FINAL
Site Inspection Report
Martindale Army Aviation Support Facility
San Antonio, Texas

Site Inspection for Perfluorooctanoic acid (PFOA), Perfluorooctanesulfonic acid (PFOS), Perfluorohexanesulfonic acid (PFHxS), Perfluorononanoic acid (PFNA), Hexafluoropropylene oxide dimer acid (HFPO-DA), and Perfluorobutanesulfonic acid (PFBS) at ARNG Installations, Nationwide

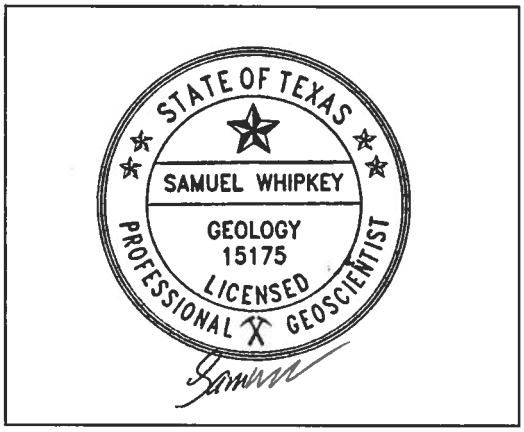
September 2023

Prepared for:

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

UNCLASSIFIED

The seal appearing on this document was authorized by Samuel Whipkey, P.G. 15175 on May 23, 2023, for the information contained herein for Texas Commission on Environmental Quality Facility ID No T3690, in accordance with applicable TCEQ requirements.



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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
AOI	Area of Interest
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
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
DoD	Department of Defense
DOT	Department of Transportation
DPT	direct push technology
DQO	data quality objective
DUA	data usability assessment
EIS	extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FedEx	Federal Express
GPS	global positioning system
GPRS	Ground Penetrating Radar Systems
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
MIL-SPEC	military specification
MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
OMS	Organizational Maintenance Shop
OSD	Office of the Secretary of Defense
OWS	oil-water separator
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid

PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TBWE	Texas Board of Water Engineers
TOC	total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USACHPPM	US Army Center for Health Promotion and Preventive Medicine
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

Executive Summary

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

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

Martindale AASF is located within the San Antonio city limits, southeast of the intersection of Interstate 10 and Interstate 410. The facility comprises approximately 220 acres of mostly grassland, as well as a storage hangar, maintenance hangar, armory, and flight lines. The facility was opened by the United States Air Force in 1943 for the purpose of training and was restricted to take offs and landings. The property deed was transferred from the United States Air Force to the ARNG in 1954.

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

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

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

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

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

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

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

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Grass Fire Near Flight Line	◐	●	●	Proceed to RI
2	Area East of the Maintenance Hangar	◐	●	N/A	Proceed to RI
3	Wash Rack	◐	●	◐	Proceed to RI

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

1

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum will be referred to as "relevant compounds" throughout this document and include perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS) at ARNG facilities nationwide. The ARNG performed this SI at the Martindale Army Aviation Support Facility (AASF) in San Antonio, Texas. The Martindale AASF is also referred to as the "facility" throughout this document.

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

1.2 SI Purpose

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

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

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2. Facility Background

2.1 Facility Location and Description

Martindale AASF is located within the San Antonio city limits, southeast of the intersection of Interstate 10 and Interstate 410. The facility is located 7 miles east of downtown San Antonio (**Figure 2-1**). The facility comprises approximately 220 acres of mostly grassland, as well as a storage hangar, maintenance hangar, armory, and flight lines (US Army Center for Health Promotion and Preventive Medicine [USACHPPM], January 1997). The facility was opened by the US Air Force in 1943 for the purpose of training and was restricted to take offs and landings. The property deed was transferred from the US Air Force to the ARNG in 1954. Most of the buildings were constructed in the early 1960s except for the current Organizational Maintenance Shop (OMS) built in 1991, the Storage Hangar built in 2004, and additional facility support buildings built from 2010 to 2012.

