FINAL
Site Inspection Report
Army Aviation Support Facility #1 and Armory
West Bend, Wisconsin

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

March 2022

Prepared for:

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

UNCLASSIFIED

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Tables

Acronyms and Abbreviations

6:2 FTS	6:2 Fluorotelomer sulfonate
8:2 FTS	8:2 Fluorotelomer sulfonate
µg/kg	micrograms per kilogram
°C	degrees Celsius
°F	degrees Fahrenheit
%	percent
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DO	dissolved oxygen
DoD	Department of Defense
DPT	direct-push technology
DQI	data quality indicator
DQO	data quality objective
DUA	data usability assessment
DVR	data validation report
EIS	extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
FedEx	Federal Express
ERB	equipment rinsate blank
FRB	Field Reagent Blank
gpm	gallons per minute
HDPE	high-density polyethylene
IDW	investigation-derived waste
IIS	Injection internal standards
ISC	Instrument sensitivity check
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
LOQ	limit of quantitation
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid

ng/L	nanograms per liter
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
ORP	oxidation-reduction potential
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutyrate
PFBS	perfluorobutanesulfonic acid
PFCs	perfluorinated compounds
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUdA	perfluoroundecanoic acid
PID	photoionization detector
PPE	personal protective equipment
PQAPP	Programmatic UFP-QAPP
PVC	poly-vinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
RPD	relative percent differences
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TOC	total organic carbon
TPP	Technical Project Planning
UCMR 3	Third Unregulated Contaminant Monitoring Rule
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WIARNG	Wisconsin Army National Guard
WIDNR	Wisconsin Department of Natural Resources

WWTP Waste Water Treatment Plant

Executive Summary

The Army National Guard (ARNG) G9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at per- and polyfluoroalkyl substances (PFAS)-impacted sites at ARNG facilities nationwide. The objective of the SI at each facility is to identify whether there has been a release to the environment from the Areas of Interest (AOIs) identified in the PA and determine the presence or absence of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutanesulfonic acid (PFBS) at or above screening levels (SLs). An SI was completed at West Bend Army Aviation Support Facility (AASF) #1 and Armory (also referred to as the "facility"), Wisconsin.

West Bend AASF #1 and Armory is in Washington County, Wisconsin, approximately 2 miles east of West Bend, 30 miles northwest of Milwaukee, and 75 miles northeast of Madison. The facility is accessible from East Washington Street by Chopper Drive and Trenton Road.

West Bend AASF #1 and Armory was constructed in 2004 on a parcel of land, approximately 35-acres, owned by the City of West Bend, and leased to the Wisconsin ARNG (WIARNG); the current lease agreement expires September 2075. The current West Bend AASF #1 and Armory facilities include administrative offices, classrooms, and hangars for the operation, maintenance, and repair of WIARNG rotary-winged aircraft. Two potential PFAS release areas were identified in the PA Report (AECOM Technical Services, Inc. [AECOM], 2019). The release areas, which include the fire suppression testing area and the Tri-Max™ training area, were grouped into two AOIs and investigated during the SI. The SI field activities were conducted from 26 to 29 October 2020 and included the collection of soil and groundwater samples.

To fulfill the project Data Quality Objectives set forth in the approved SI Quality Assurance Project Plan Addendum (AECOM, 2020b), samples were collected and analyzed for a subset of 18 PFAS by liquid chromatography with tandem mass spectrometry compliant with Quality Systems Manual 5.1 Table B-15. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.8** of this Report.

The Department of Defense (DoD) has adopted a policy to retain facilities in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process based on risk-based SLs for soil and groundwater, as described in a memorandum from the Office of the Secretary of Defense dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG PFAS SIs follow this DoD policy and, should the maximum site concentration for sampled media exceed the SLs, the AOI will proceed to a Remedial Investigation (RI), the next phase under CERCLA. The SLs apply to three compounds, PFOA, PFOS, and PFBS, for both soil and groundwater, as presented in **Table ES-1**. All other results presented in this report are considered informational in nature and serve as an indication as to whether soil, groundwater, sediment, and surface water contain or do not contain the 18 PFAS analyzed within the boundaries of the facility.

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

- PFOA in groundwater at AOI 1: Fire Suppression System Testing exceeded the SL of 40 nanograms per liter (ng/L), with a concentration of 990 ng/L at the source area, AOI01-01. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.
- PFOS in groundwater at AOI 2: Tri-Max™ Release exceeded the SL of 40 ng/L in four of the well locations, with concentrations ranging from 225 ng/L to 702 J- ng/L. Based on the results of the SI, further evaluation of AOI 2 is warranted in the RI.
- The detected concentrations of PFOA, PFOS, and PFBS in soil samples from all AOIs were below the SLs.

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

Table ES-3 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, further evaluation is warranted in the RI for AOI 1: Fire Suppression System Testing, and AOI 2: Tri-Max™ Release.

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

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

Notes:

a.) Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 15 October 2019.

b.) If only one PFAS is present, a HQ of 1 applies and the values presented would increase by a factor of x10.

c.) bgs= below ground surface, µg/kg= micrograms per kilogram

Table ES-2: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Fire Suppression System Testing	◐	●	●
2	Tri-Max™ Release	◐	●	●

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

Table ES-3: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Fire Suppression System Testing	Exceedances of SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI
2	Tri-Max™ Release	Exceedances of SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) at Impacted Sites, ARNG Installations, Nationwide. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor, AECOM Technical Services, Inc. (AECOM), under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017. The ARNG performed this SI at West Bend Army Aviation Support Facility (AASF) #1 and Armory (also referred to as the "facility"), Wisconsin.

The SI project elements were performed in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; US Environmental Protection Agency [USEPA], 1980), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300; USEPA, 1994), and in compliance with US Department of the Army (DA) requirements and guidance for field investigations including specific requirements for sampling for PFOA, PFOS, and perfluorobutanesulfonic acid (PFBS), and the group of related compounds known in the industry as per- and poly-fluoroalkyl substances (PFAS). The term PFAS is used throughout this report to encompass all PFAS chemicals being evaluated, including PFOA, PFOS, and PFBS, which are the key components of the suspected releases being evaluated, and the other 15 related compounds listed in the task order.

1.2 SI Purpose

A PA was performed at the West Bend AASF #1 and Armory (AECOM, 2019) that identified two potential PFAS release areas, which were grouped into two Areas of Interest (AOIs). The objective of the SI is to identify whether there has been a release to the environment from the AOIs and determine the presence or absence of PFOA, PFOS, and PFBS at or above screening levels (SLs).

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

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

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

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2. Facility Background

2.1 Facility Location and Description

West Bend AASF #1 and Armory is in Washington County, Wisconsin, approximately 2 miles east of West Bend, 30 miles northwest of Milwaukee, and 75 miles northeast of Madison (**Figure 2-1**). The facility is accessible from East Washington Street by Chopper Drive and Trenton Road.

West Bend AASF #1 was constructed in 2004 on a parcel of land, approximately 35-acres, owned by the City of West Bend, and leased to the WIARNG; the current lease agreement expires September 2075. The current West Bend AASF #1 and Armory facilities include administrative offices, classrooms, and hangars for the operation, maintenance, and repair of WIARNG rotary-winged aircraft.

2.2 Facility Environmental Setting

West Bend AASF #1 and Armory lies within the Milwaukee River Basin, which encompasses several land tributaries to the Milwaukee River. The topography of the area is comprised of rolling hills and numerous drumlins (**Figure 2-2**). The elevation of the facility is approximately 896 feet above mean sea level. The surrounding area is covered by cropland, grasslands, wooded area, and wetlands (Wisconsin Department of Natural Resources [WIDNR, 2001]).

The following sections include information on geology, hydrogeology, hydrology, climate, current and future land use, and critical habitat. The facility geology and groundwater features are presented on **Figure 2-3**, groundwater elevations and contours are presented on **Figure 2-4**, and surface water features are presented on **Figure 2-5**.

2.2.1 Geology

West Bend AASF #1 and Armory is situated in the Southeast Glacial Plains, which are characterized by having a rolling topography with silt loam soils, an outstanding array of glacial landforms, and numerous wetlands (WIDNR, 2015). The surficial geology is strongly influenced by the Pleistocene glacial advance, which modified the land surface by carving and gouging out soft bedrock and depositing hills and ridges of sand and gravel, as well as flat lake beds of sand, silt, and clay (Wisconsin Geological and Natural History Survey, 2005). The thickness of these deposits typically ranges up to 100 feet but can exceed 500 feet in the bedrock valleys (Young and Batten, 1980).

The facility is underlain by Quaternary-aged sediments. Towards the Milwaukee River, on the southern portion of the facility, the surficial geology is composed of postglacial sand and silt. The rest of the facility is directly underlain by the silt and sand facies of the Waubeka Member of the Holy Hill Formation. This member is composed primarily of well-sorted silt with some sand and clay (Mickelson and Syverson, 1997). Underlying the Waubeka Member is the New Berlin Member of the Holy Hill Formation. At the facility, this member is characterized as diamicton, gravel, and sand (Mickelson and Syverson, 1997).

Beneath the Quaternary-aged sediments, West Bend AASF #1 and Armory partially overlies a bedrock valley. Directly to the east of the facility, the uppermost bedrock is undifferentiated Silurian-aged dolomite, while bedrock directly beneath the facility is primarily Ordovician-aged shale of the Maquoketa Formation (**Figure 2-3**; Evans et al., 2004a). The precise extent of the Silurian dolomite near the facility is uncertain; it may be partially present beneath glacial deposits at the eastern portion of the facility, near the West Bend Municipal Airport (Evans et al., 2004a). The dolomite is often undifferentiated; however, the uppermost dolomite is known to be of the

Manistique Formation, which is composed of gray, fine- to medium-grained dolomite with thin to medium bed thickness (Evans et al., 2004a). Depth to bedrock at the facility ranges between 200 and 400 feet below ground surface (bgs) (Evans et al., 2004b). Regionally, thickness of the undifferentiated dolomite ranges from 0 to 700 feet, depending on the degree of post-depositional erosion. Near the facility, the estimated dolomite thickness is believed to be the same as the saturated thickness of the Eastern Dolomite aquifer, which is between 100 to 200 feet. Directly underlying the dolomite is the Ordovician-aged Maquoketa Shale of the Maquoketa Formation (**Figure 2-3**; Young and Batten, 1980). All bedrock units dip regionally eastward toward Lake Michigan (Young and Batten, 1980).

2.2.2 Hydrogeology

The facility is directly underlain by a surficial aquifer that resides within the unconsolidated sand and gravel deposits of glacial outwash, glacial-lake deposits, or alluvium. Wells screened in this aquifer have historically been used for domestic purposes and have a wide range of yields; however, wells at West Bend have reached high yields of 500 to 1,750 gallons per minute (gpm) (Young and Batten, 1980).

Directly east of the facility, the surficial aquifer is underlain by the Eastern Dolomite aquifer (also known as the Silurian or Niagaran aquifer). This aquifer resides within the undifferentiated Silurian-aged dolomites and produces water from interconnected cracks, pores, and dissolution channels. The Eastern Dolomite aquifer is thickest along the east side of Wisconsin and thins to the west (Wisconsin Geological and Natural History Survey, 2019). Historically, the Eastern Dolomite aquifer has been sourced for domestic, public, industrial, and agricultural purposes, with yields typically ranging between 150 and 500 gpm (Young and Batten, 1980). The Eastern Dolomite aquifer is unconfined near the facility and is particularly vulnerable to contamination where the unconsolidated deposits are relatively thin. Vertical cracks and cavities may also result in the quick vertical migration of groundwater (Wisconsin Geological and Natural History Survey, 2019).

The facility is primarily underlain by the Maquoketa Shale, which separates the Eastern Dolomite aquifer from the Cambrian-Ordovician aquifer. The shale restricts the vertical migration of groundwater and therefore acts as a regional aquiclude (Young and Batten, 1980). The Cambrian-Ordovician aquifer resides in the Ordovician- and Cambrian-aged sandstone and dolomite units below the Maquoketa Shale, yielding water from fractures and pore spaces between the sand grains or from cracks and fractures (Wisconsin Geological and Natural History Survey, 2019).

Depth to groundwater in the area ranges from 5 to 25 feet bgs. Shallow groundwater on the east and west side of the facility likely flows either towards the Milwaukee River or to Wingate Creek, which discharges into the Milwaukee River just south of the facility (**Figure 2-4**). Groundwater in the regional bedrock aquifers is expected to flow generally east towards Lake Michigan. Aquifer recharge is predominantly through infiltration of precipitation, although some recharge occurs from open water sources (Stantec Consulting Services, Inc., 2018).

No known municipal drinking water supply wells are located within the boundary of the West Bend AASF #1 and Armory; however, public supply, domestic, and unknown well types exist within 4 miles of the facility (**Figure 2-3**). Domestic and unknown wells are downgradient of West Bend AASF #1; and other unknown wells are locally up-, down-, and cross-gradient and therefore, may be impacted by potential PFAS releases. Several public drinking water wells are located side gradient and regionally upgradient of the facility but are unlikely to be impacted by potential PFAS releases (**Figure 2-3**). Drinking water for West Bend AASF #1 and Armory is supplied by the City of West Bend, which uses the Lake Michigan and the bedrock aquifers as its drinking water sources (WIDNR, 2001).

