northwestern portion of the Bismarck AASF #1 property and consists of two hangar spaces (northern and southern) connected by a smaller room used for the storage of maintenance equipment (Maintenance Room). The southern hangar was built in 1975 without a fire suppression system, and the northern hangar was built in 2006. A fire suppression system for the entire Main Hangar was installed in 2006 by the NDARNG during the construction of the northern hangar. The hangar fire suppression system consists of one 300-gallon tank filled with 2% C2 HEF. Following installation in 2006, the fire suppression system was tested resulting in a full system release to the hangar. The hangar doors were closed during testing allowing the C2 HEF to flow to the Main Hangar drains, which drain to the oil/water separator (OWS) (AECOM, 2020). It is unknown whether 2% C2 HEF contains fluorinated compounds; however, due to the uncertainty of the unknown chemical composition of the 2% C2 HEF, the area immediately surrounding the Main Hangar was included in the boundary of AOI 1. The structural integrity of the OWS and the sewer lines is unknown and can potentially act as a conduit for PFAS migration to the groundwater.

Fourteen TriMax30™ fire extinguishers filled with AFFF were observed in the Main Hangar during the PA facility visit. Some of these fire extinguishers were taken out on the ramp for very short durations for operations. Disposal records document the disposal of 10 TriMax30™ fire extinguishers. A thorough search has been conducted at the facility, and no TriMax30™ fire extinguishers remain. The four TriMax30™ fire extinguishers that remain unaccounted for may have been shipped elsewhere between the PA Facility visit and the disposal of the 10 TriMax30™ fire extinguishers.

Historically, hydrostatic testing was conducted on the TriMax30™ fire extinguishers every five years. During the testing, NDARNG emptied the TriMax30™ fire extinguishers into polyethylene tanks that were stored in the Maintenance Room. The emptied TriMax30™ fire extinguishers were sent to a contractor to undergo hydrostatic testing. When the fire extinguishers were returned, they were refilled by the NDARNG with the original AFFF solution from the polyethylene tanks in the Maintenance Room. All the drains in the Maintenance Room discharge into an OWS. According to the PA, the TriMax30™ fire extinguishers have not been used to put out a fire, or in fire training exercises (AECOM, 2020). All AFFF liquids, debris, and equipment have been removed from the Facility and are no longer present.

Approximately 100 gallons of bulk 6% AFFF, for use during overland firefighting response, was also historically stored in the Hazardous Materials Room, located in the northern section of the Main Hangar. Potential releases identified at the Facility may have occurred on paved surfaces.

AFFF releases to the paved surfaces could have infiltrated the subsurface via cracks in the pavement or joints between areas that are paved. If the 2006 release of 2% C2 HEF was not contained within the Main Hangar, 2% C2 HEF runoff could have traveled to the unpaved surface and infiltrated the soil into the groundwater, or to the stormwater catch basins located at the ramp area. The stormwater lines ultimately discharge to Apple Creek (AECOM, 2020).

3.2 AOI 2 – FUEL POINT

Following the SI fieldwork, photographs were found showing that a TriMax30™ fire extinguisher was stored near the Fuel Point for emergencies. The photographs of the TriMax30™ were taken in 2011. Subsequent photographs of the area indicate that the fire extinguisher was replaced sometime between 2011 and 2020.

3.3 AOI 3 – FUEL TRUCK PARKING

Following the SI fieldwork, photographs were found showing that a TriMax30™ fire extinguisher was stored near the Fuel Truck Parking for emergencies. The photographs of the TriMax30™ were taken in 2017. Subsequent photographs of the area indicate that the fire extinguisher was replaced sometime between 2017 and 2020.

3.4 ADJACENT SOURCES

Two potential off-facility sources of PFAS are adjacent to the Facility and are not under the control of the NDARNG. A description of each off-facility source is presented below and shown on **Figure 3-1**.

3.4.1 Bismarck Airport Fire Department

The Bismarck Airport Fire Department provides emergency response to the Facility. The fire department is located approximately 0.75 miles northwest of the Facility on the Bismarck Airport property. Based on synoptic water levels measured during the SI (see **Section 5.4**), the Bismarck Airport Fire Department appears to be cross-gradient of the Facility (**Figure 3-1**). The Bismarck Airport Fire Department has three fire trucks with AFFF tanks. One truck has a 400-gallon capacity of AFFF, and the other two have a 200-gallon capacity of AFFF. The fire department has approximately 800 to 1,000-gallons of bulk 6% AFFF stored within the fire station. The fire department has never had to respond to a fire or crash at the airport. During annual fire truck nozzle testing, the AFFF is dispensed from the fire trucks and containerized in 55-gallon drums. It is unknown whether the nozzle testing has always been performed in a manner that containerizes AFFF. Annual fire training by the fire department is currently conducted using only water, but it is unknown whether AFFF has ever been used for training purposes (AECOM, 2020).

3.4.2 Corporate Hangars

Private corporate hangars are located approximately 0.88 miles northwest of the Facility. Based on synoptic water levels measured during the SI (see **Section 5.4**), the Corporate Hangars appears to be cross-gradient of the Facility (**Figure 3-1**). There are also numerous hangar

facilities located northwest of the Main Terminal. An interviewee with the NDARNG stated that the corporate hangars have a fire suppression system; however, the type of fire suppressant used in the fire suppression system is unknown. The corporate hangars have been identified as a potential adjacent source due to the possibility that the fire suppression system may contain AFFF. No additional information for the corporate hangar was available during the Facility visit (AECOM, 2020).

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Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

wood.

Figure 3-1
Areas of Interest

Facility Data

- Potential PFAS Release
- Potential PFAS Release Area (Identified after SI, to be investigated in RI)
- Area of Interest
- Building
- Facility Boundary
- Stormwater Line

Hydrology/ Hydrogeology

- Surface Water Flow Direction
- Shallow Groundwater Flow Direction (November 2021)
- Water Bodies

Data Sources:
ESRI 2020
AECOM 2020

Date:.....APRIL 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:..NAD 1983 StatePlane

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4. PROJECT DATA QUALITY OBJECTIVES

As identified during the Data Quality Objective (DQO) process and outlined in the SI Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) Addendum (EA/Wood, 2021a), the objective of the SI is to identify whether there has been a release to the environment at the AOIs identified in the PA. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for the presence or absence of relevant compounds at AOI 1; AOIs 2 and 3 will be assessed during the RI.

4.1 PROBLEM STATEMENT

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

4.2 INFORMATION INPUTS

Primary information inputs for the SI include the following:

- The PA Report for Bismarck AASF #1 (AECOM, 2020);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the facility-specific UFP –QAPP Addendum (EA/Wood, 2021a); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 STUDY BOUNDARIES

The scope of the SI was bounded horizontally by the property limits of the Facility (**Figures 2-1 and 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s). The scope of the SI was vertically bounded as follows: groundwater (11 ft bgs) and soil from direct-push technology (DPT) borings (15 ft bgs). Temporal boundaries were limited to the earliest available time field resources were available to complete the study.

4.4 ANALYTICAL APPROACH

Samples were analyzed by Eurofins, accredited under the DoD Environmental Laboratory Accreditation Program (DoD ELAP; Accreditation Number 1.01) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 021). Data were compared to applicable SLs within this document and decision rules as defined in the UFP-QAPP Addendum (EA/Wood, 2021a).

4.5 DATA USABILITY ASSESSMENT

The Data Usability Assessment (DUA), which is provided in **Appendix A**, is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment determines whether project execution and the resulting data have met installation specific DQOs. Both sampling and analytical activities are considered to assess whether the collected data are of the right type, quality, and quantity to support the decision-making (DoD, 2019a, DoD, 2019b, USEPA, 2017).

Based on the DUA, the environmental data collected during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUA and its associated data validation reports. These data are of sufficient quality to meet the objectives and requirements of the UFP-QAPP (EA, 2020a).

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 was implemented in accordance with the following approved documents.

- *Final Preliminary Assessment Report, Bismarck Army Aviation Support Facility #1, North Dakota,* dated August 2020 (AECOM, 2020)

- *Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan, Site Inspections for Per- and Polyfluoroalkyl Substances Impacted Sites, ARNG Installations, Nationwide,* dated December 2020 (EA, 2020a)

- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Bismarck Army Aviation Support #1, North Dakota* dated October 2021 (EA/Wood, 2021a)

- *Final Programmatic Accident Prevention Plan, Revision 1,* dated November 2020 (EA, 2020b)

- *Final Site Safety and Health Plan, Bismarck Army Aviation Support Facility #1, North Dakota,* dated May 2021 (EA/Wood, 2021b).

The SI field activities were conducted from 01 to 03 November 2021 and consisted of utility clearance, DPT borings and soil sample collection, temporary monitoring well installation and grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the UFP-QAPP Addendum (EA/Wood, 2021a), except as noted in **Section 5.8**.

The following samples were collected during the SI and analyzed for 24 compounds via liquid chromatography/tandem mass spectrometry (LC/MS/MS) compliant with QSM Version 5.3 Table B-15 to fulfill the project DQOs:

- Nine (9) soil samples from three locations (AOI01-02, AOI01-03, and AOI01-04);
- Seven (7) grab groundwater samples from temporary well locations;
- Five (5) quality assurance (QA)/quality control (QC) samples.

Figure 5-1 provides the sample locations for all media across the Facility. **Table 5-1** presents the list of samples collected for each medium. Field documentation is provided in **Appendix B**. A log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**, land survey data are provided in **Appendix B3**, a Field Change Request Form is provided in **Appendix B4**, and investigation-derived waste (IDW) placement locations 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. Additionally, a Facility visit with Wood Environment & Infrastructure Solutions, Inc. (Wood, prior to 21 September 2022, now WSP USA Environment and Infrastructure, Inc. [WSP]), ARNG, NDARNG, and North Dakota Department of Environmental Quality (NDDEQ) was conducted. Details of these activities are presented below.

5.1.1 Technical Project Planning

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

A combined TPP Meeting 1 and 2 was held on 05 October 2021, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. As part of TPP Meeting 1 and 2, Wood, ARNG, NDARNG, and NDDEQ conducted a Facility walk.

The stakeholders for this SI include ARNG, NDARNG, NDDEQ, USACE, 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 UFP-QAPP Addendum (EA/Wood 2021a).