2.2 Facility Environmental Setting

Martindale AASF is located in Bexar County, south-central Texas, approximately 140 miles northwest of the Gulf of Mexico. The facility is about 10 miles northwest of Calaveras Lake and less than 1 mile west of Rosillo Creek. The 220-acre facility is located within the San Antonio city limits, east of the city center (**Figure 2-2**). Industrial/commercial properties lie to the north, with Interstate 10 beyond. West and southwest of the facility are predominately single-family homes, with Interstate 410 beyond. East of the facility, in the area stretching between Interstate 10 and E Houston Street, a planned industrial park is currently under construction. South of the facility is mostly undeveloped property and industrial industries including a cemetery, recycling center, and a galvanizing company; E. Houston Street lies beyond these properties. Some nearby industrial facilities represent potential PFAS sources.

2.2.1 Geology

The facility is underlain by fluviatile terrace deposits of the Quaternary period consisting of gravel, sand, silt and clay. The fluviatile terrace deposits are underlain by the Midway Group consisting of clay and sand deposited in the Tertiary period (**Figure 2-3**) (USACHPPM, 1997). The Edwards Limestone outcrops about 10 miles to the north-northwest of the facility, on the upward shifted side of significant northeast–southwest trending normal faults (Bureau of Economic Geology, 1982). The facility lies on the downward-shifted side of this fault zone and therefore has several hundred feet of younger Quaternary, Tertiary and Upper Cretaceous geologic units overlying the Edwards Limestone (Texas Board of Water Engineers [TBWE], 1959).

During the SI, lean clay was observed as the dominant lithology of the unconsolidated sediments below the Martindale AASF. The borings were completed at depths between 20 and 33.5 feet below ground surface (bgs). Isolated layers of sand and silt were also observed in the borings with thicknesses ranging from a few inches to 5 feet. The facility observations are consistent with the reported depositional environment of the region. Boring logs are presented in **Appendix E**.

2.2.2 Hydrogeology

The Edwards Limestone is the sole-source aquifer for the San Antonio area, and San Antonio obtains its entire water supply from this aquifer. The presence of a fault zone coupled with the high degree of fracturing in the limestone results in a complex flow pattern. The top of the Edwards aquifer is bounded by an upper confining layer that results in artesian conditions. The nearest water supply well is approximately 1.5 miles north of the facility. The well is reported as 1,139 feet

deep and supplies the City of Kirby. Shallower water-bearing zones are most likely discontinuous perched lenses and not used as a drinking water supply in the San Antonio area (USACHPPM, 1997). Shallow unconfined groundwater would normally follow the local topography, which is to the southeast, towards Rosillo Creek.

No wells exist at the facility. An exploratory boring was drilled on 8 July 1988 to provide information to bidders on a contract to construct the OMS building. The borehole extended to a depth of 20.5 feet, and it remained open for at least 3 days, at which time the groundwater level was measured at 15.8 feet bgs. There are no data available on the behavior of this uppermost water-bearing zone at the facility. The shallow groundwater is not used as a drinking water supply in the San Antonio area and is probably a discontinuous perched lens with little or no interconnection with the Edwards aquifer (USACHPPM, 1997). The general groundwater flow in the Edwards aquifer in San Antonio is to the southeast (TBWE, 1954).

A query of the Texas Water Development Board's Interactive Groundwater Data Viewer identified 71 monitoring wells and 92 environmental soil boring records within a 1-mile radius of the center of the facility (**Figure 2-3**). The monitoring wells directly north of the facility are owned by Travel Centers of America, and NuStar Logistics LP owns 13 monitoring wells approximately 0.8 miles northeast of the facility. Midtex Oil, LP and CCC Group own 18 monitoring wells approximately 0.8 miles north-northeast of the facility. Other monitoring wells located within a 1-mile radius of the facility are owned by LIT Industrial Texas, LP, Southwest Galvanizing, Summit Truck Group, and York International Corp., among others. The facility's drinking water is supplied by the City of San Antonio.

Depths to water measured in April 2022 during the SI ranged from 9.12 to 25.62 feet bgs. Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate the groundwater flow direction within the shallow aquifer at Martindale AASF is generally to the south-southeast. Locations AOI02-04 and AOI03-02 were excluded from contouring as discussed in **Section 5.8**.