The Third Unregulated Contaminant Monitoring Rule (UCMR 3) sampling program was an addition to the 1996 Safe Drinking Water Act which requires USEPA to, every 5 years, issue a new list of no more than 30 unregulated contaminants to be monitored by public water systems. Six PFAS compounds are currently included as part of the UCMR 3 list. The UCMR 3 dataset was evaluated to determine which public water systems were sampled for PFAS within a 20-mile radius of a site. The City of West Bend public drinking water was sampled; results for the six PFAS compounds sampled were below the USEPA Health Advisory. No other public water system was sampled within 20 miles of the facility. Observed groundwater elevations from the October 2020 synoptic gauging event and corresponding contours are displayed on **Figure 2-4**.

2.2.3 Hydrology

West Bend AASF #1 and Armory is within the Milwaukee River Basin, which includes six watersheds. The facility is located between the Silver Creek-Milwaukee River Watershed and the Village of Newburg-Milwaukee Watershed (**Figure 2-5**). The tributary that runs between West Bend AASF #1 and the Armory is Wingate Creek, which discharges to the Milwaukee River. The WIARNG Armory is located on the east side of West Bend AASF #1. The facility is currently connected to the City of West Bend sanitary sewer system. On the west side of the facility, the surface water flows to the south and east towards the stormwater basin. On the east side of the facility, surface water flows northwest and southwest to Wingate Creek, then to the Milwaukee River.

2.2.4 Climate

The climate of West Bend consists of warm summers, and winters with freezing, dry, and windy months. Seasonally, temperatures vary from summer highs of 81.5 degrees Fahrenheit (°F) to winter lows of 9.1°F; the average temperature is 55.0°F. Average precipitation is 31.2 inches of rain, and the average snowfall is 43.3 inches (World Climate, 2021). The area is subject to severe storms in the winter.

2.2.5 Current and Future Land Use

West Bend AASF #1 and Armory is a controlled access facility with public roads and is adjacent to the West Bend Municipal Airport. The facility consists of a storage hangar, repair hangar, shops, and a two-story office area. Exterior features are vehicle parking areas, roads, aircraft parking, taxiways, and a 90-feet clear-span bridge. The West Bend Municipal Airport is owned and operated by the City of West Bend and provides private, commercial, corporate, cargo, and military air service. Future infrastructure improvements, land acquisitions, and land use controls are not anticipated to change. Reasonably anticipated future land use is not expected to change from the current land use described above.

2.2.6 Critical Habitat and Threatened/ Endangered Species

The following birds, plants, mammals, and reptiles are federally endangered, threatened, proposed, and/ or are listed as candidate species in Washington County, Wisconsin (US Fish and Wildlife Service [USFWS], 2018).

- **Birds**: Whooping crane, *Grus americana* (experimental population)
- **Plants**: Eastern prairie fringed orchid, *Platanthera leucophaea* (threatened)
- **Mammals**: Northern Long-Eared Bat, *Myotis septentrionalis* (threatened)
- **Insects:** Rusty patched bumble bee, *Bombus affinis* (endangered)

2.3 History of PFAS Use

The primary source of PFAS at the facility is related to hangar fire suppression system testing and a single fire training exercise. The main hangar is equipped with a fire suppression system that is supplied by two 500-gallon tanks filled with 3 percent (%) aqueous film forming foam (AFFF). Bulk 55-gallon drums of AFFF that supply the fire suppression system are housed in a building connected to the hangar. The fire suppression system has been tested annually, since 2004, by occasionally dispensing 20-40 gallons of 3% AFFF used during testing onto the grassy area behind the building. A stormwater drain that discharges to Wingate Creek, which then discharges to the Milwaukee River, is located at the edge of the grassy area. In addition, there was a one-time reported training event with one TriMax™ fire extinguisher that occurred in a grassy area on the east side of the Armory. The exact date, amount, and concentration of AFFF used are unknown. The overlying surface water flow from the release area is north, then west to Wingate Creek, which ultimately discharges to the Milwaukee River. A description of each AOI is presented in **Section 3**.

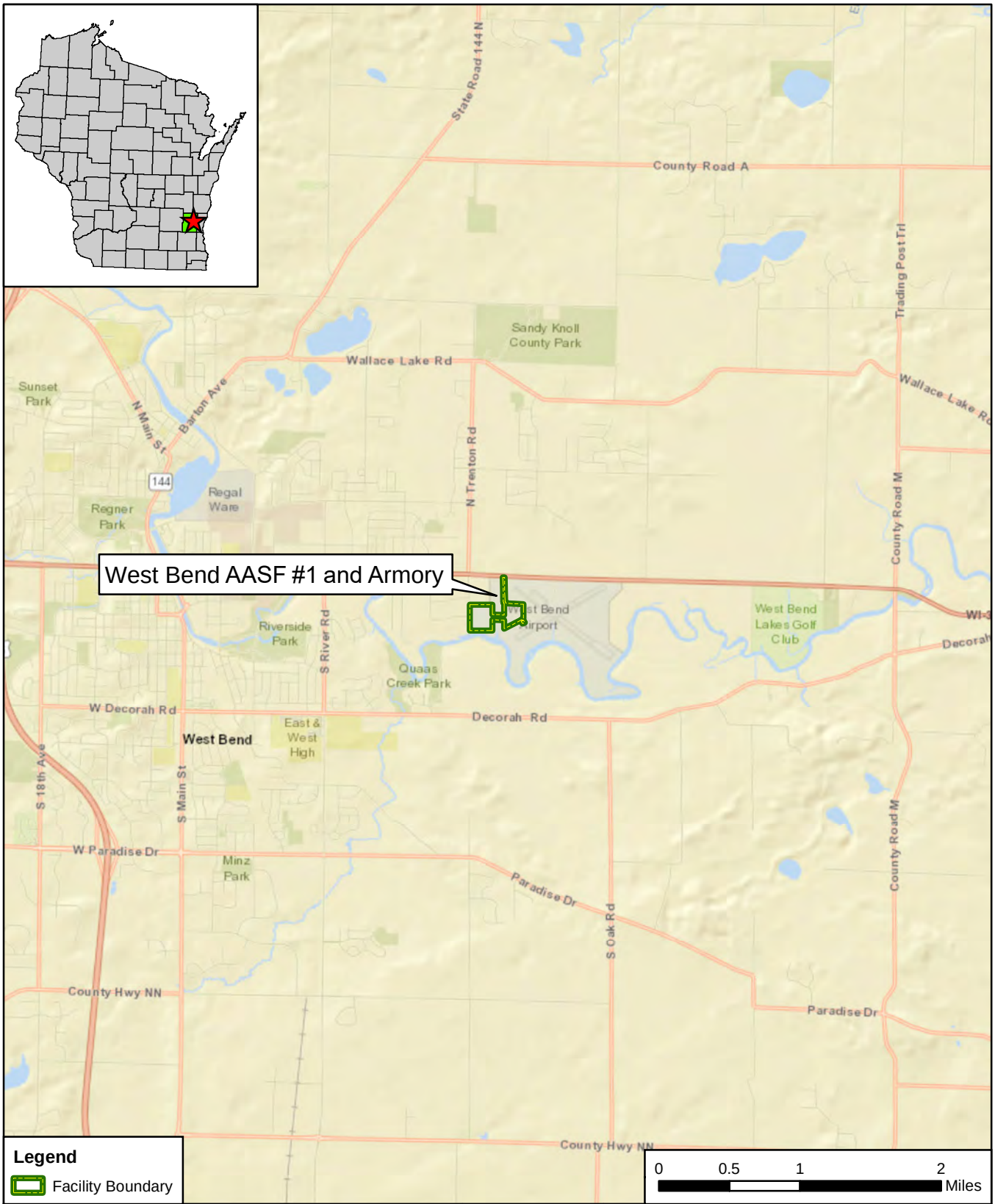
2.4 Other PFAS Investigations

This SI is the first PFAS investigation completed at the West Bend AASF #1 and Armory.

2.5 Potable Water Sampling

Due to historical fire suppression testing and Tri-Max™ fire training activities, the potential exists for exposure to offsite residential drinking water receptors south of the West Bend AASF #1 and Armory boundary. Prior to sampling, approval was obtained from the Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health (DASA ESOH). Potable water samples were collected from five potable wells located in closest proximity to the facility boundary (downgradient of AOI 1 and AOI 2) (**Figure 2-6**). Sample results are provided in **Appendix F**, and the laboratory report is provided in **Appendix G**.

- PFOA, PFOS, and PFBS were reported non-detect at all potable well locations.



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Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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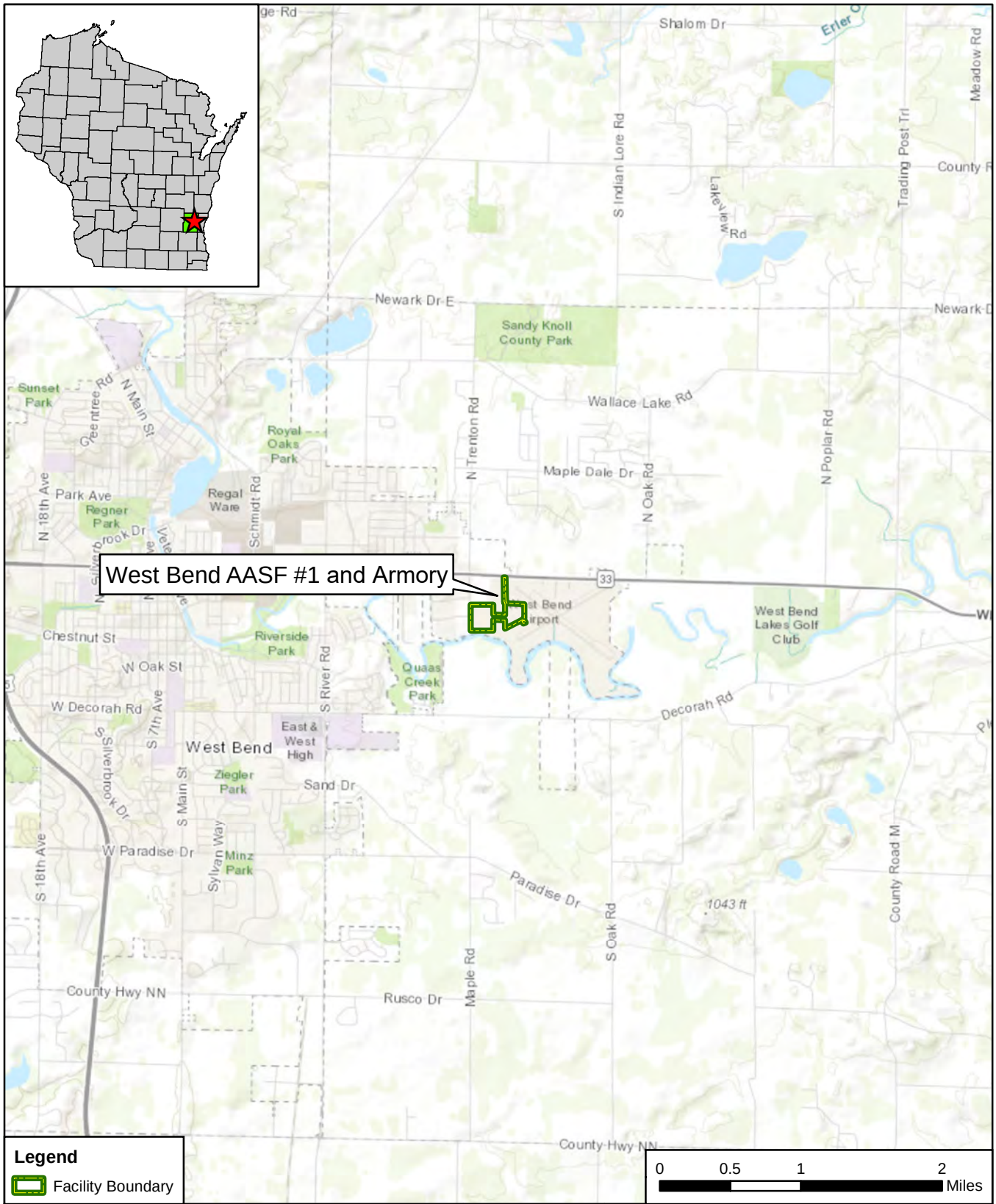