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

5.1.2 Utility Clearance

WSP contacted the North Dakota One Call to notify them of intrusive work at the Facility. Wood contracted GPRS, Inc., a private utility location service, to perform utility clearance at the Facility. Utility clearance was performed at each of the proposed boring locations on 01 November 2021 with input from the WSP field team. General locating services and ground-penetrating radar (GPR) were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared by WSP's drilling subcontractor, Dakota Drilling, Inc., using a hand auger 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 meet acceptability criteria, as defined in the UFP-QAPP Addendum, prior to the start of field activities. A sample from a potable water source at Bismarck AASF #1, was collected on 05 October 2021, prior to mobilization, and analyzed for PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 (DoD, 2020). The results of the sample of the potable water source used for decontamination of drilling and reusable sampling equipment during the SI are provided in **Appendix F**. A discussion of the results is presented in the Data Usability Assessment (**Appendix A**).

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 appendix to the Programmatic UFP-QAPP (PQAPP) (EA, 2020a).

5.2 SOIL BORINGS AND SOIL SAMPLING

Soil samples were collected via DPT drilling methods in accordance with Standard Operating Procedure 047 *Direct-Push Technology Sampling* (EA, 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 5 ft of the boring in compliance with utility clearance procedures. The soil boring locations are shown on **Figure 5-1**, and boring sample depths are provided in **Table 5-1**. Several boring locations were adjusted within an 80-feet offset for reasons including drill rig access, utility avoidance and bias toward sampling within observed drainage features.

Three discrete soil samples were collected for chemical analysis from each of three soil borings: one sample at the surface (0 to 2 ft bgs) and two subsurface soil samples. One subsurface soil sample was collected approximately 1 ft above the groundwater table and one collected at the mid-point between the surface and the groundwater table (not to exceed 15 ft bgs). Groundwater was encountered at depths ranging from 8.39 to 10.92 ft bgs during drilling. Total boring completion depths, to accommodate temporary well installation, ranged from 12 to 15 ft bgs.

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

Each sample was collected into a laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottle 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 (liquid chromatography tandem mass spectrometry [LC/MS/MS] compliant with QSM Version 5.3 Table B-15), total organic carbon (TOC, EPA

Method 9060A), pH (EPA Method 9045D), and grain size (ASTM Method D-422) in accordance with the UFP-QAPP Addendum (EA/Wood, 2021a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike/matrix spike duplicate (MS/MSD) 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, one equipment blank (EB) was collected per day and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler for use in confirming that samples were preserved at or below 6 degrees Celsius (°C) during shipment.

DPT borings were converted to temporary wells, which were subsequently abandoned after sampling and surveying in accordance with the UFP-QAPP Addendum (EA/Wood, 2021a). After removal of the casings, boreholes were abandoned using bentonite chips. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 TEMPORARY WELL INSTALLATION AND GROUNDWATER GRAB SAMPLING

Temporary wells were installed using a GeoProbe® 7822DT dual-tube sampling system. Once the borehole was advanced to the desired depth, a temporary well was constructed of a 5-ft section of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach the 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 in **Table 5-2**.

Groundwater samples were collected after a period of time following well installation to allow groundwater to infiltrate and recharge the temporary well screen intervals. After the recharge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. The temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) before each grab sample was collected in a separate container. The temporary monitoring wells at locations AOI01-03 and AOI01-04 went dry while purging, therefore the groundwater samples were collected after the wells recharged enough to fill the sample containers in accordance with the UFP-QAPP Addendum (EA/Wood, 2021a). 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 in 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 Version 5.3 Table B-15 in accordance with the UFP-QAPP Addendum (EA/Wood, 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 blank (FB) sample was collected in accordance with the UFP-QAPP Addendum (EA, 2021a). A temperature blank was placed in each cooler for use in confirming that samples were preserved at or below 6°C during shipment.

Following well surveying (described below in **Section 5.7**), temporary wells were abandoned in accordance with the SI UFP-QAPP Addendum (EA/Wood, 2021a) by removing the PVC and backfilling the hole with bentonite chips.

5.4 SYNOPTIC WATER LEVEL MEASUREMENTS

A synoptic groundwater gauging event was performed on 3 November 2021. Groundwater elevation measurements were collected from the seven new temporary monitoring wells. Water level measurements were taken from the survey mark on the northern side of the well casing. Groundwater elevation data is provided in **Table 5-3**. A groundwater flow contour map is provided as **Figure 2-4**.

5.5 SURVEYING

The northern side of each new temporary well casing was surveyed using a TOPCON Hiper V global positioning system with FC-5000 data collection software. Positions were collected in the applicable Universal Transverse Mercator zone projection with World Geodetic System 1984 datum (horizontal) and North American Vertical Datum 1988 (vertical). Surveying data were collected on 04 November 2021 and are provided in **Appendix B3**.

5.6 INVESTIGATION-DERIVED WASTE

As of the date of this report, the disposal of PFAS IDW is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the UFP-QAPP Addendum (EA/Wood, 2021a).

Soil IDW (i.e., soil cuttings) and liquid IDW (i.e., purge water, development water, and decontamination fluids) generated during the SI activities were discharged directly to the ground surface at a point slightly downgradient of the source of generation. The IDW was not sampled and assumes the characteristics of the associated samples collected from that source location. Geographic coordinates were collected using a Global positioning system (GPS) at each location where IDW was placed (i.e., an IDW point). The IDW points are displayed on the figure in **Appendix B5**.

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

5.7 LABORATORY ANALYTICAL METHODS

Samples were analyzed by LC/MS/MS, compliant with QSM Version 5.3 Table B-15, at Eurofins in Lancaster, Pennsylvania, a DoD ELAP and NELAP-certified laboratory.

Soil samples were also analyzed for TOC using EPA Method 9060A, pH by EPA Method 9045D, and grain size using ASTM Method D-422.

5.8 Deviations from SI UFP-QAPP Addendum

Deviations from the UFP-QAPP Addendum occurred based on conditions encountered during field activities. These deviations were discussed between WSP, EA, ARNG, and USACE. One deviation from the UFP-QAPP Addendum is noted below:

- The location of AOI01-02 was adjusted approximately 80 ft northeast of the proposed location to avoid a potential conflict with an underground watermain in that area. The new location was in a low point of a drainage swale that is adjacent to the concrete apron. Facility personnel noted that this was likely the drainage path of any foam that would have escaped Building 3410. A field change request form documenting the relocation was submitted to USACE and ARNG on 2 November 2021. The approved field change request form is included in **Appendix B4**.

Table 5-1. Samples by Medium
Bismarck AASF #1, Bismarck, North Dakota
Site Inspection Report

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15)	TOC (EPA Method 9060A)	pH (EPA Method 9045D)	Grain Size (ASTM D422)	Comments
Soil Samples							
AOI01-02-SB-0-2	11/02/2021	0-2	X				
AOI01-02-SB-3-4	11/02/2021	3-4	X				
AOI01-02-SB-5-6	11/02/2021	5-6	X				
AOI01-03-SB-0-2	11/02/2021	0-2	X				MS/MSD Collected
AOI01-03-SB-2-4	11/02/2021	2-4		X	X	X	
AOI01-03-SB-4-5	11/02/2021	4-5	X				
AOI01-03-SB-7-8	11/02/2021	7-8	X				
AOI01-04-SB-0-2	11/02/2021	0-2	X				Parent Sample of AOI01-SB-DUP01
AOI01-SB-DUP01	11/02/2021	0-2	X				Field Duplicate
AOI01-04-SB-4-5	11/02/2021	4-5	X				
AOI01-04-SB-9-10	11/02/2021	9-10	X				
Groundwater Samples							
AOI01-01-GW	11/03/2021		X				MS/MSD Collected
AOI01-02-GW	11/03/2021		X				
AOI01-03-GW	11/03/2021		X				
AOI01-04-GW	11/03/2021		X				
AOI01-05-GW	11/03/2021		X				
AOI01-06-GW	11/03/2021		X				Parent Sample of AOI01-GW-DUP01
AOI01-GW-DUP01	11/03/2021		X				
BAASF-01-GW	11/03/2021		X				
Blank Samples							
BAASF-EB-01-HA	11/02/2021		X				Equipment Blank Collected from Hand Auger
BAASF-FB-01	11/03/2021		X				Field Blank
BAASF-EB-02-WLM	11/03/2021		X				Equipment Blank Collected from Water Level Meter

Notes:

ASTM = American Society for Testing and Materials
bgs = below ground surface
EB = equipment blank
FB = field blank
ft = feet
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
QSM = Quality Systems Manual
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2. Soil Boring Depths and Temporary Well Screen Intervals
Bismarck AASF #1, Bismarck, North Dakota
Site Inspection Report

Area of Interest	Boring Location	Soil Boring Depth (ft bgs)	Temporary Well Screen Interval (ft bgs)
1	AOI01-01	15.0	10.0 – 15.0
	AOI01-02	11.5	6.5 – 11.5
	AOI01-03	14.0	9.0 – 14.0
	AOI01-04	15.0	10.0 – 15.0
	AOI01-05	15.0	10.0 – 15.0
	AOI01-06	12.0	7.0 – 12.0
	BAASF-01	13.0	8.0 – 13.0

Notes:
bgs = below ground surface
ft = feet

Table 5-3. Groundwater Elevation
Bismarck AASF #1, Bismarck, North Dakota
Site Inspection Report

Monitoring Well ID	Top of Casing Elevation (ft NAVD88)	Depth to Water (ft btoc)	Depth to Water (ft bgs)	Groundwater Elevation (ft NAVD88)
AOI01-01	1650.843	9.70	7.01	1641.14
AOI01-02	1651.646	10.92	7.22	1640.72
AOI01-03	1651.978	10.26	10.32	1641.71
AOI01-04	1651.351	9.53	9.82	1641.82
AOI01-05	1650.601	8.49	8.39	1642.11
AOI01-06	1649.472	9.05	6.83	1640.42
BAASF-01	1651.989	10.23	8.98	1641.76

Notes:
bgs = below ground surface
btoc = below top of casing
ft = feet
NAVD88 = North American Vertical Datum 1988

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Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

wood.