2.2.3 Hydrology

Surface water at the facility flows through ditches around the perimeter of the flight line to the southeast and settles in a retention pond in the southeast corner of the facility. The retention pond is less than 2,000 feet from Rosillo Creek, so it is likely that surface water flows from the retention pond to the creek under heavy rain conditions.

Wastewater that collects in the wash rack flows to an oil-water separator (OWS) and then, depending on the position of a diverter valve, either travels through underground piping to the sanitary sewer, or goes through a series of manholes before discharging to Rosillo Creek and then Salado Creek. Surface water features are presented on **Figure 2-5**.

2.2.4 Climate

The San Antonio climate is humid subtropical, with long, hot summers and warm to cool winters. Cold fronts from the north occasionally descend during the winters and affect the weather conditions. The average high temperature is around 96 degrees Fahrenheit (°F) in the peak of August (National Weather Service Forecast Office, 2022). Winters range from mild to cool, with the average daily highs rarely dropping below 60 °F. The spring and autumn months tend to be warm and wet. The average humidity in San Antonio is around 67 percent (%). San Antonio is usually sunny, with average annual precipitation around 32 inches. May, September, and October tend to be the rainiest months. Snowfall is rare in San Antonio, but the area occasionally experiences sleet and freezing rain. Floods occur regularly, and tornados occasionally occur in the region (Weather Atlas, 2022).

2.2.5 Current and Future Land Use

The Martindale AASF currently includes temporary and permanent storage buildings, an OMS building, two hangars, and an armory used for administration. Current land use in the direct vicinity of the facility includes undeveloped/agricultural land to the east, residential land to the west, and commercial/industrial land to the north and south. Historically, undeveloped land surrounding the facility was leased to a farmer who grew corn until sometime between 2016 and 2017. No future changes to the current use were noted during personnel interviews.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

The following arachnids, birds, crustaceans, fishes, plants, insects, and mammals are federally endangered, threatened, proposed, and/ or are listed as candidate species in Bexar County, Texas (US Fish and Wildlife Service [USFWS], 2022).

- **Arachnids:** Government Canyon Bat Cave spider, *Tayshaneta microps* (endangered); Madla Cave Meshweaver, *Cicurina madla* (endangered); Robber Baron Cave Meshweaver, *Cicurina baronia* (endangered); Cokendolpher Cave Harvestman, *Texella cokendolpheri* (endangered); Government Canyon Bat Cave meshweaver, *Cicurina vespera* (endangered)
- **Birds:** Whooping crane, *Grus americana* (endangered); Red knot, *Calidris canutus rufa* (threatened); Golden-cheeked warbler, *Setophaga chrysoparia* (endangered); Piping Plover, *Charadrius melodus* (threatened);
- **Crustaceans:** Peck's cave amphipod, *Stygobromus (=Stygonectes) pecki* (endangered)
- **Fishes:** Fountain darter, *Etheostoma fonticola* (endangered)
- **Flowering Plants:** Black lace cactus, *Echinocereus reichenbachii var. albertii* (endangered); Texas wild-rice, *Zizania texana* (endangered); Bracted twistflower, *Streptanthus bracteatus* (proposed threatened)
- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate); Comal Springs riffle beetle, *Heterelmis comalensis* (endangered); [no common name] Beetle, *Rhadine exilis* (endangered); Helotes mold beetle, *Batrisodes venyivi* (endangered); Comal Springs dryopid beetle, *Stygoparnus comalensis* (endangered); [no common name] Beetle, *Rhadine infernalis* (endangered)
- **Mammals**: Tricolored bat, *Perimyotis subflavus* (proposed endangered)

2.3 History of PFAS Use

Three AOIs were identified in the PA where AFFF may have been used, stored, disposed, or released historically at the Martindale AASF (AECOM, 2020). Sometime between 1999 and 2014, AFFF was used to put out a grass fire near the flightline. Additionally, AFFF may have historically been released at the facility during Tri-Max™ maintenance events and incidental spills due to storage of a firetruck. The potential release areas were grouped into three AOIs based on preliminary data and presumed groundwater flow directions. A description of each AOI is presented in **Section 3**.