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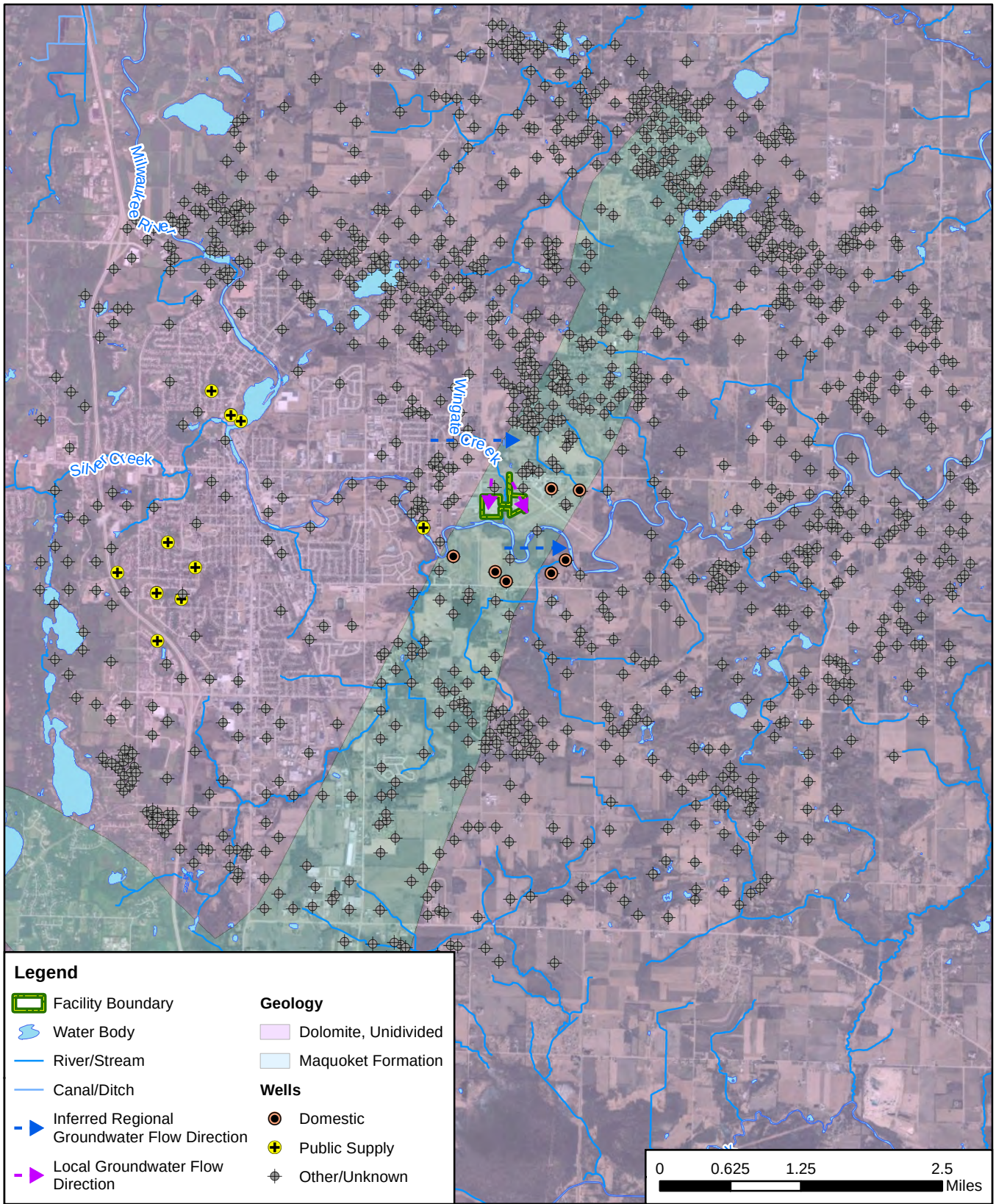

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Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

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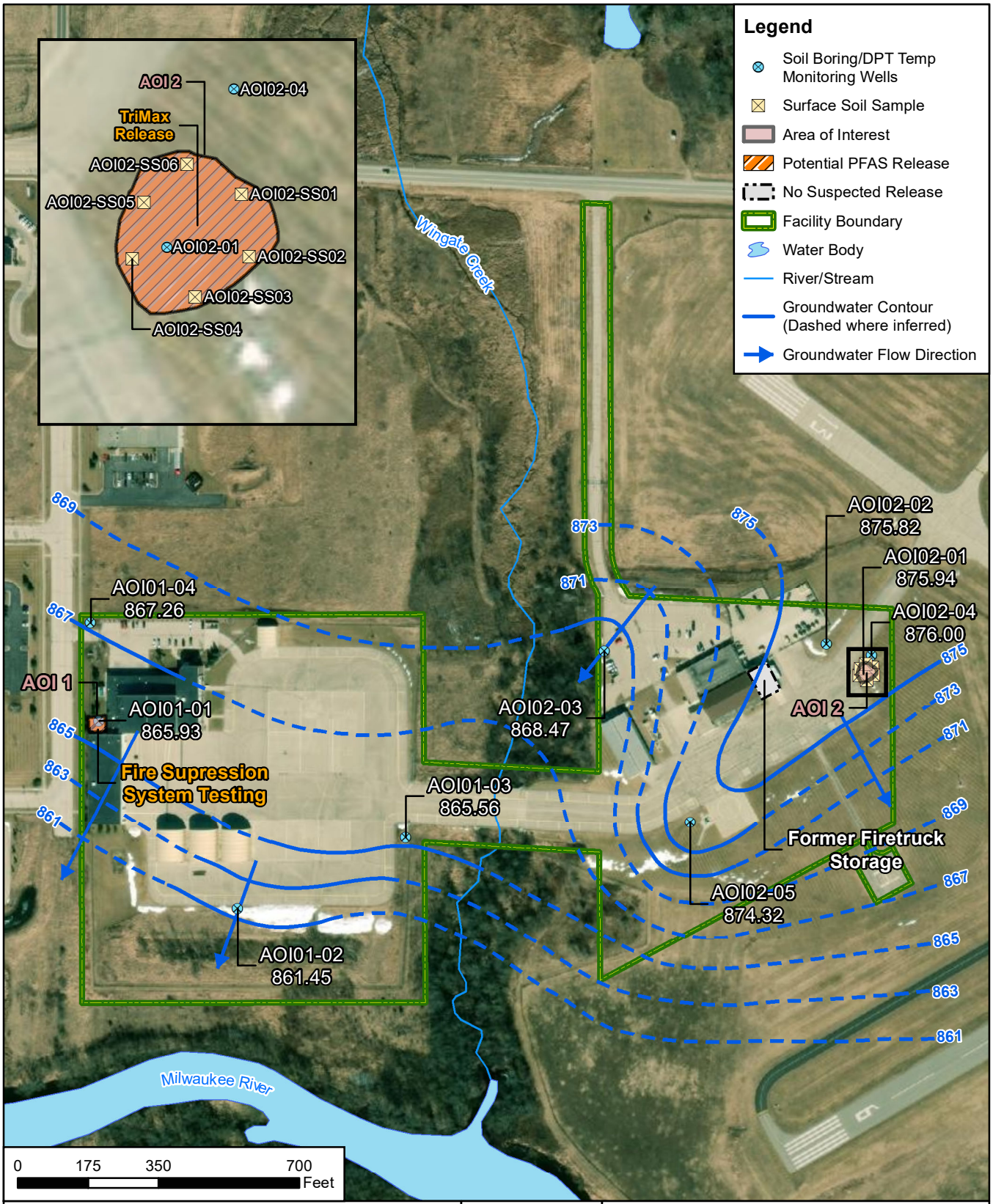

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Groundwater Contours

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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Surface Water Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-5

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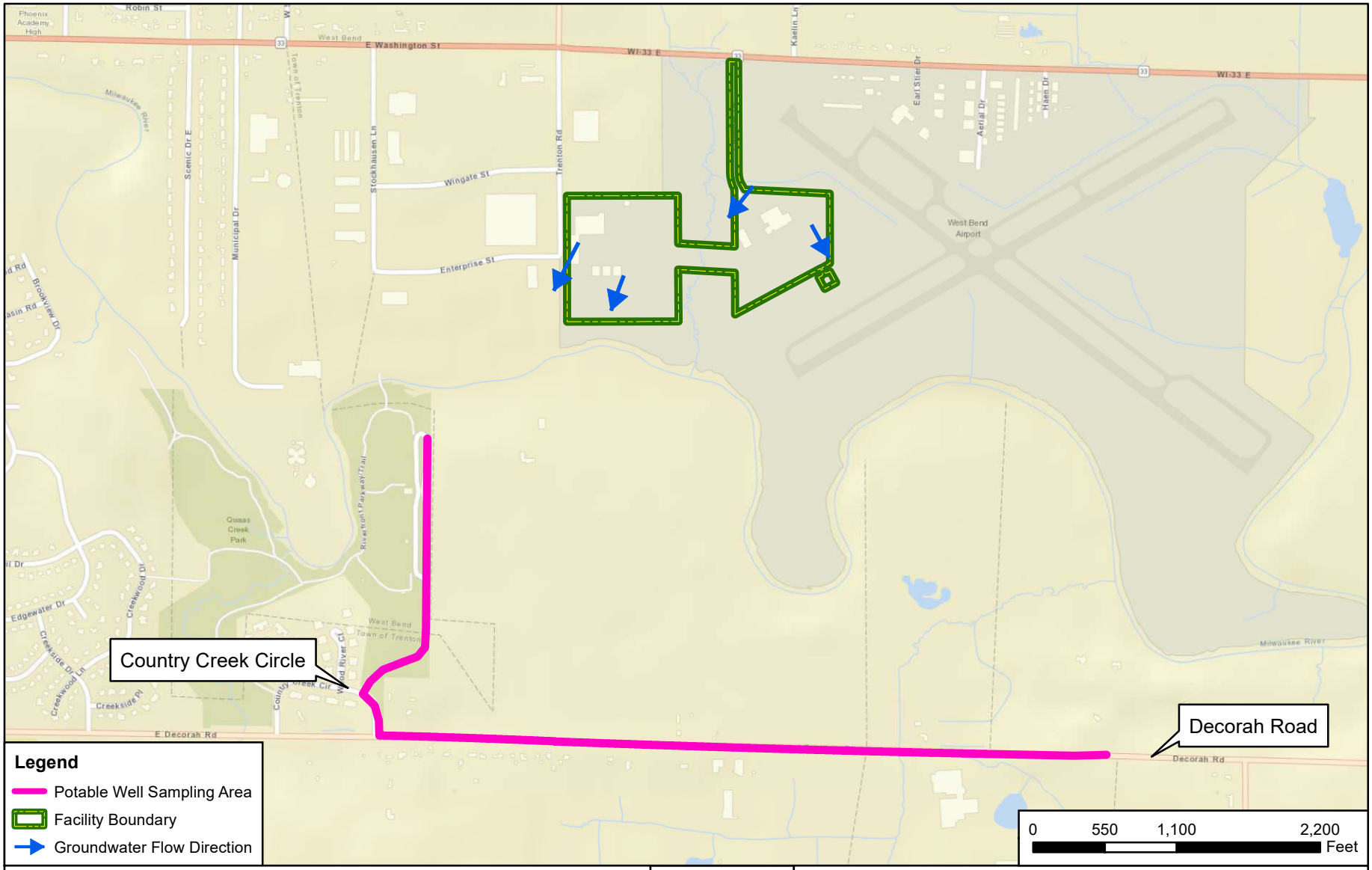

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Potable Well Sampling Area

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-6

3. Summary of Areas of Interest

This section presents a summary of each potential PFAS release area by AOI. Based on the PA findings, two AOIs were identified at the West Bend AASF #1 and Armory. These AOIs include the fire suppression system testing releases at the main hangar and a one-time fire extinguisher training on the east side of the Armory (**Figure 3-1**).

3.1 AOI 1 Fire Suppression System Testing

AOI 1 is the Fire Suppression System Testing area, where 20-40 gallons of 3% AFFF were dispensed annually onto the grassy area behind the building, which took place annually from 2004 to 2019. The main hangar fire suppression system is supplied by two 500-gallon tanks filled with 3% AFFF. The AFFF tanks, pumps, and four bulk 55-gallon drums of AFFF that supply the fire suppression system are housed in a building connected to the hangar. The stormwater drain within AOI 1 flows through the stormwater system to the south, where it discharges to a stormwater basin on the south side of the property. Additionally, if there is flooding at the stormwater basin, surface water can overflow to the Milwaukee River. In 2018, the AFFF dispensed during the annual fire suppression system testing was containerized and removed from the facility for offsite disposal. Since then, the annual inspections no longer include flow testing, and therefore no AFFF is discharged or disposed.

3.2 AOI 2 Tri-Max™ Release

AOI 2 is the Tri-Max™ Release area, where a one-time reported training event with one Tri-Max™ fire extinguisher occurred in a grassy area located on the east side of the Armory. The exact date, amount, and concentration of AFFF used are unknown. The surface water flows northwest and southwest toward Wingate Creek, and ultimately to the Milwaukee River.

3.3 Adjacent Sources

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

3.3.1 West Bend Municipal Airport

The West Bend Municipal Airport was constructed in 1928 and is owned and operated by the City West Bend. The AASF is southwest and adjacent to the West Bend Municipal Airport. The City of West Bend Fire Department provides fire emergency services for the West Bend Municipal Airport.

3.3.2 Americraft CookWare Manufacturing

The Americraft Cookware Manufacturing building was identified due to the potential production of non-stick cookware containing Teflon® and other non-stick materials. The Americraft Cookware Manufacturing building is upgradient of the AASF.

3.3.3 West Bend Waste Water Treatment Plant

The West Bend Waste Water Treatment Plant (WWTP) is approximately 0.5 mile west and upgradient of the AASF. It is unknown if waste water at the WWTP is tested or treated for PFAS. Due to the nature and lack of knowledge regarding the WWTP, this was identified as a potential adjacent source.

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CLIENT	ARNG			
Site Inspection for PFAS at West Bend, WI				
REVISED	3/29/2021	GIS BY	MS	3/29/2021
SCALE	1:11,400	CHK BY	SI	3/29/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	3/29/2021

N

Areas of Interest

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

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

4.1 Problem Statement

The following problem statement was developed during project planning:

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

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the Office of the Secretary of Defense (OSD) dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to three compounds: PFOS, PFOA, and PFBS. The SLs are presented in **Section 6.1** of this Report.

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

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

4.2 Goals of the Study

The following goals were established for this SI:

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

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

4.3 Information Inputs:

Primary information inputs included:

- The PA for West Bend AASF #1, Wisconsin (AECOM, 2019);
- Analytical data from soil and groundwater samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2020b); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.4 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s).

4.5 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the DoD Environmental Laboratory Accreditation Program (ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs and decision rules as defined in the SI QAPP Addendum (AECOM, 2020b). These rules governed response actions based on the results of the SI sampling effort.

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

Groundwater:

- Is there a human receptor within 4 miles of the facility?
- What is the concentration of PFOA, PFOS, and PFBS at the potential release areas?
- What is the concentration of PFOA, PFOS, and PFBS at the facility boundary upgradient and downgradient of the potential release areas?
- What does the conceptual site model (CSM) suggest in terms of source, pathway and receptor?