Figure 5-1
Site Inspection Sample Locations

ND

Facility Data

- Manhole (Stormwater Line)
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator
- Temporary Groundwater Well Location
- Soil Boring and Temporary Groundwater Well Location
- Stormwater Line
- Sewer Line
- Surface Water Flow Direction
- Shallow Groundwater Flow Direction (November 2021)
- RetentionBasin
- Building
- Potential PFAS Release
- Area of Interest
- Facility Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:..... JANUARY 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:...NAD 1983 StatePlane

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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 **Sections 6.2, 6.3 and 6.4**. **Tables 6-2** through **6-5** present results in soil or groundwater for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 SCREENING LEVELS

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the OSD (Assistant Secretary of Defense, 2022). 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 the next phase under CERCLA. The SLs established in the OSD memorandum apply to the five compounds presented on **Table 6-1**.

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

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

Notes:
1. Assistant Secretary of Defense. July 2022. Risk Based Screening Levels in Groundwater and Soil using U.S. Environmental Protection Agency's (EPA's) Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Abbreviations:
µg/kg = microgram(s) per kilogram
bgs = below ground surface
ft = feet
ng/L = nanogram(s) per liter

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 Facility: the residential scenario is applied to surface soil results (0 to 2

feet bgs) and the industrial/commercial worker scenario is applied to shallow subsurface soil results (2 to 15 feet bgs). The SLs are not applied to deep subsurface soil results (>15 feet bgs) because 15 feet is the anticipated limit of construction activities.

6.2 SOIL PHYSICOCHEMICAL ANALYSES

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

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport. According to the Interstate Technology Regulatory Council (ITRC), several important 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 and groundwater in comparison to SLs for AOI 1: Main Hangar. The soil and groundwater results are summarized in **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

Soil samples were collected from three boring locations associated with AOI 1 during the SI. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Tables 6-2** through **6-4** summarize the soil results.

Surface soil (0 to 2 ft bgs) was sampled from boring locations AOI01-02 through AOI01-04, with a duplicate surface soil sample collected at AOI01-04. Soil was also sampled from shallow subsurface soil (3 to 5 ft bgs) and deep subsurface soil intervals (5 to 10 ft bgs) from boring locations AOI01-02 through AOI01-04.

PFOS was detected in surface soil above the SL with a maximum concentration of 26 µg/kg (AOI01-04 duplicate). PFHxS and PFOA were detected in surface soil at concentrations below their respective SLs. PFHxS was detected in two of the four surface soil samples at locations AOI01-02 and AOI01-04 (duplicate sample only) at a maximum concentration of 0.36 µg/kg. PFOA was detected in two of the four surface soil samples at location AOI01-04 (and its duplicate) at maximum concentration of 0.38 J µg/kg, where J denotes an estimated concentration. PFBS and PFNA were not detected in the surface soil samples.

PFHxS and PFOS were detected in shallow subsurface soil at concentrations below their respective SLs. PFHxS was detected in one of three locations (AOI01-04) at 1.1 µg/kg. PFOS was detected in one of three locations (AOI01-04) at 1.4 J µg/kg. PFOA, PFBS and PFNA were not detected in the shallow subsurface soil samples.

PFOS was detected in deep subsurface soil at concentrations below the SLs. PFOS was detected in one of three locations (AOI01-04) at 6.3 µg/kg. PFOA, PFBS, PFHxS and PFNA were not detected in the deep subsurface soil samples.

6.3.2 AOI 1 Groundwater Analytical Results

Groundwater samples were collected from seven temporary wells associated with AOI 1 during the SI. **Figure 6-6 and Figure 6-7** presents the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

Groundwater was sampled from temporary monitoring well locations AOI01-01 through AOI01-06, BAASF-01, with a duplicate groundwater sample collected at AOI01-06. PFOA, PFOS and PFHxS were detected at concentrations exceeding their respective SLs. PFOS was detected in seven of the eight groundwater samples at concentrations that ranged from 0.78 ng/L to 2500 ng/L. PFHxS was detected in all eight groundwater samples at concentrations that ranged from 1.1 ng/L to 370 ng/L. PFOA was detected in all eight groundwater samples at concentrations that ranged from 1.2 ng/L to 20 ng/L. PFBS was detected in all eight groundwater samples at concentrations below the SL that ranged from 0.61 ng/L to 55 ng/L. PFNA was detected at one temporary monitoring well location (AOI01-06) at 0.52 ng/L, below the SL.

6.3.3 Conclusions

Based on the results of the SI, PFOS was detected in surface soil above the SL at AOI01-04. No other soil samples exceeded the SLs. PFOA, PFOS and PFHxS were detected in groundwater at concentrations above their respective SLs. Sample location AOI01-04 had the highest concentration of PFOS in groundwater. Based on the exceedances of the SLs in groundwater and surface soil, further evaluation at AOI 1 is warranted.

The regional groundwater flow direction within the surficial aquifer was inferred to be easterly based on the location of surficial water bodies, namely Apple Creek located east of the facility. BAASF-01 was intended as an upgradient boundary well based on the inferred regional groundwater flow toward the east. Synoptic water level measurements taken from temporary wells during the SI fieldwork indicated that the local groundwater flow is northeasterly. As such, BAASF-01 is actually located cross-gradient to AOI 1. The PFOS concentration at the most downgradient temporary well (AOI01-02) was above the SL. Based on a review of the North Dakota Department of Water Resources MapServices, it was noted that there are four wells (one domestic well, two irrigation wells, and an unknown well) that are within approximately one mile of the facility and potentially downgradient.

6.4 AOI 2

Following the SI fieldwork, photographs were found showing that a TriMax30™ fire extinguisher was stored near the Fuel Point for emergencies. The photographs of the TriMax30™ were taken in 2011. Subsequent photographs of the area indicate that the fire extinguisher was replaced sometime between 2011 and 2020. AOI 2 will be investigated as part of the RI. Photographs are included in **Appendix C**.

6.5 AOI 3

Following the SI fieldwork, photographs were found showing that a TriMax30™ fire extinguisher was stored near the Fuel Truck Parking for emergencies. The photographs of the TriMax30™ were taken in 2011 and 2017. Subsequent photographs of the area indicate that the fire extinguisher was replaced sometime between 2017 and 2020. AOI 3 will be investigated as part of the RI. Photographs are included in **Appendix C**.

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report
Bismarck AASF #1

Area of Interest		AOI01							
Location ID		AOI01-02		AOI01-03		AOI01-04		AOI01-04, Duplicate	
Sample ID		AOI01-02-SB-0-2		AOI01-03-SB-0-2		AOI01-04-SB-0-2		AOI01-SB-DUP01	
Sample Date		11/2/2021		11/2/2021		11/2/2021		11/2/2021	
Depth		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	**OSD Screening Level [1]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)									
PFBS	1900	ND	U	ND	U	ND	U	ND	U
PFHxS	130	0.23	J	ND	U	ND	U	0.36	J
PFNA	19	ND	U	ND	U	ND	U	ND	U
PFOA	19	ND	U	ND	U	0.37	J	0.38	J
PFOS	13	ND	U	ND	U	19		26	

Notes

Gray Fill — Detected concentration exceeded OSD Screening Levels

References

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

Chemical Abbreviations

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

Interpreted Qualifiers

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

Acronyms and Abbreviations

µg/kg	microgram(s) per kilogram
AASF	Army Aviation Support Facility
AOI	Area of Interest
DUP	duplicate
HQ	Hazard Quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
LOQ	limit of quantitation
ND	analyte not detected above the LOD (LOD values are presented in Appendix F)
OSD	Office of the Secretary of the Defense
QSM	Quality Systems Manual
PFAS	per- and polyfluoroalkyl substances
SB	soil boring
USEPA	United States Environmental Protection Agency
Qual	interpreted qualifier

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Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report
Bismarck AASF #1

	Area of Interest	AOI01					
	Location ID	AOI01-02		AOI01-03		AOI01-04	
	Sample ID	AOI01-02-SB-3-4		AOI01-03-SB-4-5		AOI01-04-SB-4-5	
	Sample Date	11/2/2021		11/2/2021		11/2/2021	
	Depth	3 - 4 ft		4 - 5 ft		4 - 5 ft	
Analyte	**OSD Screening Level [1]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)							
PFBS	25000	ND	U	ND	U	ND	U
PFHxS	1600	ND	U	ND	U	1.1	
PFNA	250	ND	U	ND	U	ND	U
PFOA	250	ND	U	ND	U	ND	U
PFOS	160	ND	U	ND	U	1.4	J

Notes

Gray Fill — Detected concentration exceeded OSD Screening Levels

References

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

Chemical Abbreviations

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

Interpreted Qualifiers

J = The result is an estimated quantity.
U = The analyte was not detected at a level greater than or equal to the adjusted DL.

Acronyms and Abbreviations

µg/kg	microgram(s) per kilogram
AASF	Army Aviation Support Facility
AOI	Area of Interest
DUP	duplicate
HQ	Hazard Quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
LOQ	limit of quantitation
ND	analyte not detected above the LOD (LOD values are presented in Appendix F)
OSD	Office of the Secretary of the Defense
QSM	Quality Systems Manual
PFAS	per- and polyfluoroalkyl substances
SB	soil boring
USEPA	United States Environmental Protection Agency
Qual	interpreted qualifier

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Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report
Bismarck AASF #1

Area of Interest		AOI01					
Location ID		AOI01-02		AOI01-03		AOI01-04	
Sample ID		AOI01-02-SB-5-6		AOI01-03-SB-7-8		AOI01-04-SB-9-10	
Sample Date		11/2/2021		11/2/2021		11/2/2021	
Depth		5 - 6 ft		7 - 8 ft		9 - 10 ft	
Analyte	**OSD Screening Level [1]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)							
PFBS	25000	ND	U	ND	UJ	ND	U
PFHxS	1600	ND	U	ND	UJ	ND	U
PFNA	250	ND	U	ND	U	ND	U
PFOA	250	ND	U	ND	UJ	ND	U
PFOS	160	ND	U	ND	UJ	6.3	

Notes

Gray Fill — Detected concentration exceeded OSD Screening Levels

Chemical Abbreviations

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

References

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

Interpreted Qualifiers

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

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

Acronyms and Abbreviations

µg/kg	microgram(s) per kilogram
AASF	Army Aviation Support Facility
AOI	Area of Interest
DUP	duplicate
HQ	Hazard Quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
LOQ	limit of quantitation
ND	analyte not detected above the LOD (LOD values are presented in Appendix F)
OSD	Office of the Secretary of the Defense
QSM	Quality Systems Manual
PFAS	per- and polyfluoroalkyl substances
SB	soil boring
USEPA	United States Environmental Protection Agency
Qual	interpreted qualifier