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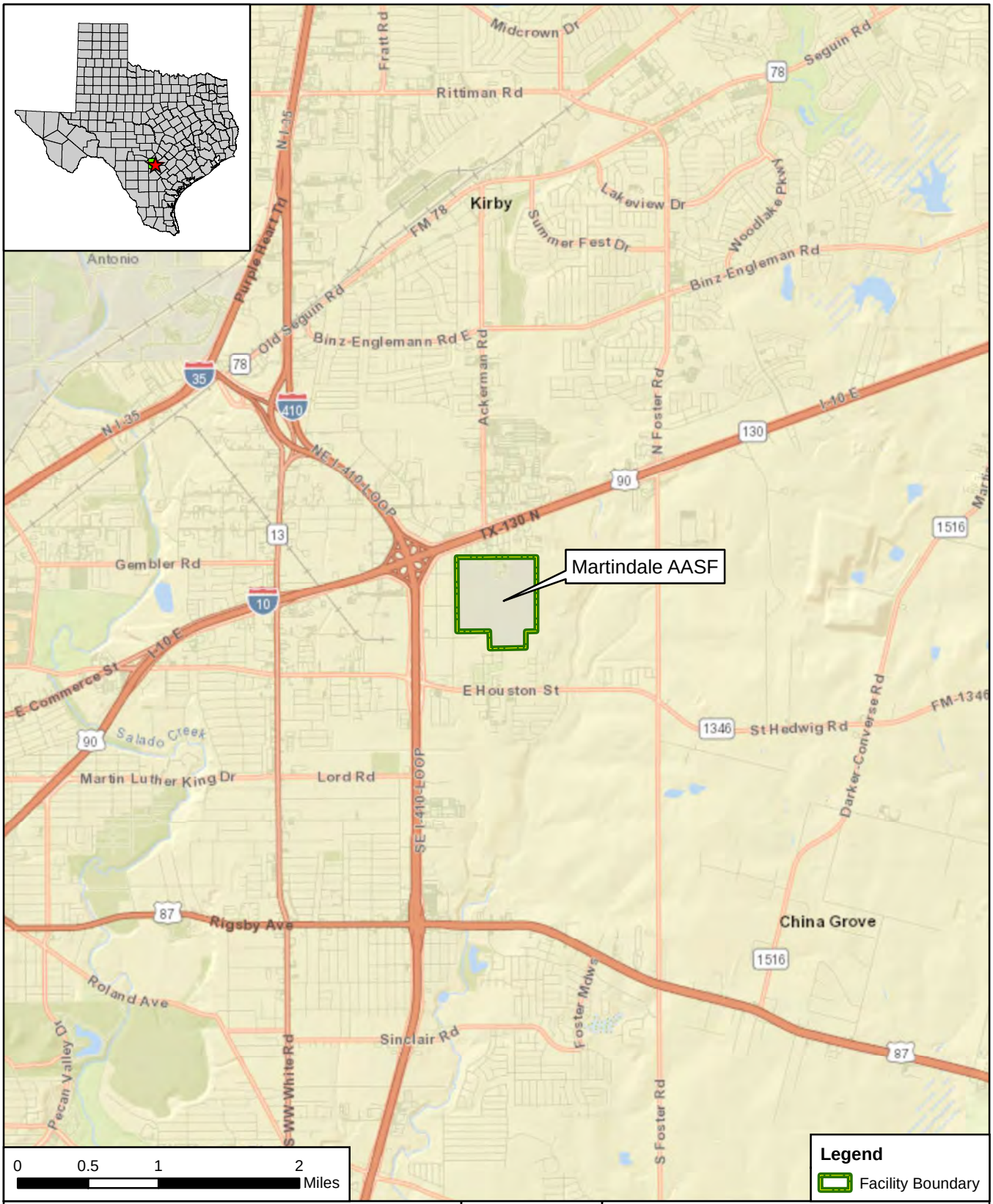