Soil:

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

Soil and groundwater samples were collected from each of the potential release areas. Groundwater was encountered at approximately 4 to 16 feet bgs.

4.6 Data Usability Assessment

The Data Usability Assessment (DUA) is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment determines whether project execution and the resulting data have met installation-specific DQOs. Both sampling and analytical activities are considered to assess whether the collected data are of the right type, quality, and quantity to support the decision-making (DoD, 2018a; DoD, 2018b; USEPA, 2017).

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

4.6.1 Precision

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

Extraction internal standards (EIS) were added by the laboratory during sample extraction to measure relative responses of target analytes and used to correct for bias associated with matrix interferences and sample preparation efficiencies, injection volume variances, mass spectrometry ionization efficiencies, and other associated preparation and analytical anomalies. Several field samples displayed EIS percent recoveries outside of quality control (QC) limits for 6:2 fluorotelomer sulfonate (6:2 FTS) and 8:2 fluorotelomer sulfonate (8:2 FTS). The field sample results associated with the positive bias were positive and were qualified “J+”. The field sample results associated with the negative biases were all positive and were qualified “J-“. The field samples AOI01-01-GW and AOI01-01-SB-0-2 were re-extracted outside holding time with similar results. The initial results were recommended for retention in the data set.

Injection internal standards (IIS) were added by the laboratory after sample extraction and prior to analysis as a requirement of DoD Quality Systems Manual (QSM) 5.1 to measure relative responses of target analytes. Several QC samples displayed IIS recoveries greater than the QC limit of 50% for surrogate M_2PFDA, M_2PFHxA, M_2PFOA, and M_4PFOS in the extraction analysis. PFAS analytes are not quantitated based on IIS recoveries in non-drinking water matrices; therefore, no impact on data quality is anticipated.

Calibration verifications were performed routinely to ensure that instrument responses for all calibrated analytes were within established QC criteria. The continuing calibration verification associated with QC batch 697682 displayed a percent recovery greater than the upper QC limit of 130%, at 321%, for 6:2 FTS. The associated field sample result was positive and was qualified “J+”. The instrument sensitivity checks (ISC) associated with QC batch 696644 recovered above the QC limits for perfluorotridecanoic acid (PFTrDA) at 144% and 147%. PFTrDA was not a target analyte in the batch associated with these ISC anomalies; no data qualifying action was required, and no impact on data quality is anticipated.

LCS/LCS duplicate (LCSD) pairs were prepared by addition of known concentrations of each analyte in a matrix-free media known to be free of target analytes. LCS/LCSD pairs were analyzed for every analytical batch to demonstrate the ability of the laboratory to detect similar concentrations of a known quantity in matrix-free media. The LCS/LCSD samples were within the project established precision limits presented in the SI QAPP Addendum (AECOM, 2020b).

MS/MS duplicate (MSD) samples were prepared, analyzed, and reported for all preparation batches. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested, with one exception. The field sample AOI02-01-GW displayed an MS/MSD RPD outside the QC limit of 30%, at 39%, for perfluorotetradecanoic acid (PFTeDA). The associated field sample result was previously qualified due to an MS/MSD anomaly, and no further data qualifying action was required.

Field duplicate samples were collected at a rate of 10% to assess the overall sampling and measurement precision for this sampling effort. The field duplicate samples were analyzed for PFAS and general chemistry parameters. The field duplicate samples were within the project established precision limits presented in the SI QAPP Addendum (AECOM, 2020b).

4.6.2 Accuracy

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

LCS/LCSD samples were prepared by addition of known concentrations of each analyte in a matrix free media known to be free of target analytes. LCS/LCSD samples were analyzed for every analytical batch and demonstrated that the analytical system was in control during sample preparation and analysis, with one exception. The LCS associated with the QC sample LCS2086432 displayed a percent recovery greater than the upper QC limit of 130%, at 133%, for N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA). Field sample results were not flagged based on QC sample LCS recoveries; no impact on data quality is anticipated.

MS/MSD samples were prepared, analyzed, and reported at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested. Field samples AOI02-SS05 and AOI02-01-GW displayed MS/MSD percent recoveries less than the lower QC limit for several target analytes. The field sample results associated with MS/MSD recoveries less than 10% were positive and were qualified “J-“. The positive field sample results associated with percent recoveries less than 70% but greater than 10% were qualified “J-“, while non-detects were qualified “UJ-“.

4.6.3 Representativeness

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

Relating to the use of standard analytical methods, the laboratory followed the method as established in PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) Compliant with QSM 5.1 Table B-15, including the specific preparation requirements (i.e. ENVI-Carb or equivalent used), mass calibration, spectra, all the ion transitions identified in Table B-15 were monitored, standards that contained both branch and linear isomers when available were used, and isotopically labeled standards were used for quantitation.

Field QC samples were collected to assess the representativeness of the data collected. Field duplicates were collected at a rate of 10% for all field samples, while MS/MSD samples were collected at a rate of 5%. All preservation techniques were followed by the field staff, and all technical and analytical holding times were met by the laboratory, except for the pH analyses. For the pH analysis the technical holding time is “immediate”. The field sample results associated with the holding time exceedance were qualified “J”. The laboratory used approved standard methods in accordance with the SI QAPP Addendum (AECOM, 2020b) for all analyses.

Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control. All associated instrument blanks and method blanks were non-detect for all target analytes, with a few exceptions. Method blanks, MB2105014, MB2105014RE, and MB2105004 displayed concentrations greater than the detection limit for perfluoroheanoic acid (PFHxA), PFOA, and PFBA, respectively. The positive field sample results associated with the method blank detections that were less than five times the blanks concentrations were qualified “U”, while field sample results greater than five times the blank concentrations required no data qualifying action. The instrument blank performed in QC batch 696772 displayed a concentration for 6:2 FTS greater than the detection limit. The positive associated field sample results displayed concentrations greater than five times the detections displayed in the instrument blank; no data qualifying action was required.

Equipment blanks and field blanks were also collected for groundwater and soil samples. The field and equipment blanks WB-ERB-02, WB-ERB-01, and WB-FRB-01 all displayed concentrations for 6:2 FTS and PFBA greater than the detection limit. The positive field sample results associated with the blank detections that were less than five times the blank concentrations were qualified “U”, while field sample results greater than five times the blank concentrations required no data qualifying action. Non-detect field sample results required no data qualifying action.

A sample of the water used for decontamination of the drill rig was collected in advance of the field effort. The drill rig decontamination sample, WB-DECON-20200921, was non-detect for all target analytes. Based on the sample results, the potable water source was deemed acceptable for use during the investigation for decontamination of drilling equipment and during well installation.

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

4.6.4 Comparability

Comparability is the extent to which data from one study can be compared directly to either past data from the current project or data from another study. Using standardized sampling and

analytical methods, units of reporting, and site selection procedures help ensure comparability. Standard field sampling and typical laboratory protocols were used during the SI and are considered comparable to ongoing investigations.

4.6.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data expected under normal conditions. The laboratory provided data meeting system QC acceptance criteria for all samples tested. Project completeness was determined by evaluating the planned versus actual quantities of data. Percent completeness per parameter is as follows and reflects the exclusion of "X" flagged data, if applicable:

- PFAS in groundwater by LC/MS/MS compliant with QSM 5.1 Table B-15 at 100%
- PFAS in soil by LC/MS/MS compliant with QSM 5.1 Table B-15 at 100%
- pH in soil by USEPA Method 9045D at 100%
- Total organic carbon (TOC) by USEPA Method 9060 at 100%

4.6.6 Sensitivity

Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory fortified blanks, a method detection limit (MDL) study, and calibration standards at the limit of quantitation (LOQ). In order to meet the needs of the data users, project data must meet the measurement performance criteria for sensitivity and project LOQs specified in the SI QAPP Addendum (AECOM, 20120b). The laboratory provided the requested MDL studies and provided applicable calibration standards at the LOQ. In order to achieve the DQOs for sensitivity outlined in the SI QAPP Addendum (AECOM, 2020b), the laboratory reported all field sample results at the lowest possible dilution. Additionally, any analytes detected below the LOQ and above the MDL were reported and qualified "J" as estimated values by the laboratory.

5. Site Inspection Activities

This section describes the environmental investigation and sampling activities that occurred as part of the SI. The SI sampling approach was based on the findings of the PA and implemented in accordance with the following approved documents:

- *Final Preliminary Assessment Report, Final Preliminary Assessment Report, West Bend Army Aviation Support Facility, Wisconsin, dated November 2019* (AECOM, 2019);
- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan dated March 2018* (AECOM, 2018a);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Final Preliminary Assessment Report, West Bend Army Aviation Support Facility, Wisconsin, dated October 2020* (AECOM, 2020b);
- *Final Programmatic Accident Prevention Plan dated July 2018* (AECOM, 2018b); and
- *Final Site Safety and Health Plan, Final Preliminary Assessment Report, West Bend Army Aviation Support Facility, Wisconsin, dated October 2020* (AECOM, 2020a).

The SI field activities were conducted from 26 to 29 October 2020 and consisted of direct push boring and soil sample collection, temporary monitoring well installation, and grab groundwater sample collection. Field activities were conducted in accordance with the QAPP Addendum (AECOM, 2020b), except as noted in **Section 5.7**.

The following samples were collected during the SI and analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15 to fulfill the project DQOs:

- Twenty-three (23) soil grab samples from nine (9) boring locations;
- Six (6) soil grab samples from six (6) surface locations;
- Nine (9) groundwater grab samples from nine (9) temporary well locations; and
- Eighteen (18) Quality Assurance (QA) samples collected.

Figure 5-1 provides the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. A Field Change Request Form is provided in **Appendix B3**, and sampling forms are provided in **Appendix B2**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

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

5.1.1 Technical Project Planning

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

A combined TPP Meeting 1 and 2 was held on 27 August 2020, prior to SI field activities. Meeting minutes are provided in **Appendix D**. TPP meetings 1 and 2 were conducted in general accordance with EM 200-1-2.

The stakeholders for this SI include the ARNG G9, Wisconsin Department of Military Affairs, USACE, WIDNR, and representatives familiar with the facility, the regulations, and the community. Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the SI QAPP Addendum (AECOM, 2020b).

A TPP Meeting 3 was held on 12 May 2021 after the field event to discuss the results of the SI. Meeting minutes for TPP 3 are included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

Utility clearance was conducted by GLS Utility, LLC., with input from the AECOM field team. AECOM's drilling subcontractor, Cascade Technical Services, LLC, contacted "Call811" one-call utility clearance contractor to notify them of intrusive work. Additionally, the first 5 feet of each boring were advanced using hand augering methods to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

The potable water source used for decontamination of drilling equipment was confirmed to be PFAS-free prior to the start of field activities. A sample of the City of West Bend Municipal Water Supply was collected from a spigot at the AASF on 21 September 2020, prior to mobilization, and analyzed for PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15. The results of the potable well sample are provided in **Appendix F**. A discussion of the results is presented in **Section 4.6.3**.

Materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 2020b). Prior to the start of field work each day, a PFAS Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Soil samples were collected via direct-push technology (DPT) in accordance with the SI QAPP Addendum (AECOM, 2020b). A GeoProbe® 7822DT dual-tube sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top five feet of the boring to be compliant with utility clearance procedures.

Three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring, except where the depth to groundwater was shallow, only allowing two samples to be collected. This process occurred at several sample locations on the east side of the facility, near AOI02. These deviations from the work plan are described further in **Section 5.7**. One subsurface soil sample approximately 1 foot above the groundwater table, and one subsurface soil sample at the mid-point between the ground surface and the groundwater table, were collected at each boring using DPT.

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

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

Clay layers exceeding 3 feet in thickness were encountered in four of the nine boreholes. Depths to the top of clay layer ranged from 2 to 5.5 feet bgs. A grain size analysis collected at AOI01-03 at a depth of 6 to 8 feet had 65.50% silt, 32.27% clay, 2.23% sand and gravel. These results suggest that what was identified as a lean clay by field tests may actually be categorized as clay-rich silt when a grain size analysis is performed.

Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed for PFAS (LC/MS/MS compliant with QSM 5.1 Table B-15), TOC (USEPA Method 9060A) and pH (USEPA Method 9045D) in accordance with the SI QAPP Addendum (AECOM, 2020b).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. In instances when non-dedicated sampling equipment was used, such as a hand auger for the shallow soil samples, equipment rinsate blanks (ERBs) were collected at a rate of 5% and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 4 degrees Celsius (°C) during shipment.

DPT borings were converted to temporary wells, which were subsequently abandoned in accordance with the SI QAPP Addendum (AECOM, 2020b) using bentonite chips at completion of sampling activities. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 Temporary Well Installation and Groundwater Grab Sampling

Temporary wells were installed using a GeoProbe® 7822DT dual-tube sampling system. Once the borehole was advanced to the desired depth, wherever conditions allowed, a temporary well was constructed of a 5-foot section of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. New PVC pipe and screen were used to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

The temporary wells were allowed to recharge and purged for a total of approximately three well volumes after installation before collection of groundwater samples. After the recharge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) after each grab sample was collected. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under

standard CoC procedures to the laboratory and analyzed for PFAS by LC/MS/MS Compliant with QSM 5.1 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2020b).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. One field reagent blank (FRB) was collected in accordance with the PQAPP (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 4°C during shipment.

Temporary wells were abandoned in accordance with the SI QAPP Addendum (AECOM, 2020b) by removing the PVC and backfilling the hole with bentonite chips. Temporary wells were installed in grass areas to avoid disturbing concrete or asphalt.