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Table 6-5
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report
Bismarck AASF #1

Area of Interest		AOI01															
Location ID		AOI01-01		AOI01-02		AOI01-03		AOI01-04		AOI01-05		AOI01-06		AOI01-06, Duplicate		BAASF-01	
Sample Name		AOI01-01-GW		AOI01-02-GW		AOI01-03-GW		AOI01-04-GW		AOI01-05-GW		AOI01-06-GW		AOI01-GW-DUP01		BAASF-01-GW	
Sample Date		11/3/2021		11/3/2021		11/3/2021		11/2/2021		11/3/2021		11/3/2021		11/3/2021		11/3/2021	
Analyte	**Screening Level [1]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS (ng/L)																	
PFBS	601	0.61	J	7.		10		34		55		5.1		5.3		8.1	
PFHxS	39	1.1	J	18		140		370		160		26		26		150	
PFNA	6	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.52	
PFOA	6	1.4	J	1.4	J	9.2		20		11		1.4		1.2		7	
PFOS	4	ND	U	67		320		2500		1300		0.82		0.78		2100	

Notes

Gray Fill — Detected concentration exceeded OSD Screening Levels

Chemical Abbreviations

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

References

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

Interpreted Qualifiers

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
DUP	duplicate
HQ	Hazard Quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
LOQ	limit of quantitation
ND	analyte not detected above the LOD (LOD values are presented in Appendix F)
ng/L	nanogram(s) per liter
OSD	Office of the Secretary of the Defense
QSM	Quality Systems Manual
PFAS	per- and polyfluoroalkyl substances
SB	soil boring
USEPA	United States Environmental Protection Agency
Qual	interpreted qualifier

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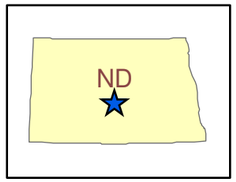
Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

Figure 6-1
PFOA Detections in Soil



Facility Data
- Facility Boundary
- Potential PFAS Release
- Area of Interest
- Building
- Stormwater Line
- Sewer Line
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator

Hydrology
- Shallow Groundwater Flow Direction (November 2021)

PFOA Results (µg/Kg)
- ND
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

NOTES:
PFOA = perfluorooctanoic acid
ND = Non-Detect
(µg/Kg) = Microgram(s) per Kilogram
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....SEPTEMBER 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:.....NAD 83 State Plane

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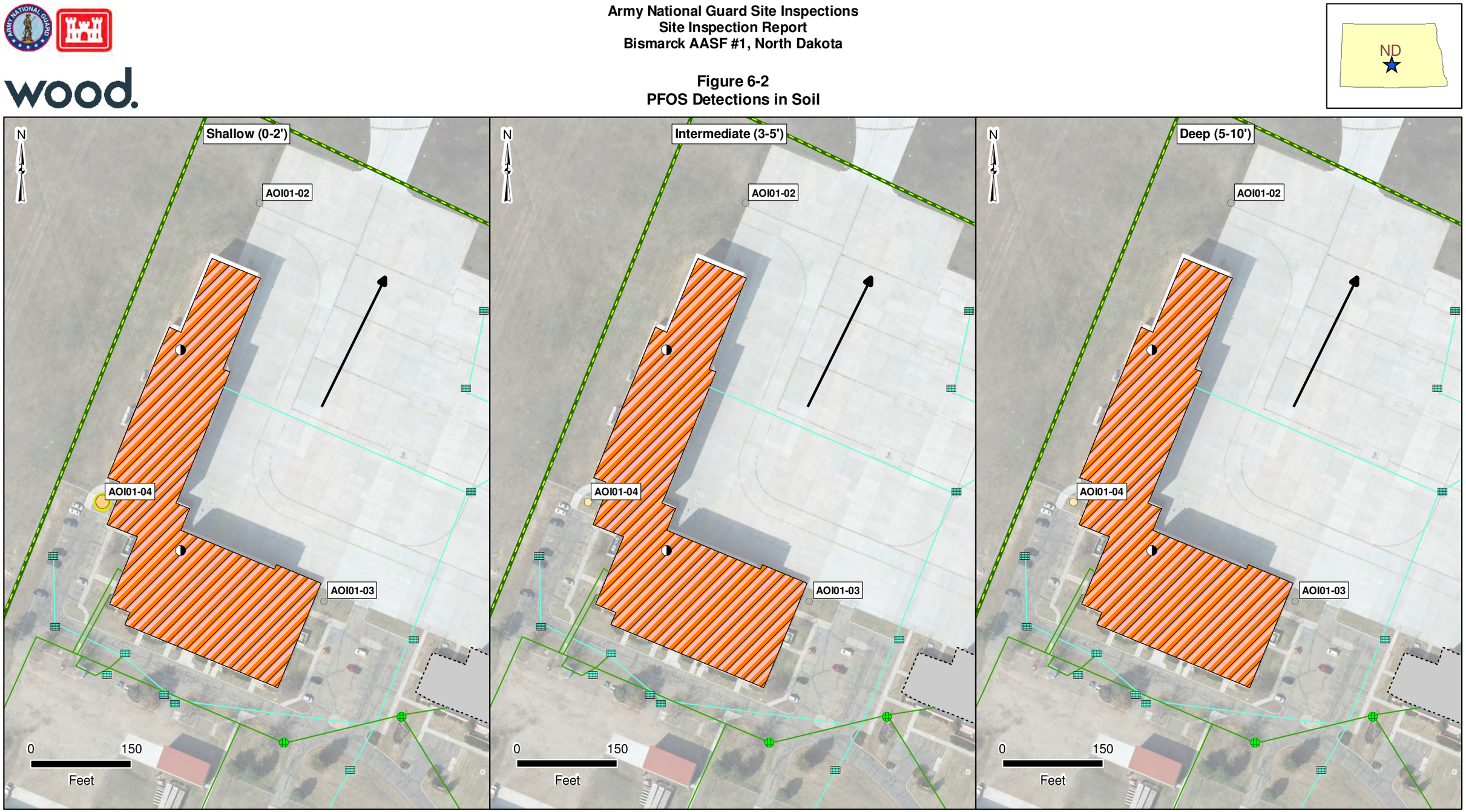
Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

Figure 6-2
PFOS Detections in Soil



Facility Data
- Facility Boundary
- Potential PFAS Release
- Area of Interest
- Building
- Stormwater Line
- Sewer Line
- Manhole (Stormwater Line)
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator

Hydrology
- Shallow Groundwater Flow Direction (November 2021)

PFOS Results (µg/Kg)
- ND
- >ND - 13
- >13 - 160
- >160 - 1,600
- >1,600

NOTES:
PFOS = perfluorooctanesulfonic acid
ND = Non-Detect
(µg/Kg) = Microgram(s) per Kilogram
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....SEPTEMBER 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:.....NAD 83 State Plane

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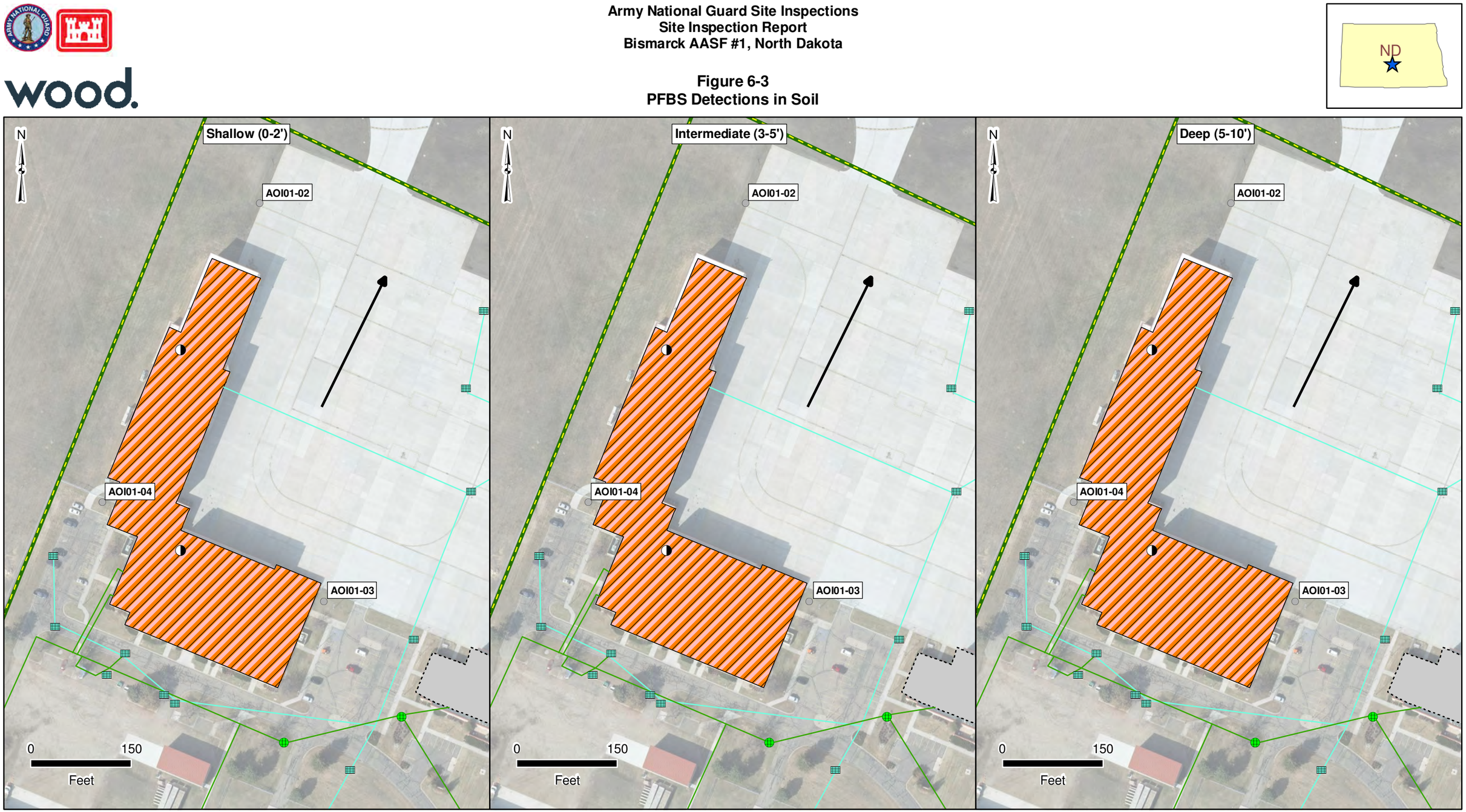
Site Inspection Report
Bismarck AASF #1, North Dakota