5.4 Water Level Measurements

Groundwater level measurements were taken prior to sampling. Groundwater elevation measurements were collected from each of the installed temporary wells. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-3**.

5.5 Surveying

Each well casing was surveyed by Wisconsin-Licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2019b). Survey data from the newly installed temporary wells on the facility were collected on 29 October 2020 in the Universal Transverse Mercator Zone 16 North projection with World Geodetic System 84 datum. The surveyed well data are provided in **Appendix B4**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of PFAS investigation-derived waste (IDW) is not regulated federally. PFAS IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the SI QAPP Addendum (AECOM, 2020b) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) and liquid IDW (purge and decontamination water) generated during the SI activities were containerized in two, 55-gallon drums for soil IDW and one, 55-gallon drum of liquid IDW and were stored inside the hangar. The soil and liquid IDW was not sampled and assumes the PFAS characteristics of the associated soil samples collected from that source location.

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

5.7 Laboratory Analytical Methods

Samples were analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15 at Pace Analytical Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP certified laboratory. The 18 PFAS analyzed as part of the ARNG SI program include the following:

- 6:2 fluorotelomer sulfonate (6:2 FTS)
- 8:2 fluorotelomer sulfonate (8:2 FTS)
- Perfluorohexanoic acid (PFHxA)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)

- N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
- N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
- Perfluorobutyrate (PFBA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS)
- Perfluoropentanoic acid (PFPeA)
- Perfluorotetradecanoic acid (PFTeDA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluoroundecanoic acid (PFUdA)

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

5.8 Deviations from SI QAPP Addendum

Derivations from the SI QAPP Addendum occurred based on field conditions and discussion between AECOM, ARNG, and USACE. Deviations from the SI QAPP Addendum are noted below and are documented in the following appendices:

- The SI QAPP Addendum stated that three soil samples were to be collected from each direct-push boring location at representative depths of the surface soil, vadose soil, and intermediate soil. However, four out of the nine direct-push locations (AOI01-01, AOI02-02, AOI02-04, and AOI02-05), located on the eastern side of the facility, had very shallow depths-to-water, ranging from 5 to 6 feet bgs. Therefore, soil samples at these four borings could only be collected in two intervals (0-2 feet bgs and 3-5 feet bgs) instead of three intervals. This action was documented in the Log of Daily Notice of Field Activities provided in **Appendix B1**.
- The SI QAPP Addendum stated that each soil boring location must be cleared to 5 feet bgs using a hand auger prior to direct-push technology. At location AOI01-02, clearing to 5 feet bgs with a hand auger was not possible due to the presence of pea gravel under the topsoil. The location of AOI01-02 was relocated approximately 64 feet north of the original location presented in the SI QAPP Addendum. The updated sample location is shown on **Figure 5.1**.This action was documented in the Field Change Request Forms provided in **Appendix B3**.

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, West Bend AASF #1 and Armory

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-0-2	10/28/2020	0-2	x				
AOI01-01-SB-6-8	10/28/2020	6-8	x	x	x		
AOI01-01-SB-6-8-FD	10/28/2020	6-8		x	x	x	Field Duplicate
AOI01-01-SB-10-12	10/28/2020	10-12	x				
AOI01-02-SB-0-2	10/28/2020	0-2	x				
AOI01-02-SB-5-7	10/28/2020	5-7	x				
AOI01-02-SB-7-9	10/28/2020	7-9	x				
AOI01-02-SB-7-9-MS	10/28/2020	7-9	x				Matrix Spike
AOI01-02-SB-7-9-MSD	10/28/2020	7-9	x				Matrix Spike Duplicate
AOI01-03-SB-0-2	10/27/2020	0-2	x				
AOI01-03-SB-6-8	10/27/2020	6-8	x				
AOI01-03-SB-6-8-FD	10/27/2020	6-8	x				Field Duplicate
AOI01-03-SB-15-17	10/27/2020	15-17	x				
AOI01-04-SB-0-2	10/28/2020	0-2	x				
AOI01-04-SB-6-8	10/28/2020	6-8	x				
AOI01-04-SB-13-15	10/28/2020	13-15	x				
AOI01-04-SB-13-15-FD	10/28/2020	13-15	x				Field Duplicate
AOI02-01-SB-0-2	10/27/2020	0-2	x				
AOI02-01-SB-3-5	10/27/2020	3-5	x				
AOI02-02-SB-0-2	10/27/2020	0-2	x				
AOI02-02-SB-0-2-FD	10/27/2020	0-2	x				Field Duplicate
AOI02-02-SB-3-5	10/27/2020	3-5	x				
AOI02-03-SB-0-2	10/27/2020	0-2	x				
AOI02-03-SB-3-5	10/27/2020	3-5	x				
AOI02-03-SB-7-9	10/27/2020	7-9	x				
AOI02-04-SB-0-2	10/27/2020	0-2	x				
AOI02-04-SB-3-5	10/27/2020	3-5	x	x	x		
AOI02-04-SB-3-5-MS	10/27/2020	3-5		x	x		Matrix Spike
AOI02-04-SB-3-5-MSD	10/27/2020	3-5		x	x		Matrix Spike Duplicate
AOI02-05-SB-0-2	10/27/2020	0-2	x				
AOI02-05-SB-3-5	10/27/2020	3-5	x				
AOI02-SS01	10/26/2020	0-2	x				
AOI02-SS02	10/26/2020	0-2	x				
AOI02-SS03	10/26/2020	0-2	x				
AOI02-SS03-FD	10/26/2020	0-2	x				Field Duplicate
AOI02-SS04	10/26/2020	0-2	x				
AOI02-SS05	10/26/2020	0-2	x				
AOI02-SS05-MS	10/26/2020	0-2	x				Matrix Spike
AOI02-SS05-MSD	10/26/2020	0-2	x				Matrix Spike Duplicate
AOI02-SS06	10/26/2020	0-2	x				
Groundwater Samples							
AOI01-01-GW	10/29/2020	20-25	x				
AOI01-02-GW	10/28/2020	15-20	x				
AOI01-03-GW	10/28/2020	16-21	x				
AOI01-04-GW	10/28/2020	15-20	x				
AOI02-01-GW	10/27/2020	5-10	x				
AOI02-01-GW-MS	10/27/2020	5-10	x				Matrix Spike
AOI02-01-GW-MSD	10/27/2020	5-10	x				Matrix Spike Duplicate
AOI02-02-GW	10/27/2020	5-10	x				
AOI02-03-GW	10/28/2020	20-25	x				
AOI02-04-GW	10/27/2020	5-10	x				
AOI02-05-GW	10/27/2020	5-10	x				
AOI02-05-GW-FD	10/27/2020	5-10	x				Field Duplicate

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, West Bend AASF #1 and Armory

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Blank Samples							
WB-DECON-20200921	9/21/2020	NA	x				Decontamination Water Blank
WB-FRB-01	10/28/2020	NA	x				Field Reagent Blank
WB-ERB-01	10/28/2020	NA	x				Equipment Rinsate Blank
WB-ERB-02	10/26/2020	NA	x				Equipment Rinsate Blank

Notes:
AASF = Army Aviation Support Facility
AOI = Area of Interest
ASTM = American Society for Testing Materials
bgs = below ground surface
DECON = decontamination water blank
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
GW = groundwater
LC/MS/MS = liquid chromatography tandem mass spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
NA = not applicable
PFAS = per- and polyfluoroalkyl substances
pH = potential for hydrogen
QSM = Quality Systems Manual
SB = soil boring
SS = surface soil
TOC = total organic carbon
USEPA = United States Environmental Protection Agency
WB = water blank

Table 5-2
Soil Boring Depths and Temporary Well Screen Intervals Site Inspection Report, West Bend AASF #1 and Armory

Area of Interest	Soil Boring ID	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)	Groundwater Elevation (feet amsl)
AOI 1	AOI01-01	25	20-25	865.93
	AOI01-02	20	15-20	861.45
	AOI01-03	21	16-21	865.56
	AOI01-04	20	15-20	867.26
AOI 2	AOI02-01	10	5-10	875.94
	AOI02-02	10	5-10	875.82
	AOI02-03	25	20-25	868.47
	AOI02-04	10	5-10	876.00
	AOI02-05	10	5-10	874.32

Notes:
AASF = Army Aviation Support Facility
AOI = Area of Interest
bgs = below ground surface
ID = identification
amsl = above mean sea level

Table 5-3
Groundwater Elevations at Temporary Groundwater Monitoring Wells
Site Inspection Report, West Bend AASF #1 and Armory

Monitoring Well ID	Ground Surface Elevation (ft amsl)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
AOI01-01	879.63	13.7	865.93
AOI01-02	872.15	10.7	861.45
AOI01-03	870.16	4.6	865.56
AOI01-04	880.26	13.0	867.26
AOI02-01	879.14	3.2	875.94
AOI02-02	879.62	3.8	875.82
AOI02-03	878.47	10.0	868.47
AOI02-04	879.60	3.6	876.00
AOI02-05	878.72	4.4	874.32

Notes:

AASF = Army Aviation Support Facility

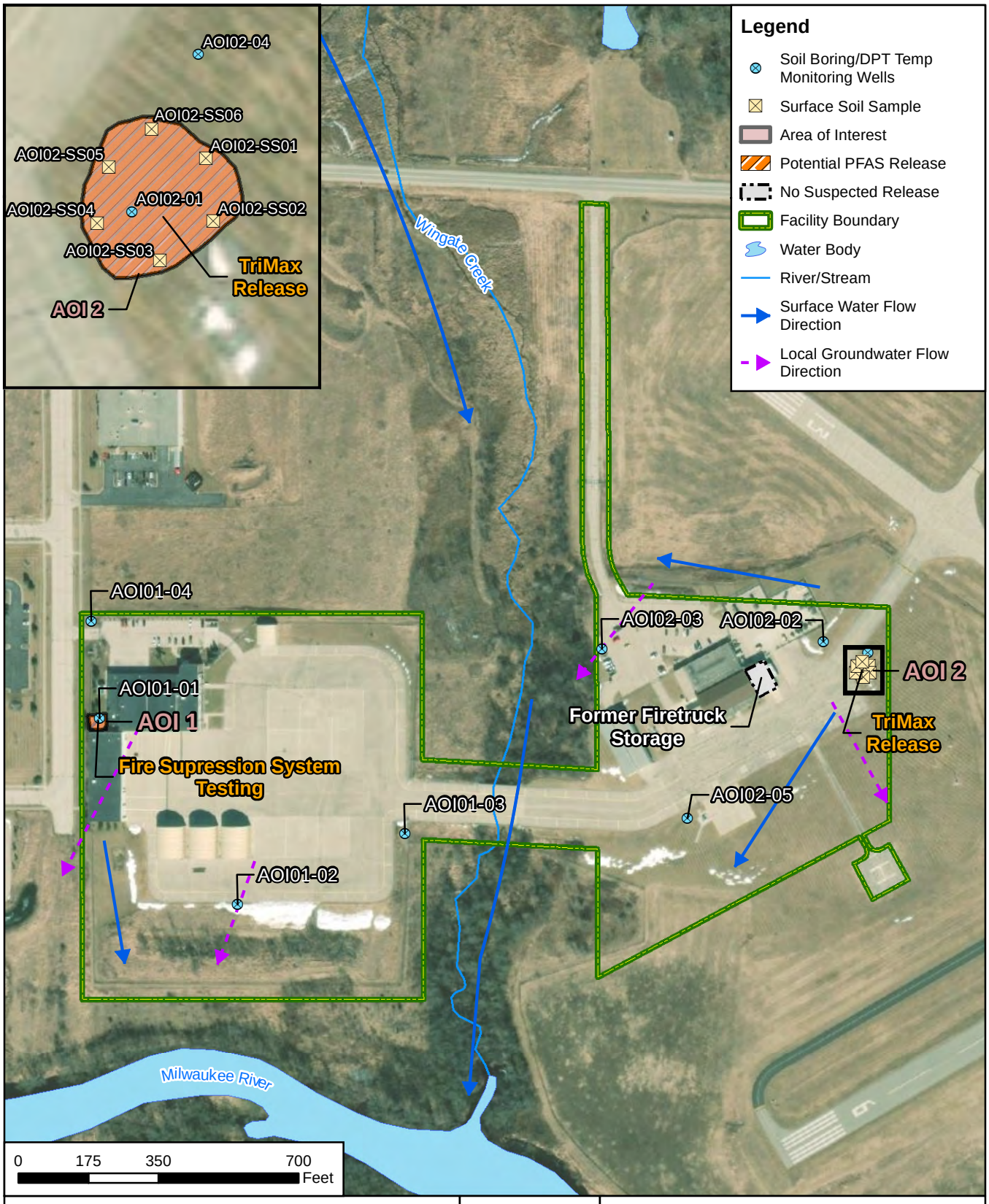
AOI = Area of Interest

amsl = above mean sea level

bgs = below ground surface

ft = feet

ID = identification



CLIENT	ARNG			
Site Inspection for PFAS at West Bend, WI				
REVISED	3/29/2021	GIS BY	MS	3/29/2021
SCALE	1:4,200	CHK BY	SI	3/29/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	3/29/2021

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

C:\Users\stankevichm\OneDrive - AECOM Directory\ARNG_PFAS_GIS_60552172\MXDs\WI\West_Bend_Figures\West_Bend_SI_Figures\SI_Report\Fig_5-1_West_Bend_SI_Sample_Locations.mxd

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6. Site Inspection Results

This section presents the analytical results of the SI for each AOI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Section 6.3** through **Section 6.9**. **Table 6-2** through **Table 6-4** present PFAS results for samples with detections in soil and groundwater; only constituents detected in one or more samples are included. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

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

All other results presented in this report are considered informational in nature and serve as an indication as to whether soil, groundwater, sediment, and surface water contain or do not contain PFAS within the boundaries of the facility.

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

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

Notes:
a.) Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 15 October 2019.
b.) If only one PFAS is present, a HQ of 1 applies and the values presented would increase by a factor of x10.
c.) µg/kg= micrograms per kilogram

6.2 Soil Physicochemical Analyses

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

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport of PFAS contaminants. According to the Interstate Technology Regulatory Council (ITRC), several important PFAS partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions and are therefore relatively mobile in groundwater (Xiao et al., 2015), but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy 2006; Guelfo and Higgins, 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (Koc 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, which includes one potential PFAS release area: Fire Suppression System Testing area at the main hangar. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.3.1 AOI 1 Soil Analytical Results

Soil was sampled at AOI 1 from three depth intervals at boring locations AOI01-1, AOI01-02, AOI01-03, and AOI01-04 during the SI: shallow interval (0 to 2 feet bgs), intermediate interval (6 to 8 feet bgs), and deep interval (7 to 17 feet bgs). PFOS, PFOA, and PFBS were detected in soil at concentrations several orders of magnitude lower than the SLs.

PFOS was detected in the shallow soil interval at all four locations with concentrations ranging from 0.220 J micrograms per kilogram (µg/kg) to 0.827 J µg/kg but not detected in the intermediate or deep intervals. PFOA was detected in the shallow soil interval at all four locations with concentrations ranging from 0.214 J µg/kg to 0.380 J µg/kg. PFOA was detected in the intermediate and deep soil intervals at AOI01-01 with concentrations of 0.606 J µg/Kg and 0.504 J µg/kg, respectively. PFBS was detected in the shallow soil interval at location AOI01-02 with a concentration of 3.41 µg/kg but was not detected in the intermediate or deep soil intervals.

6.3.2 AOI 1 Groundwater Analytical Results

Groundwater samples were collected from four temporary monitoring well locations at AOI 1 during the SI (AOI01-01-GW, AOI01-02-GW, AOI01-03-GW, and AOI01-04-GW). PFOS was detected below the SL of 40 nanograms per liter (ng/L), with concentrations ranging from 1.33 J ng/L to 18.3 J ng/L, with the maximum concentration occurring at AOI01-01-GW. The SL of 40 ng/L for PFOA was exceeded at AOI01-01-GW with a concentration of 990 ng/L. PFBS was detected below the SL of 40,000 ng/L at two well locations, with concentrations ranging from 0.860 J ng/L to 1.34 ng/L, with the maximum concentration occurring at AOI01-03-GW.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were detected in soil and groundwater at AOI 1. The detected concentrations of PFOA, PFOS, and PFBS in soil were several orders of magnitude lower than the soil SLs. PFOA was detected in groundwater at a concentration exceeding the SL of 40 ng/L at the potential source area. The detected concentrations of PFOS and PFBS in groundwater were below their respective SLs. Based on the exceedances of the SL for PFOA in groundwater, further evaluation at AOI 1 is warranted.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2, which includes one potential PFAS release area: Tri-Max™ Release. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.4.1 AOI 2 Soil Analytical Results

Soil was sampled at AOI 2 from two depth intervals at boring locations AOI02-01, AOI02-02, AOI02-04, and AOI02-05 during the SI: shallow interval (0 to 2 feet bgs) and intermediate interval (3 to 5 feet bgs); from three depth intervals at boring location AOI02-03: shallow interval (0 to 2 feet bgs), intermediate interval (3 to 5 feet bgs), and deep interval (7 to 9 feet bgs); and from one depth interval at AOI02-SS01, AOI02-SS02, AOI02-SS03, AOI02-SS04, AOI02-SS05, and AOI02-SS06: shallow (0 to 2 feet bgs). PFOS, PFOA, and PFBS were detected in soil at concentrations an order of magnitude lower than the SLs.

PFOS was detected in the shallow soil interval at all eleven locations with concentrations ranging from 0.828 J µg/kg to 6.85 µg/kg. PFOS was detected in the intermediate soil interval at AOI01-01, AOI02-03, AOI02-04, and AOI02-05 with concentrations ranging from 0.344 J µg/kg to 5.75 µg/kg. PFOS was not detected in the deep interval. PFOA was detected in the shallow soil interval at AOI02-01, AOI02-03, AOI02-04, and AOI02-05 locations with concentrations ranging from 0.163 J µg/kg to 0.262 J µg/kg, but was not detected in the intermediate or deep intervals. PFBS was not detected in soil at AOI 2.

6.4.2 AOI 2 Groundwater Analytical Results

Groundwater samples were collected from five temporary monitoring well locations at AOI 2 during the SI (AOI02-01-GW, AOI02-02-GW, AOI02-03-GW, AOI02-04-GW, and AOI02-05-GW). The SL of 40 ng/L for PFOS was exceeded at AOI02-01-GW, AOI02-02-GW, AOI02-04-GW, and AOI2-05-GW, and AOI02-05-GW-FD with concentrations of 702 J- ng/L, 232 ng/L, 492 ng/L, 225 ng/L, and 193 ng/L, respectively. PFOA was detected below the SL of 40 ng/L at all well locations with concentrations ranging from 3.29 J ng/L to 21.0 ng/L, with the maximum concentration occurring at AOI02-02-GW. PFBS was detected below the SL of 40,000 ng/L at all well locations, with concentrations ranging from 1.44 J ng/L to 8.12 ng/L, with the maximum concentration occurring at AOI02-03.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOA and PFOS were detected in soil at AOI 2; however, the detected concentrations were an order of magnitude lower than the soil SLs. PFOS was detected in groundwater at concentrations exceeding the individual SL of 40 ng/L at the potential source area. The detected concentrations of PFOA and PFBS in groundwater were below their respective SLs. Based on the exceedances of the SL for PFOS in groundwater, further evaluation at AOI 2 is warranted.

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Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, West Bend AASF #1 and Armory

	Area of Interest	AOI01								AOI02											
	Sample ID	AOI01-01-SB-0-2		AOI01-02-SB-0-2		AOI01-03-SB-0-2		AOI01-04-SB-0-2		AOI02-01-SB-0-2		AOI02-02-SB-0-2		AOI02-02-SB-0-2-FD		AOI02-03-SB-0-2		AOI02-04-SB-0-2		AOI02-05-SB-0-2	
	Sample Date	10/28/2020		10/28/2020		10/27/2020		10/28/2020		10/27/2020		10/27/2020		10/27/2020		10/27/2020		10/27/2020		10/27/2020	
	Depth	0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																					
6:2 FTS	-	51.5	J-	0.210	J	ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	0.992	J	0.398	J	0.317	J	ND		ND		ND		ND		ND		ND		0.226	J
PFBS	130000	ND		3.41		ND		ND		ND		ND		ND		ND		ND		ND	
PFDA	-	0.137	J	0.357	J	ND		ND		ND		ND		ND		ND		ND		ND	
PFDoA	-	ND		0.394	J	ND		ND		ND		ND		ND		ND		ND		ND	
PFHpA	-	0.568	J	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFHxA	-	3.53		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFHxS	-	ND		ND		ND		ND		ND		ND		ND		2.56		ND		ND	
PFNA	-	0.426	J	0.188	J	ND		ND		ND		0.156	J	0.137	J	ND		0.111	J	ND	
PFOA	130	0.380	J	0.250	J	0.214	J	0.228	J	0.262	J	ND		ND		0.163	J	0.177	J	0.188	J
PFOS	130	0.220	J	0.827	J	0.474	J	0.598	J	5.53		3.76		4.56		4.35		6.85		4.51	
PFPeA	-	6.70		0.252	J	ND		0.184	J	ND		ND		ND		ND		ND		ND	
PFUnDA	-	ND		0.369	J	ND		ND		ND		ND		ND		ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
FD	Duplicate
ft	feet
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, West Bend AASF #1 and Armory

	Area of Interest	AOI02													
	Sample ID	AOI02-SS01		AOI02-SS02		AOI02-SS03		AOI02-SS03-FD		AOI02-SS04		AOI02-SS05		AOI02-SS06	
	Sample Date	10/26/2020		10/26/2020		10/26/2020		10/26/2020		10/26/2020		10/26/2020		10/26/2020	
	Depth	0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)															
6:2 FTS	-	ND		ND		ND		ND		ND		ND		ND	
PFBA	-	0.161	J	0.245	J	0.179	J	0.181	J	0.215	J	0.217	J	0.239	J
PFBS	130000	ND		ND		ND		ND		ND		ND		ND	
PFDA	-	ND		ND		ND		ND		ND		ND		ND	
PFDoA	-	ND		ND		ND		ND		ND		ND		ND	
PFHpA	-	ND		ND		ND		ND		ND		ND	UJ	ND	
PFHxA	-	ND		ND		ND		ND		ND		ND		ND	
PFHxS	-	0.182	J	ND		ND		ND		ND		0.298	J	ND	
PFNA	-	ND		ND		ND		ND		ND		ND		ND	
PFOA	130	ND		ND		ND		ND		ND		ND		ND	
PFOS	130	2.07		1.32		0.828	J	1.17		2.00		5.27	J-	2.68	
PFPeA	-	ND		ND		ND		ND		ND		ND		ND	
PFUnDA	-	ND		ND		ND		ND		ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
FD	Duplicate
ft	feet
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SS	surface soil
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-3
PFAS Detections in Subsurface Soil
Site Inspection Report, West Bend AASF #1 and Armory

Area of Interest		AOI01																	
Sample ID		AOI01-01-SB-6-8		AOI01-01-SB-10-12		AOI01-02-SB-5-7		AOI01-02-SB-7-9		AOI01-03-SB-6-8		AOI01-03-SB-6-8-FD		AOI01-04-SB-6-8		AOI01-04-SB-13-15		AOI01-04-SB-13-15-FD	
Sample Date		10/28/2020		10/28/2020		10/28/2020		10/28/2020		10/27/2020		10/27/2020		10/28/2020		10/28/2020		10/28/2020	
Depth		6 - 8 ft		10 - 12 ft		5 - 7 ft		7 - 9 ft		6 - 8 ft		6 - 8 ft		6 - 8 ft		13 - 15 ft		13 - 15 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																			
6:2 FTS	-	104	J-	122	J-	ND		ND		ND		ND		ND		ND		ND	
8:2 FTS	-	1.04	J	ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	1.95		2.77		ND		ND		ND		ND		ND		ND		ND	
PFHpA	-	1.16	J	1.05	J	ND		ND		ND		ND		ND		ND		ND	
PFHxA	-	11.5		22.7		ND		ND		ND		ND		ND		ND		ND	
PFHxS	-	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFNA	-	0.168	J	ND		ND		ND		ND		ND		ND		ND		ND	
PFOA	1600	0.606	J	0.504	J	ND		ND		ND		ND		ND		ND		ND	
PFOS	1600	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFPeA	-	15.2		12.8		ND		ND		ND		ND		ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
FD	Duplicate
ft	feet
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-3
PFAS Detections in Subsurface Soil
Site Inspection Report, West Bend AASF #1 and Armory

	Area of Interest	AOI02											
	Sample ID	AOI02-01-SB-3-5		AOI02-02-SB-3-5		AOI02-03-SB-3-5		AOI02-03-SB-7-9		AOI02-04-SB-3-5		AOI02-05-SB-3-5	
	Sample Date	10/27/2020		10/27/2020		10/28/2020		10/28/2020		10/27/2020		10/27/2020	
	Depth	3 - 5 ft		3 - 5 ft		3 - 5 ft		7 - 9 ft		3 - 5 ft		3 - 5 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)													
6:2 FTS	-	ND		ND		0.314	J	0.862	J	ND		ND	
8:2 FTS	-	ND		ND		ND		ND		ND		ND	
PFBA	-	ND		ND		ND		ND		ND		0.196	J
PFHpA	-	ND		ND		ND		ND		ND		ND	
PFHxA	-	ND		ND		ND		ND		0.194	J	ND	
PFHxS	-	ND		ND		ND		0.678	J	ND		ND	
PFNA	-	ND		ND		ND		ND		ND		ND	
PFOA	1600	ND		ND		ND		ND		ND		ND	
PFOS	1600	5.75		0.344	J	ND		ND		1.14	J	0.671	J
PFPeA	-	ND		ND		ND		ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
FD	Duplicate
ft	feet
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-4
PFAS Detections in Groundwater
Site Inspection Report, West Bend AASF #1 and Armory

Area of Interest		AOI01								AOI02											
Sample ID		AOI01-01-GW		AOI01-02-GW		AOI01-03-GW		AOI01-04-GW		AOI02-01-GW		AOI02-02-GW		AOI02-03-GW		AOI02-04-GW		AOI02-05-GW		AOI02-05-GW-FD	
Sample Date		10/29/2020		10/28/2020		10/28/2020		10/28/2020		10/27/2020		10/27/2020		10/28/2020		10/27/2020		10/27/2020		10/27/2020	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)																					
6:2 FTS	-	871000	J	ND		ND		ND		ND		ND		ND		ND		ND		ND	
8:2 FTS	-	508	J+	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	8200		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBS	40000	ND		0.860	J	1.34	J	ND		2.43	J	3.37	J	8.12		1.97	J	1.44	J	1.84	J
PFDA	-	20.9	J	ND		ND		ND		ND		1.08	J	ND		ND		ND		ND	
PFHpA	-	4900		ND		1.25	J	1.20	J	2.29	J	17.3		2.14	J	2.03	J	1.85	J	0.933	J
PFHxA	-	54700		ND		1.24	J	1.66	J	8.58		16.0		7.72		15.9		3.39	J	3.74	J
PFHxS	-	ND		ND		ND		ND		66.6		88.1		24.8		33.2		11.8		13.0	
PFNA	-	117		ND		ND		ND		2.38	J	17.0		ND		ND		ND		ND	
PFOA	40	990		ND		4.03	J	2.51	J	5.88		21.0		4.91	J	7.49		4.78	J	3.29	J
PFOS	40	18.3	J	ND		1.64	J	1.33	J	702	J-	232		13.0		492		225		193	
PFPeA	-	49200		ND		1.82	J	2.40	J	5.96		14.0		5.00		4.17	J	1.79	J	1.25	J
PFTeDA	-	ND		ND		ND		ND		ND	UJ	ND		ND		2.11	J	ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