Figure 6-3
PFBS Detections in Soil



Facility Data
- Facility Boundary
- Potential PFAS Release
- Area of Interest
- Building
- Stormwater Line
- Sewer Line
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator

Hydrology
- Shallow Groundwater Flow Direction (November 2021)

PFBS Results (µg/Kg)
- ND
- >ND - 10
- >10 - 1,900
- >1,900 - 25,000
- >25,000

NOTES:
PFBS = perfluorobutanesulfonic acid
ND = Non-Detect
(µg/Kg) = Microgram(s) per Kilogram
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....SEPTEMBER 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:.....NAD 83 State Plane

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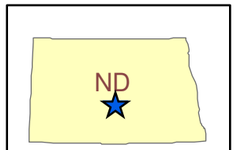
Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

Figure 6-4
PFHxS Detections in Soil



Facility Data
- Facility Boundary
- Potential PFAS Release
- Area of Interest
- Building
- Stormwater Line
- Sewer Line
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator

Hydrology
- Shallow Groundwater Flow Direction (November 2021)

PFHxS Results (µg/Kg)
- ND
- >ND - 10
- >10 - 130
- >130 - 1,600
- >1,600

NOTES:
PFHxS = Perfluorohexanesulfonic acid
ND = Non-Detect
(µg/Kg) = Microgram(s) per Kilogram
Exceedances of the OSD SL are depicted with a yellow halo

Data Sources:
ESRI 2020
AECOM 2020

Date:.....SEPTEMBER 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:.....NAD 83 State Plane

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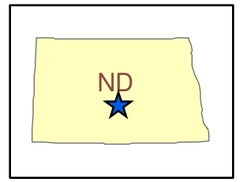
Site Inspection Report
Bismarck AASF #1, North Dakota

Figure 6-5
PFNA Detections in Soil



Facility Data

- Facility Boundary
- Potential PFAS Release
- Area of Interest
- Building
- Stormwater Line
- Sewer Line
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator

Hydrology

- Shallow Groundwater Flow Direction (November 2021)

PFNA Results (µg/Kg)

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

NOTES:
PFNA = Perfluorononanoic acid
ND = Non-Detect
(µg/Kg) = Microgram(s) per Kilogram
Exceedances of the OSD SL are depicted with a yellow halo

Data Sources:
ESRI 2020
AECOM 2020

Date:.....SEPTEMBER 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:.....NAD 83 State Plane

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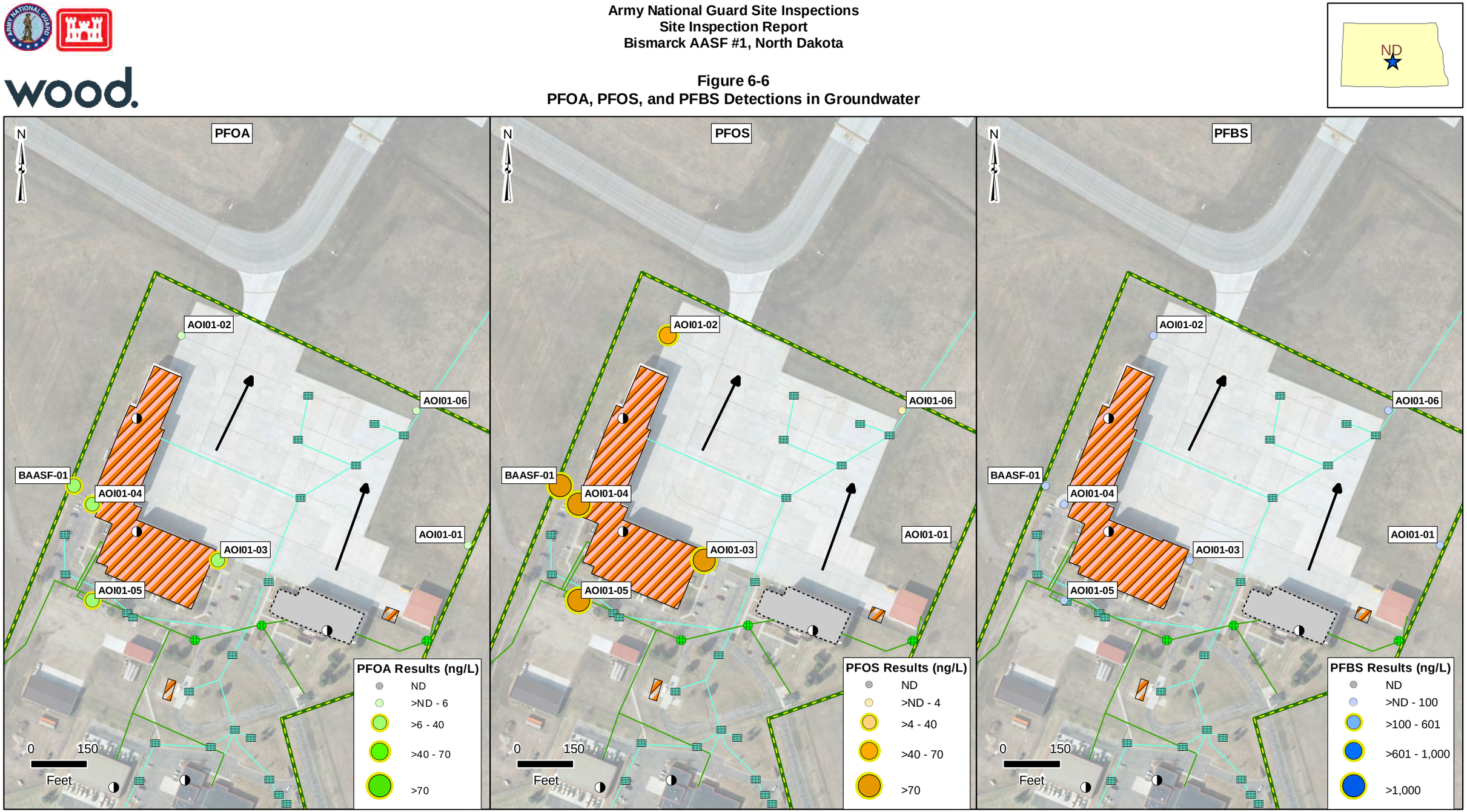
Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

Figure 6-6
PFOA, PFOS, and PFBS Detections in Groundwater



Facility Data

- Facility Boundary
- Potential PFAS Release
- Area of Interest
- Building
- Stormwater Line
- Sewer Line
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator

Hydrology

- Shallow Groundwater Flow Direction (November 2021)

NOTES:
PFOS = perfluorooctanesulfonic acid
PFOA = perfluorooctanoic acid
PFBS = perfluorobutanesulfonic acid
ND = Non-Detect
ng/L = nanogram(s) per liter
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....SEPTEMBER 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:.....NAD 83 State Plane