J+ = Estimated concentration, biased high

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

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
DL	detection limit
FD	Duplicate
GW	Groundwater
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
USEPA	United States Environmental Protection Agency
ng/L	nanogram per liter
-	Not applicable

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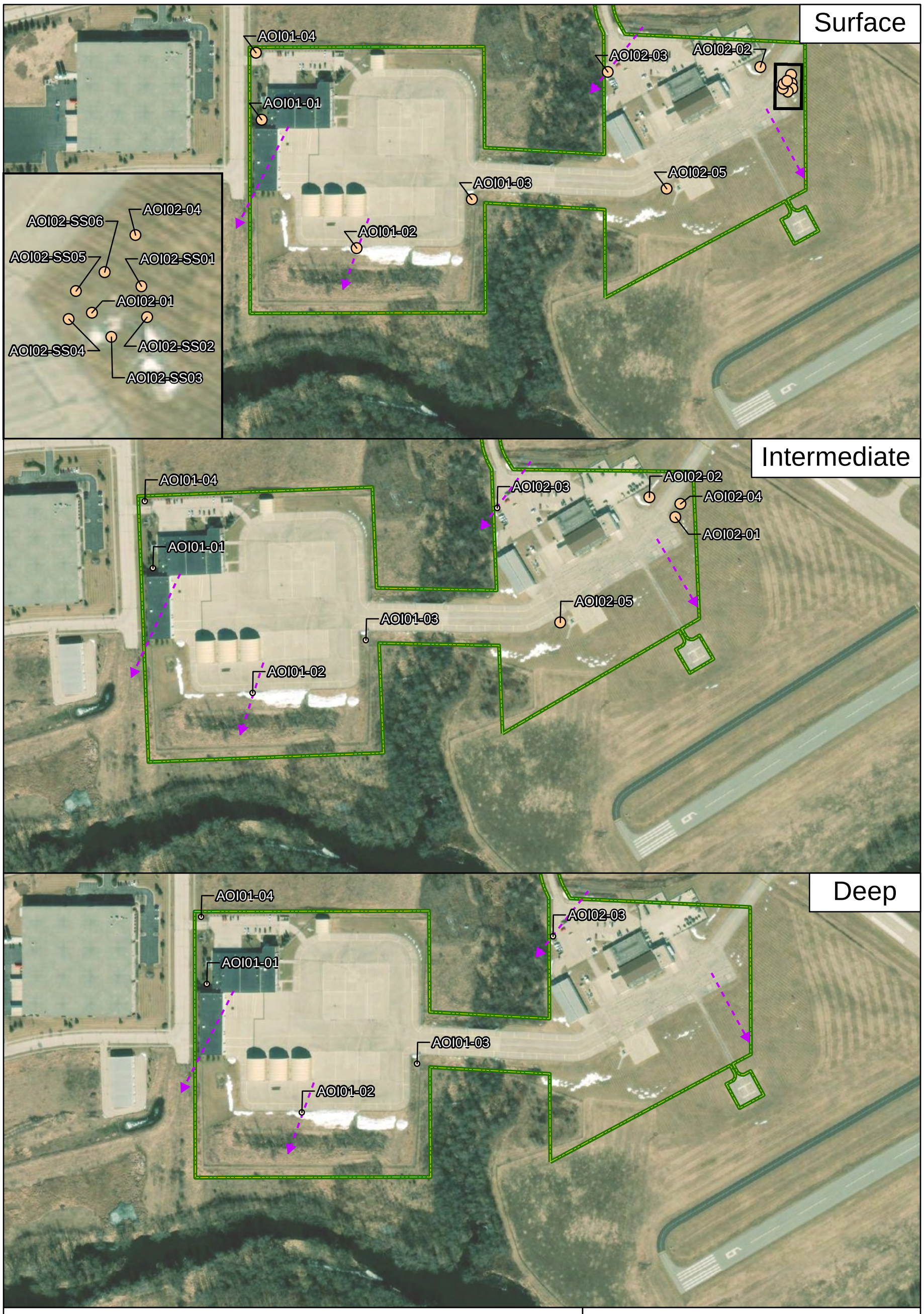


Legend

- Facility Boundary
- Local Groundwater Flow Direction

PFOS Results (µg/Kg)

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

0 175 350 700 Feet

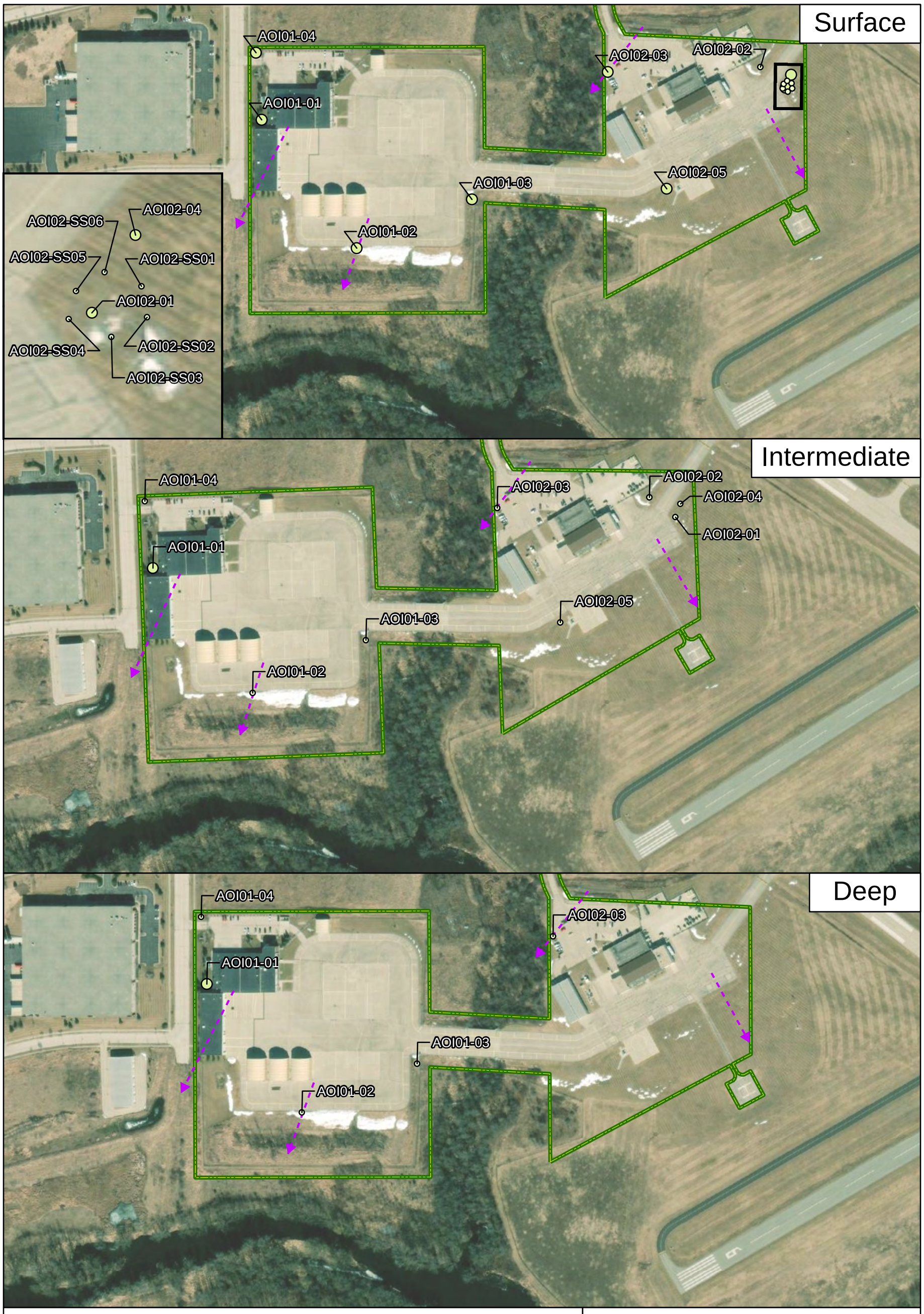
N

PFOS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at West Bend, WI			
REVISED	3/29/2021	GIS BY	MS	3/29/2021
SCALE	1:4,200	CHK BY	SI	3/29/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,		PM	CM	3/29/2021

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-1



Legend

- Facility Boundary
- Groundwater Flow Direction

PFOA Results (µg/Kg)

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

0 175 350 700 Feet

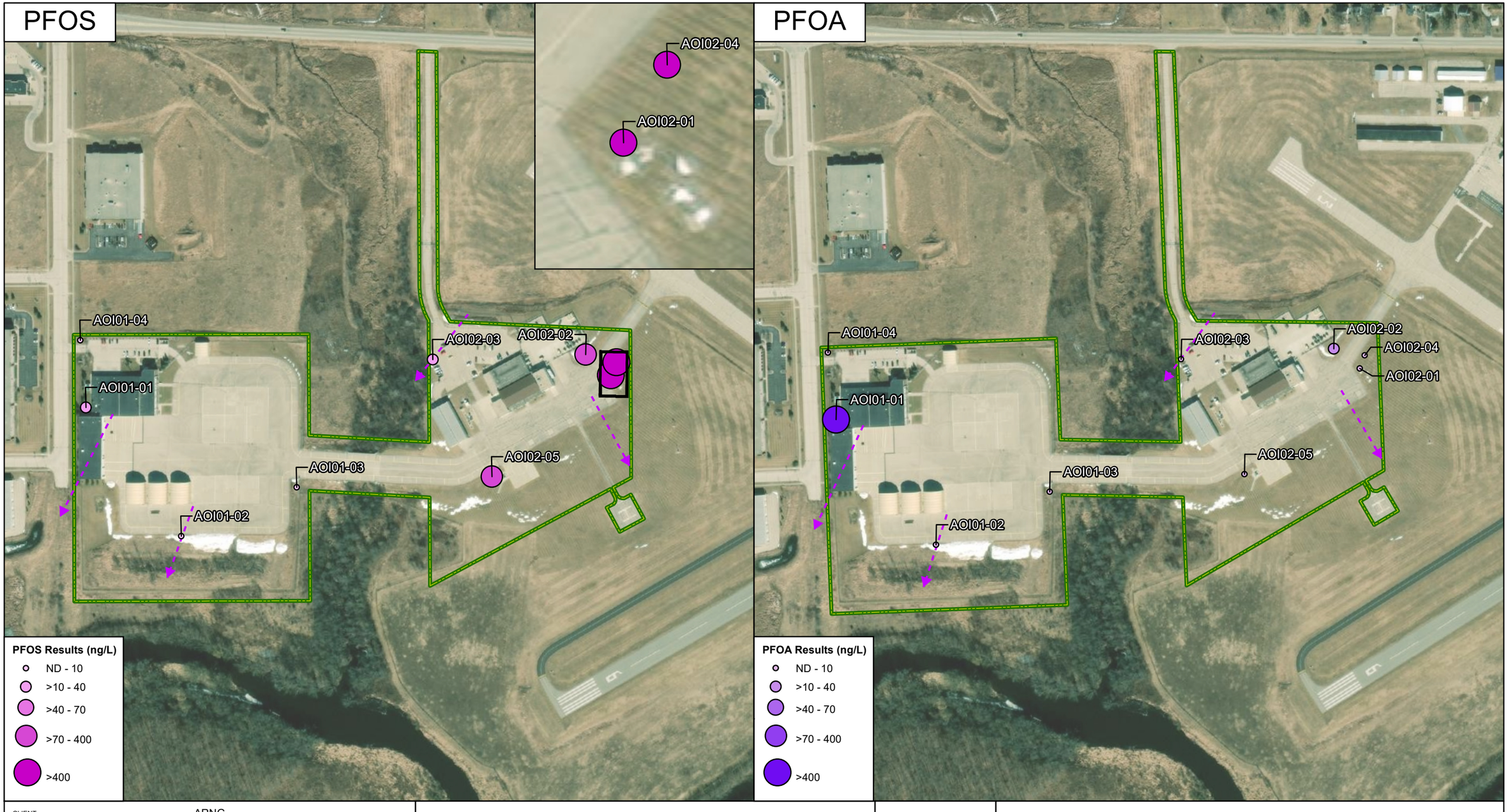
N

PFOA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at West Bend, WI			
REVISED	3/29/2021	GIS BY	MS	3/29/2021
SCALE	1:4,200	CHK BY	SI	3/29/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,		PM	CM	3/29/2021

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-2



CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at West Bend, WI			
REVISED	3/30/2021	GIS BY	GC	3/30/2021
SCALE	1:4,200	CHK BY	SI	3/30/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	3/30/2021

Legend

- Facility Boundary
- Local Groundwater Flow Direction

0 175 350 700 Feet

N

PFOS and PFOA Detections in Groundwater

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-3

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1**. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

1. Contaminant source;
2. Environmental fate and transport;
3. Exposure point;
4. Exposure route; and
5. Potentially exposed populations.