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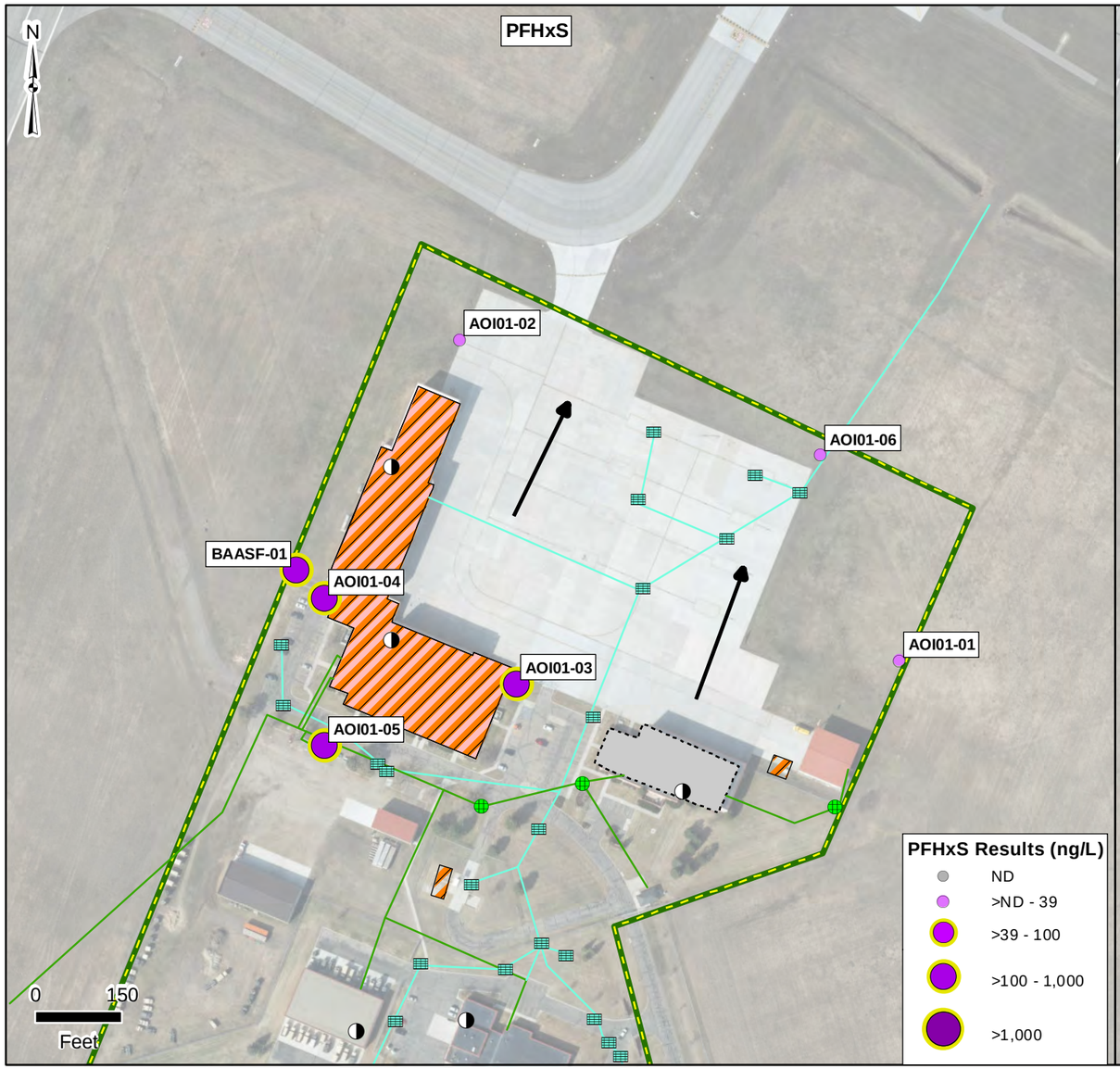
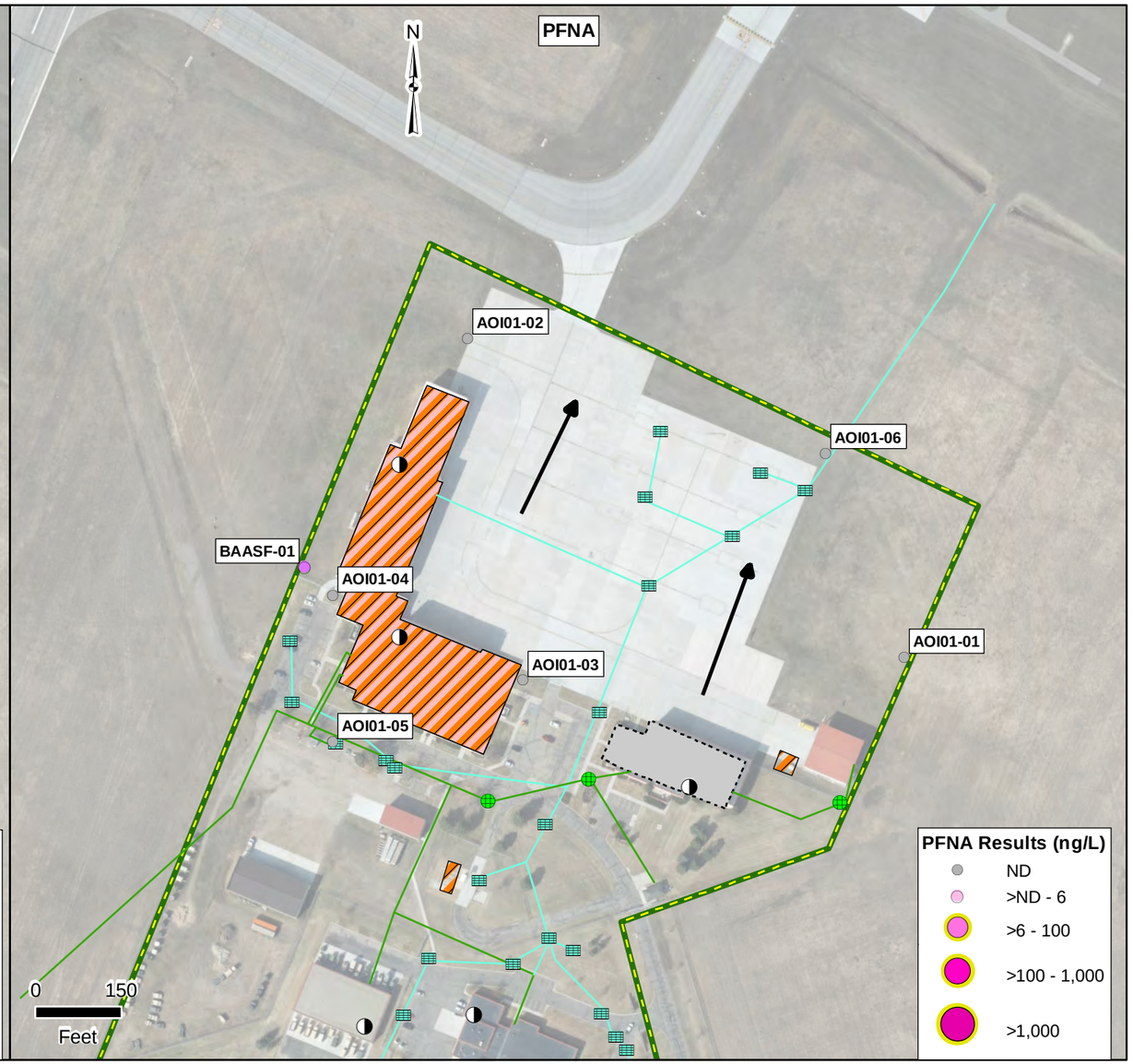
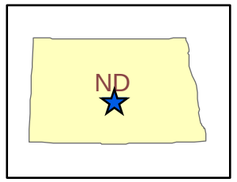
Army National Guard Site Inspections
Site Inspection Report
Bismarck AASF #1, North Dakota

Figure 6-7
PFHxS and PFNA Detections in Groundwater







Facility Data

- Facility Boundary
- Potential PFAS Release
- Area of Interest
- Building
- Stormwater Line
- Sewer Line
- Manhole (Sewer Line)
- Catch Basin
- Oil Water Separator

Hydrology

- Shallow Groundwater Flow Direction (November 2021)

NOTES:
PFHxS = Perfluorohexanesulfonic acid
PFNA = Perfluorooctanoic acid
ND = Non-Detect
ng/L = nanogram(s) per liter
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....SEPTEMBER 2022
Prepared By:.....WOOD
Prepared For:.....USACE
Projection:.....NAD 83 State Plane

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7. EXPOSURE PATHWAYS

The Conceptual Site Model (CSM) for AOI 1, revised based on the SI findings, is presented on **Figure 7-1**. Additionally, preliminary CSMs for AOI 2 and AOI 3 are included as **Figure 7-2** and **Figure 7-3**, respectively**.** AOI 2 and AOI 3 were identified as potential release areas following the SI fieldwork based on 2011 and 2017 photographs that showed TriMax30™ fire extinguishers had occasionally been stored in those areas. AOI 2 and AOI 3 will be investigated as part of the RI.

Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to RI or interim action is determined based upon exceedances of the SLs for the relevant compounds and whether the release is more than likely attributable to the DoD. A CSM presents the current understanding of the 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 no identified complete pathway generally warrant no further action. However, the pathway is considered potentially complete if the relevant compounds are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of the relevant compounds above the SLs. Areas with an identified potentially complete pathway and a complete pathway may warrant further investigation. Although the CSMs indicate whether potentially complete exposure pathways may exist, the recommendation for future study in a RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

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

7.1 SOIL EXPOSURE PATHWAY

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

7.1.1 AOI 1

AOI 1 is the Main Hangar and the immediate surrounding area (**Figure 3-1**). There were no documented releases of PFAS to the ground surface (outside the hangar), but PFAS-containing fire suppressants were stored at the Facility, and there is the potential for PFAS releases inside and immediately surrounding the Main Hangar. PFOS was detected in the surface soil at concentrations above SLs at one boring location completed outside an overhead door on the west side of the Main Hangar (AOI01-04). Surface soil also had detections of PFOA and PFHxS that were below SLs. Based on the results of the SI at AOI 1, direct contact with surface soil could result in site worker, construction worker, and/or trespasser exposure to PFOS, PFOA, and PFHxS via inhalation of dust or incidental ingestion of soil particles. Subsurface soil at AOI 1 had detections of PFOS and PFHxS that were below SLs. Construction workers could contact constituents in subsurface soil via incidental ingestion and inhalation of dust; therefore, the subsurface soil exposure pathway for construction workers is potentially complete. A recent construction project to improve a gravel parking area, which included the installation of storm sewer, fencing, and pavement, was located outside (and southwest) of AOI 1. The CSM for AOI 1 is presented in **Figure 7-1**.

7.1.2 AOI 2

AOI 2 is the Fuel Point (**Figure 3-1**). There were no documented releases of PFAS to the ground surface. Photographs from 2011 showed that PFAS-containing fire suppressants were stored in the area. Potential releases may have occurred on paved surfaces. PFAS releases to the paved surfaces could have impacted soil via cracks in the pavement of joints between areas that are paved. Direct contact with surface soil could result in site worker, construction worker, and/or trespasser exposure to PFAS via inhalation of dust or incidental ingestion of soil particles. Direct contact with subsurface soil (during excavation activities) could result in construction worker exposure to PFAS via inhalation of dust or incidental ingestion of soil particles. A recent construction project to improve a gravel parking area, which included the installation of storm sewer, fencing, and pavement, was located outside (and northwest) of AOI 2. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-2**.

7.1.3 AOI 3

AOI 3 is the Fuel Truck Parking (**Figure 3-1**). There were no documented releases of PFAS to the ground surface. Photographs from 2011 and 2017 showed that PFAS-containing fire suppressants were stored in the grassy area next to the paved Fuel Truck Parking area. Potential releases may have directly impacted soil or could have been released on paved surfaces. PFAS releases to the paved surfaces could have impacted soil via cracks in the pavement of joints between areas that are paved. Direct contact with surface soil could result in site worker, construction worker, and/or trespasser exposure to PFAS via inhalation of dust or incidental ingestion of soil particles. Direct contact with subsurface soil (during excavation activities) could

result in construction worker exposure to PFAS via inhalation of dust or incidental ingestion of soil particles. A recent construction project to improve a gravel parking area, which included the installation of storm sewer, fencing, and pavement, was located outside (and northwest) of AOI 2. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-3**.

7.2 GROUNDWATER EXPOSURE PATHWAY

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

7.2.1 AOI 1

AOI 1 is the Main Hangar and the immediate surrounding area (**Figure 3-1**). There were no documented releases of PFAS to the ground surface outside the hangar, but PFAS-containing fire suppressants were stored at the Facility and there is the potential for PFAS releases inside and immediately surrounding the Main Hangar. PFOS was detected in the groundwater at all sampling locations except for one (AOI01-01). The concentration of PFOS in groundwater exceeded the SLs at five of the seven sample locations. PFOA and PFHxS were detected in the groundwater at all 7 sampling locations and the concentrations detected exceeded their respective SLs at four of the seven sample locations. PFBS was detected in the groundwater at all 7 sampling locations at concentrations that were below the SLs. PFNA was detected in the groundwater at one sampling location at a concentration below the SL. Based on the results of the SI at AOI 1, ground disturbing activities that extend to the water table (approximately 15 ft bgs) could result in construction worker exposure to relevant compounds via incidental ingestion.

The regional groundwater flow direction within the surficial aquifer was inferred to be easterly based on the location of surficial water bodies, namely Apple Creek located east of the facility. BAASF-01 was intended as an upgradient boundary well based on the inferred regional groundwater flow toward the east. Synoptic water level measurements taken from temporary wells during the SI fieldwork indicated that the local groundwater flow is northeasterly. As such, BAASF-01 is actually located cross-gradient to AOI 1. The PFOS concentration at the most downgradient temporary well (AOI01-02) was above the SL. Based on a review of the North Dakota Department of Water Resources MapServices, it was noted that there are four wells (one domestic well, two irrigation wells, and an unknown well) that are within approximately one mile of the facility and potentially downgradient. Potential resident receptors downgradient of the AOI could also be exposed by ingestion of groundwater. The concentration at the potential point of exposure for off-facility residents is not known, therefore, the exposure pathway for ingestion is potentially complete for off-facility residential receptors. The CSM for AOI 1 is presented in **Figure 7-1**.

7.2.2 AOI 2

AOI 2 is the Fuel Point (**Figure 3-1**). There were no documented releases of PFAS to the ground surface. Photographs from 2011 showed that PFAS-containing fire suppressants were stored in

the area. Potential releases may have occurred on paved surfaces. PFAS releases to the paved surfaces could have impacted soil via cracks in the pavement of joints between areas that are paved. PFAS releases to the soil can migrate to groundwater, as such, ground disturbing activities that extend to the water table (approximately 15 ft bgs) could result in construction worker exposure to PFAS via incidental ingestion. Potential resident receptors downgradient of the AOI 2 could also be exposed by ingestion of groundwater. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-2**.

7.2.3 AOI 3

AOI 3 is the Fuel Truck Parking (**Figure 3-1**). There were no documented releases of PFAS to the ground surface. Photographs from 2011 and 2017 showed that PFAS-containing fire suppressants were stored in the grassy area next to the paved Fuel Truck Parking area. Potential releases may have directly impacted soil or could have been released on paved surfaces. PFAS releases to the paved surfaces could have impacted soil via cracks in the pavement of joints between areas that are paved. PFAS releases to the soil can migrate to groundwater, as such, ground disturbing activities that extend to the water table (approximately 15 ft bgs) could result in construction worker exposure to PFAS via incidental ingestion. Potential resident receptors downgradient of the AOI 3 could also be exposed by ingestion of groundwater. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-3**.

7.3 SURFACE WATER AND SEDIMENT EXPOSURE PATHWAY

There is no surface water located at the AASF, however, stormwater at the Facility is managed by a series of grassed trenches and small retention basins before being discharged to Apple Creek, and ultimately to the Missouri River (AECOM, 2020). Stormwater has the potential to transport AFFF or PFAS-impacted soils to water bodies. The ingestion exposure pathway for offsite surface water and sediment is considered potentially complete for recreational users of these rivers. Human consumption of fish potentially affected by PFAS from the rivers is also possible. No surface water or sediment samples were collected as part of the SI.

7.3.1 AOI 1

There were no documented releases of PFAS to the ground surface outside the hangar, but PFAS-containing fire suppressants were stored at the Facility, and there is the potential for PFAS releases inside and immediately surrounding the Main Hangar. There are no documented incidents of PFAS-containing (or potentially containing) fire suppressants being discharged to the stormwater system. PFOS was detected in the surface soil at concentrations above SL at one boring location completed outside an overhead door on the west side of the Main Hangar (AOI01-04). Due to the presence of PFAS in soil, there is the potential for stormwater to transport PFAS-impacted soil to Apple Creek, and ultimately the Missouri River and expose the potential recreational user by ingestion of surface water and/or fish potentially affected by PFAS. The CSM is presented in **Figure 7-1**.

7.3.2 AOI 2

AOI 2 is the Fuel Point (**Figure 3-1**). There were no documented releases of PFAS to the ground surface. Photographs from 2011 showed that PFAS-containing fire suppressants were stored in the area. Potential releases may have occurred on paved surfaces. PFAS releases to the paved surfaces could have impacted soil via cracks in the pavement of joints between areas that are paved. There is the potential for stormwater to transport PFAS-impacted soil to Apple Creek, and ultimately the Missouri River and expose the potential recreational user by ingestion of surface water and/or fish potentially affected by PFAS. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-2**.

7.3.3 AOI 3

AOI 3 is the Fuel Truck Parking (**Figure 3-1**). There were no documented releases of PFAS to the ground surface. Photographs from 2011 and 2017 showed that PFAS-containing fire suppressants were stored in the grassy area next to the paved Fuel Truck Parking area. Potential releases may have directly impacted soil or could have been released on paved surfaces. PFAS releases to the paved surfaces could have impacted soil via cracks in the pavement of joints between areas that are paved. There is the potential for stormwater to transport PFAS-impacted soil to Apple Creek, and ultimately the Missouri River and expose the potential recreational user by ingestion of surface water and/or fish potentially affected by PFAS. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-3**.

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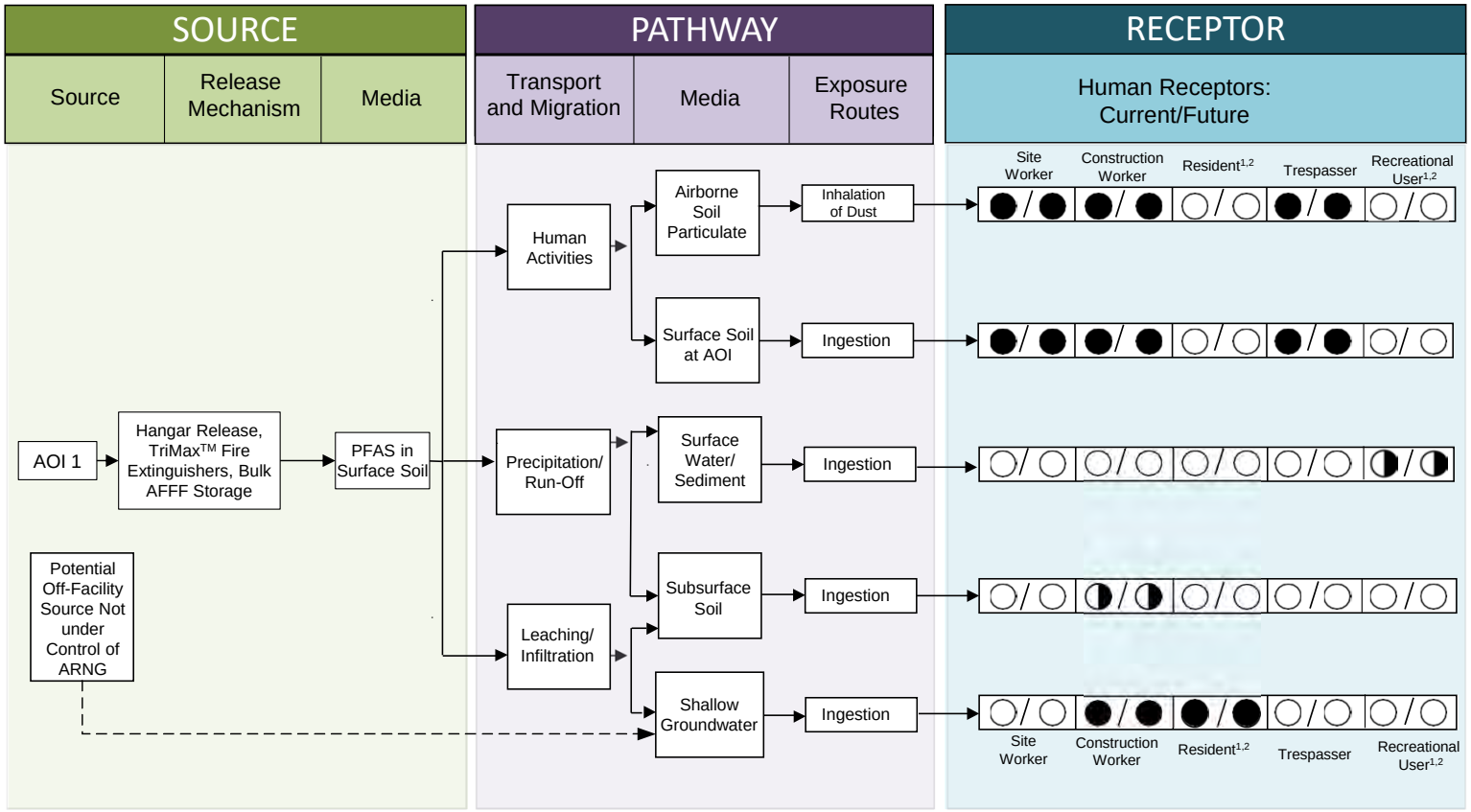

LEGEND

- Flow Chart Continues
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

Notes:

1. The resident and recreational user refers to off-site receptors.
2. Inhalation of dust for off-site receptors is highly unlikely.