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with an incomplete pathway generally warrant no further action. However, the pathway is considered potentially complete if PFOA, PFOS, or PFBS are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of PFOA, PFOS, or PFBS above the SLs. Areas with an identified potentially complete pathway may warrant further investigation.

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

7.1 Soil Exposure Pathway

The SI results for PFOA, PFOS, and PFBS 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

During the annual testing of the fire suppression system in AOI 1, 20-40 gallons of 3% AFFF were dispensed onto the grassy area behind the building, which took place since 2004. The stormwater drain within AOI 1 flows through the stormwater system to the south, where it discharges to a stormwater basin on the south side of the property. Additionally, if there is flooding at the stormwater basin, surface water can overflow to the Milwaukee River.

PFOS, PFOA, and PFBS were detected in soil at AOI 1 and confirm the release of PFAS to soil in AOI 1. Based on the results of the SI in AOI 1, ground-disturbing activities could potentially result in site worker, future construction worker, and trespasser exposure to PFOS, PFOA, and PFBS via inhalation of dust or ingestion of surface soil, and ground-disturbing activities could potentially result in future construction worker exposure to subsurface soil. No current construction is occurring at AOI 1. The CSM is presented on **Figure 7-1**.

7.1.2 AOI 2

There was a one-time training event with one TriMax™ fire extinguisher that occurred in a grassy area on the east side of the Armory. The exact date, amount, and concentration of AFFF used are unknown. From 1960-1998, there was a drain field to the north of the Armory. Currently, the drain field is paved and is used as a parking lot for the facility. The overlying surface water flow from the release area is north to the drain field, then west to Wingate Creek, which ultimately discharges to the Milwaukee River.

PFOS and PFOA were detected in soil at AOI 2 and confirm the release of PFAS to soil in AOI 2. Based on the results of the SI in AOI 2, ground-disturbing activities could potentially result in site worker, future construction worker, and trespasser exposure to PFOS and PFOA via inhalation of dust or ingestion of surface soil, and ground-disturbing activities could potentially result in future construction worker exposure to subsurface soil. No current construction is occurring at AOI 2. The CSM is presented on **Figure 7-1**.

7.2 Groundwater Exposure Pathway

No potable water wells are located within the boundary of West Bend AASF #1 and Armory; however, unknown well types exist within 4 miles of the site. Drinking water for West Bend AASF #1 and Armory is supplied by the City of West Bend, which uses the Lake Michigan and the bedrock aquifers as its drinking water source (WIDNR, 2001).

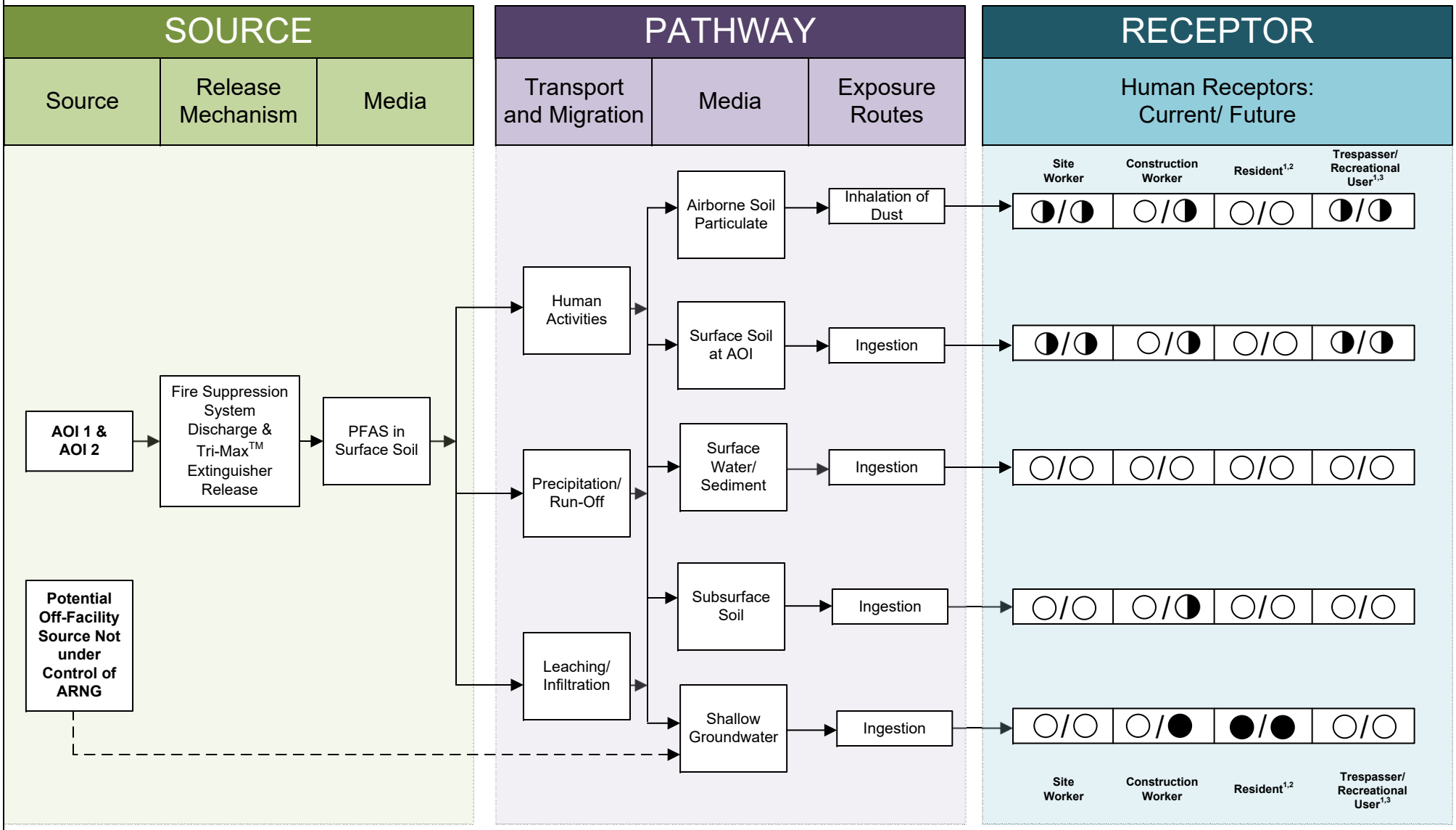
The SI results for PFOA, PFOS, and PFBS in groundwater were used to determine whether a potentially complete pathway exists between the source and potential receptors at each AOI based on the aforementioned criteria.

7.2.1 AOI 1

PFOA, PFOS, and PFBS were detected in groundwater from temporary monitoring wells in AOI 1, confirming the migration of PFAS from soil to groundwater. PFOA exceeded the SL in one temporary well in the source area. The incidental groundwater exposure pathway is potentially complete for construction workers during trenching activities deep enough to encounter shallow groundwater. The exposure pathway is also potentially complete for off-facility residential drinking water receptors. The CSM is presented on **Figure 7-1**.

7.2.2 AOI 2

PFOA, PFOS, and PFBS were detected in groundwater from temporary monitoring wells in AOI 2, confirming the migration of PFAS from soil to groundwater. PFOS exceeded the SL in two temporary wells at the source area, one downgradient well, and one upgradient well in AOI 2. The incidental groundwater exposure pathway is potentially complete for construction workers during trenching activities deep enough to encounter shallow groundwater. The exposure pathway is also potentially complete for off-facility residential drinking water receptors. The CSM is presented on **Figure 7-1**.



LEGEND

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

NOTES

1. The receptor refers to an off-site receptor.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. Human consumption of fish potentially affected by PFAS is possible.

Figure 7-1
Conceptual Site Model
AOI 1 Fire Suppression System Testing Area
AOI 2 Tri-Max™ Release

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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

SI field activities included soil and groundwater sampling from 26 October to 28 October 2021. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2020b).

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2019), samples were collected and analyzed for a subset of PFAS by LC/MS/MS compliant with QSM Table B-15 as follows. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.8** of this Report.

- Twenty-three (23) soil grab samples from nine (9) boring locations;
- Six (6) soil grab samples from six (6) surface locations;
- Nine (9) groundwater grab samples from nine (9) temporary well locations; and
- Eighteen (18) QA samples collected.

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

8.2 SI Goals Evaluation

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

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

   PFOA, PFOS, and PFBS were detected at the facility in soil, and groundwater. PFOA, PFOS, and PFBS were detected both at the source areas, as well as at the facility boundary between source areas and potential drinking water receptors. PFOA in groundwater at AOI 1 exceeded the SL of 40 ng/L. PFOS in groundwater at AOI 2 exceeded the SL of 40 ng/L. The detected concentrations of PFOA, PFOS, and PFBS in soil samples from all AOIs were below the SLs.

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

   AOI 1: Fire Suppression System Testing area and AOI 2: Tri-Max™ Release were the only potential PFAS release areas identified during the PA and examined during the SI. PFOA was detected in groundwater above the SLs in AOI 1, and PFOS were detected in groundwater above the SLs in AOI 2; therefore, these areas may pose a threat to human health and the environment.

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

   There is a potentially complete pathway between source and off-facility residential drinking water receptors. Surficial groundwater at the facility is very shallow, with depth to water ranging from 5 to 25 feet bgs. It is unknown if the downgradient domestic and unknown-type wells are screened within the surficial aquifer or the Eastern Dolomite aquifer. The Eastern Dolomite aquifer is unconfined at the facility and is particularly vulnerable to contamination where the unconsolidated deposits are relatively thin. Vertical cracks and cavities may also result in the vertical migration of groundwater.

   As described in **Section 2.5**, in 2021, offsite potable water samples were collected due to the exceedance of SLs observed in groundwater during the SI. Five properties were selected to be sampled due to their proximity to the facility. PFOA, PFOS, and/or PFBS were not detected in all five of the potable water samples collected. A removal action is not needed at this time because the potable water sample results were all non-detect.

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

   The geological data collected as part of the SI indicate the shallow subsurface soil has relatively low permeability and conductivity with soils dominated by silts and clay. Grain size analysis performed at AOI01-03 implies that what presents itself as lean clay in the field may in fact be clayey silt (i.e., predominantly silt with a large clay component). This finding may have profound impacts on the vertical migration of groundwater at the facility since silt is more permeable and conductive. Sandy silt (silt with more than 30% sand) is found in the surface silts in the eastern portion of the facility, around AOI 2. Layers of sand-dominated soils can be found at AOI01-04, AOI02-01, AOI02-02, AOI02-04, and AOI02-05 at thicknesses ranging from 0.5 to 4 feet in thickness. Overall, these data would suggest that the subsurface lithology on the eastern and northern portions of the facility are more permeable and susceptible to vertical groundwater migration.

   Underlying unconsolidated sediments at deeper depths (beyond what was drilled during the SI) are anticipated to consist mainly of sands and gravels. Consequently, deeper subsurface soils at the facility will likely have higher permeability and conductivity.

   Depth to water on the west side of the facility is approximately 15-25 feet bgs, and depth to water on the east side of the facility is approximately 5-10 feet bgs in most areas. Groundwater flow direction off the facility is south towards the Milwaukee River. These geologic and hydrogeologic observations inform development of technical approach for the RI.

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

   Based upon the evaluation of groundwater and soil results in comparison to SLs, in combination with the groundwater flow direction analysis, the results of the SI indicate that the source of detected concentrations of PFOA, PFOS, and PFBS at the facility is likely attributable to ARNG activities. However, the detected concentration of PFOS at the east side of facility boundary suggests an upgradient, off-facility source of PFAS may also be contributing to detected PFAS concentrations in surficial groundwater at the facility.

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

Detections of PFOA, PFOS, and PFBS in soil at the source area and facility boundary, indicate there is a potentially complete exposure pathway between source and site workers, future construction workers, and trespassers. The PFOS and PFOA SL exceedances in surficial groundwater indicate there is a potentially complete exposure pathway between source and future construction workers and off-facility residents.

PFOA, PFOS, and PFBS were detected in soil and groundwater at source areas and the facility boundary indicate a potentially complete pathway between source and receptor. However, as described in **Section 2.5**, offsite potable water samples were collected due to the exceedance of SLs observed in groundwater during the SI. Five properties were selected to be sampled due to their proximity to the facility. PFOA, PFOS, and PFBS were not detected in all five of the potable water samples collected.

8.3 Outcome

Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to off-facility residential drinking water receptors resulting from historical DoD activities at the facility. Sample chemical analytical concentrations collected during the SI were compared against the project SLs for PFOA, PFOS, and PFBS in soil and groundwater, as described in **Table 6-1**. The following bullets summarize the SI results:

- PFOA in groundwater at AOI 1: Fire Suppression System Testing exceeded the SL of 40 ng/L with a concentration of 990 ng/L at the source area, AOI01-01-GW. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.
- PFOS in groundwater at AOI 2: Tri-Max™ Release exceeded the SL of 40 ng/L in four of the well locations with concentrations ranging from 225 ng/L to 702 J- ng/L. Based on the results of the SI, further evaluation of AOI 2 is warranted in the RI.
- The detected concentrations of PFOA, PFOS, and PFBS in soil samples from all AOIs were below the SLs.

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

Table 8-2 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, further evaluation is warranted in the RI for AOI 1: Fire Suppression System Testing, and AOI 2: Tri-Max™ Release.

Table 8-1: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Fire Suppression System Testing	◐	●	●
2	Tri-Max™ Release	◐	●	●

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

Table 8-2: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Fire Suppression System Testing	Exceedances of SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI
2	Tri-Max™ Release	Exceedances of SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI

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