Figure 7-1
Conceptual Site Model, AOI 1
Bismarck AASF #1 Main Hangar

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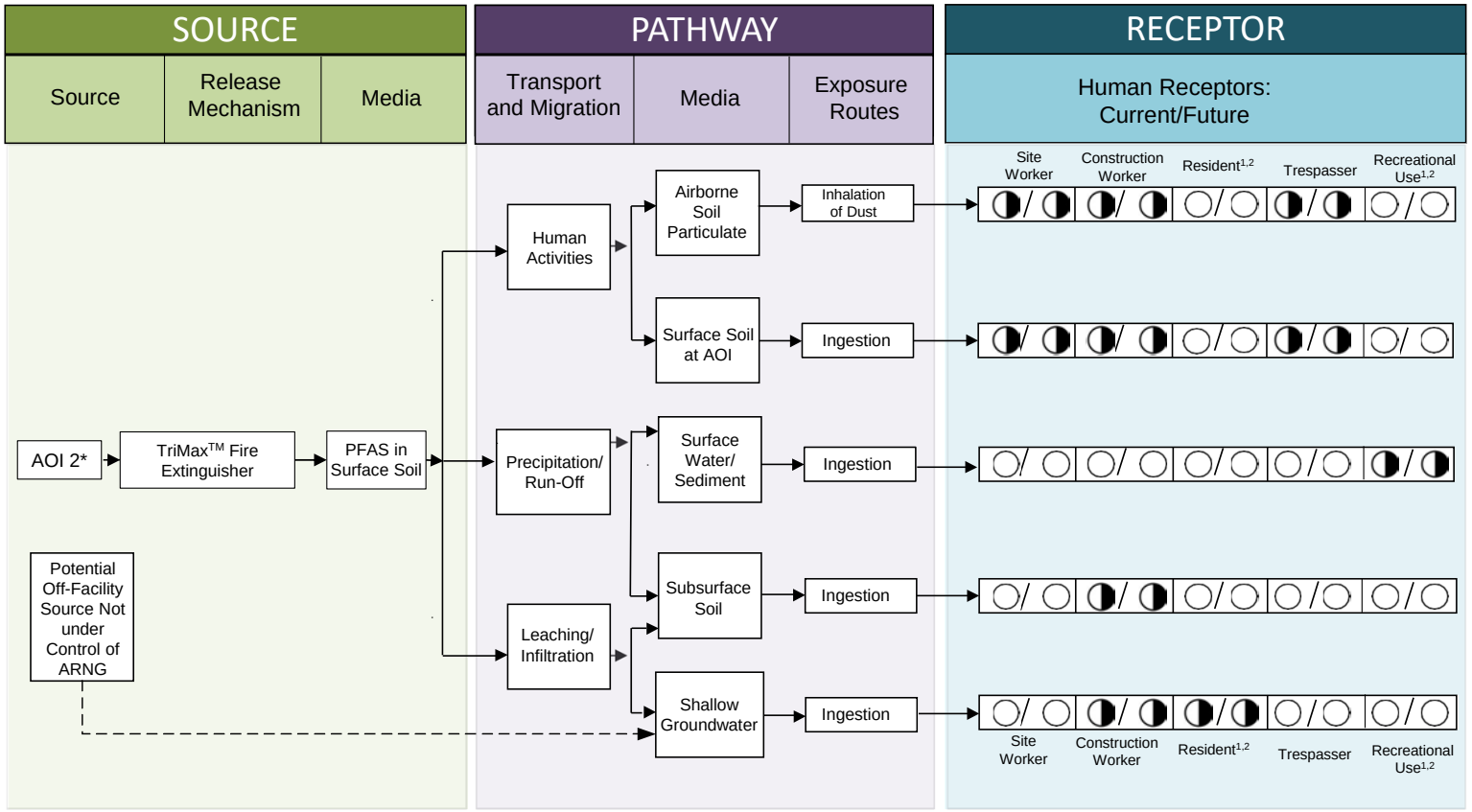

LEGEND

- Flow Chart Continues
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

Notes:

***** Assessment of pathways will be conducted during the RI

1. The resident and recreational user refers to off-site receptors.
2. Inhalation of dust for off-site receptors is highly unlikely.

Figure 7-2
Conceptual Site Model, AOI 2*
Bismarck AASF #1 Fuel Point

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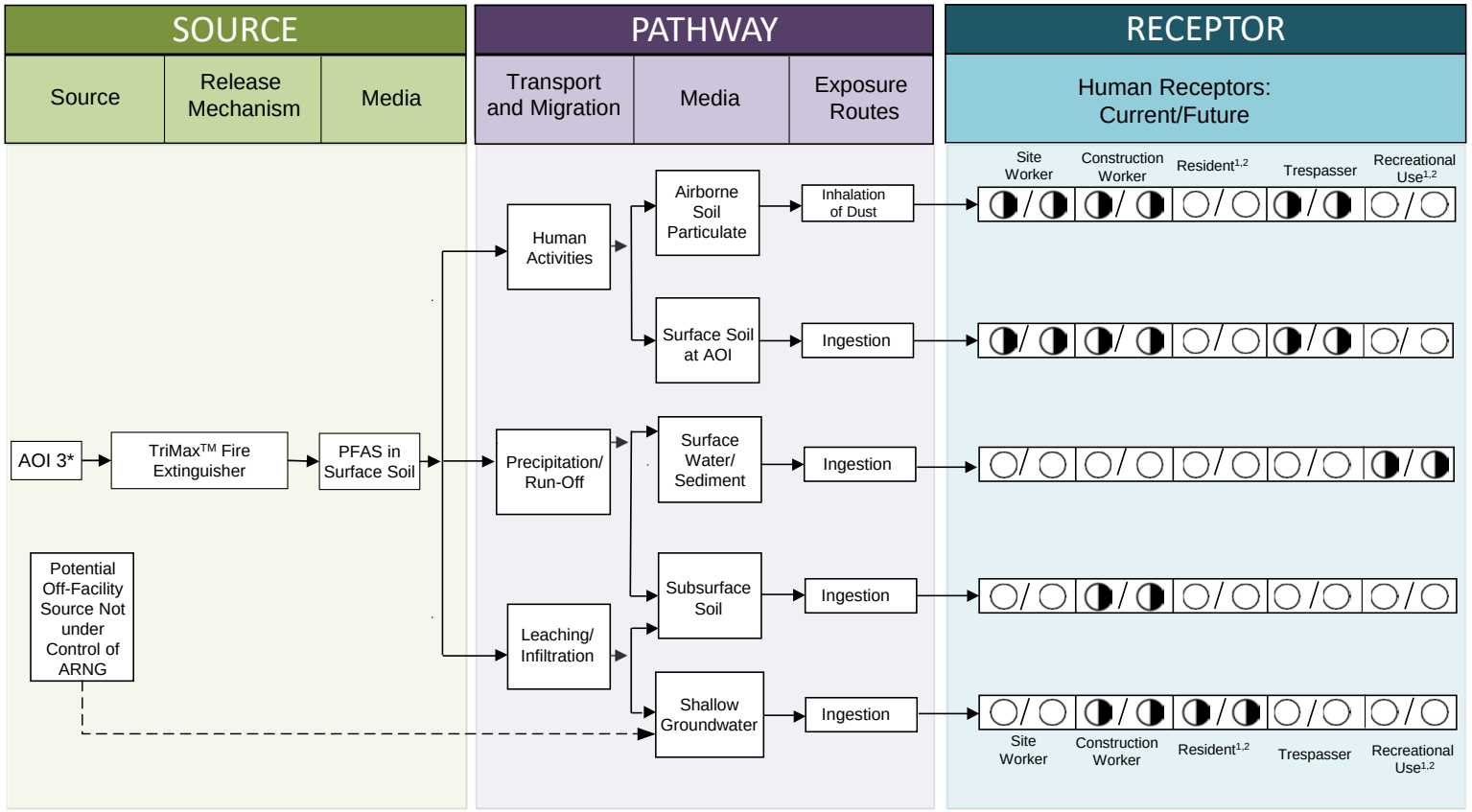

LEGEND

- Flow Chart Continues
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

Notes:

***** Assessment of pathways will be conducted during the RI

1. The resident and recreational user refers to off-site receptors.
2. Inhalation of dust for off-site receptors is highly unlikely.

Figure 7-3
Conceptual Site Model, AOI 3*
Bismarck AASF #1 Fuel Truck Parking

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8. SUMMARY AND OUTCOME

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

8.1 SI ACTIVITIES

The SI field activities at the Facility were conducted from 01 to 03 November 2021. The SI field activities included soil and groundwater sampling. Field activities were conducted in accordance with the UFP-QAPP Addendum (EA/Wood, 2021a), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI UFP-QAPP Addendum (EA/Wood, 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.

- Nine soil grab samples from three boring locations;
- Seven grab groundwater samples from seven temporary well locations; and
- Five (5) QA/QC samples.

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

8.2 OUTCOME

Based on the results of this SI, further evaluation in the form of a RI is warranted for AOI 1. Based on the CSMs developed and revised based on the SI findings, there is potential for exposure to residential drinking water receptors from AOI 1 from sources on the Facility resulting from historical DoD activities.

Sample analytical concentrations collected during the SI were compared against the project SLs for soil and groundwater, as described in **Table 6-1**. The following bullets summarize the SI results relative to the SLs:

At AOI 1:

- PFOS, PFOA, and PFHxS in groundwater exceeded their respective SLs. PFOS exceeded the SL of 4 ug/L with a maximum concentration of 2,500 ng/L at AOI01-04. PFOA exceeded the SL of 6 ug/L with a maximum concentration of 20 ng/L at AOI01-04.

PFHxS exceeded the SL of 6 ug/L with a maximum concentration of 370 ng/L at AOI01-04. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.

- PFOS in surface soil exceeded the screening level of 13 µg/kg at one location with a concentration of 19 µg/kg. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.

At AOI 2:

- During preparation of the SI report, it was discovered that a TriMax30™ fire extinguisher had occasionally been stored at the Fuel Point since at least 2011. Based on this information, the Fuel Point was designated as AOI 2 and will also be investigated as part of the RI.

At AOI 3:

- During preparation of the SI report, it was discovered that a TriMax30™ fire extinguisher had occasionally been stored at the Fuel Truck Parking since at least 2011. Based on this information, the Fuel Truck Parking was designated as AOI 3 and will also be investigated as part of the RI.

At the boundary:

- The locations of temporary monitoring wells that were positioned to evaluate potential upgradient sources were based on the expected easterly regional groundwater flow. Synoptic water levels measured during the SI indicated a northeasterly groundwater flow. As such, these monitoring wells did not provide the data to assess upgradient impacts and the evaluation of potential off-facility PFAS sources remains incomplete. This will be evaluated during the RI.

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

Table 8-1 summarizes the SI results for soil and groundwater used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI.

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Main Hangar	●	●	●	Proceed to RI
2	Fuel Point	TBD	TBD	TBD	Proceed to RI
3	Fuel Truck Parking	TBD	TBD	TBD	Proceed to RI

Legend:

● = Detected; exceedance of screening levels

◐ = Detected; no exceedance of screening levels

○ = Not detected

Abbreviations:
TBD = to be determined during RI
RI = remedial investigation

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