CLIENT	ARNG			
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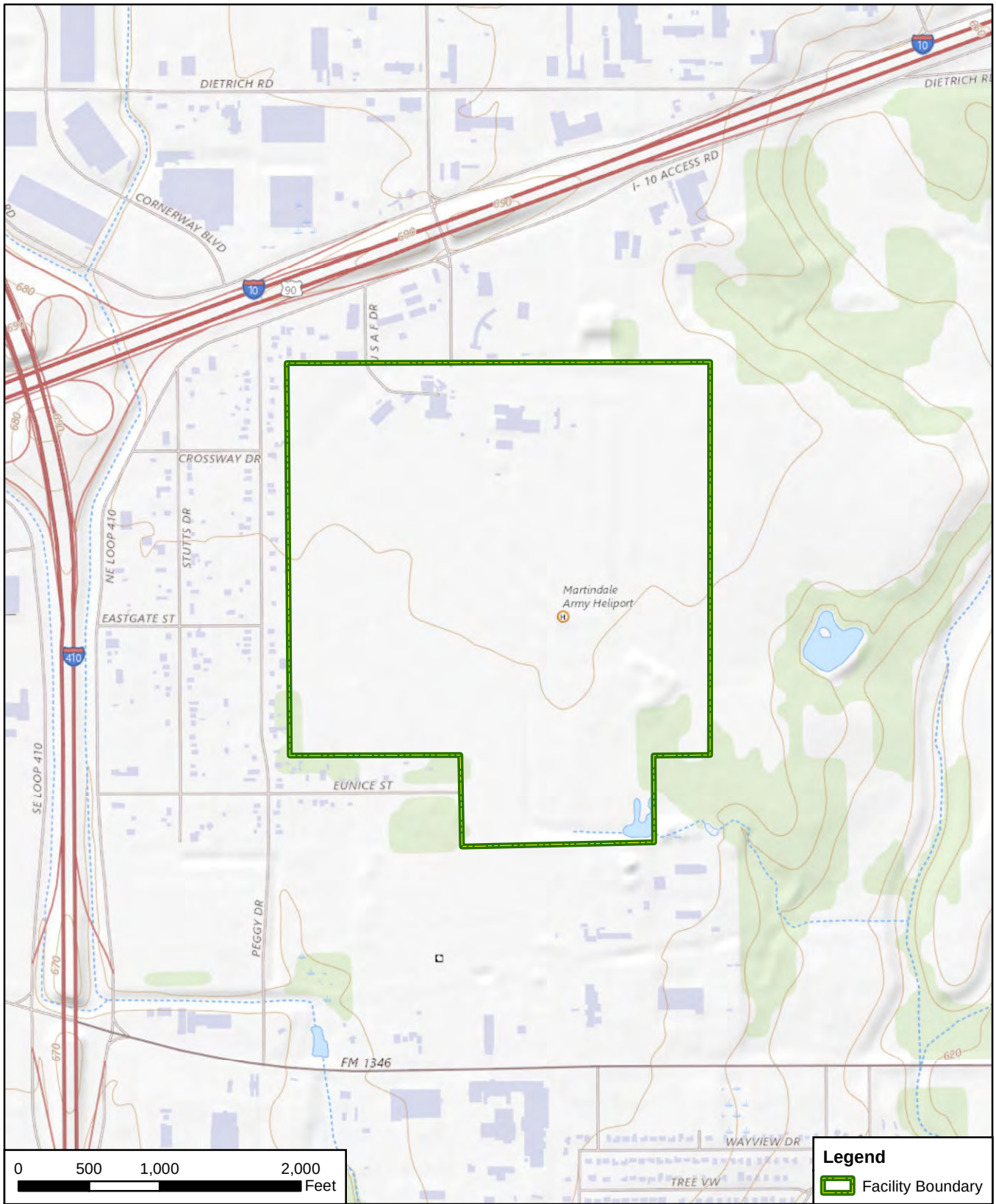
SCALE	1:63,360	CHK BY	MB	1/20/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	1/20/2023

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



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PROJECT	Site Inspection at Martindale AASF, TX			
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SCALE	1:12,000	CHK BY	MB	3/2/2023
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	3/2/2023

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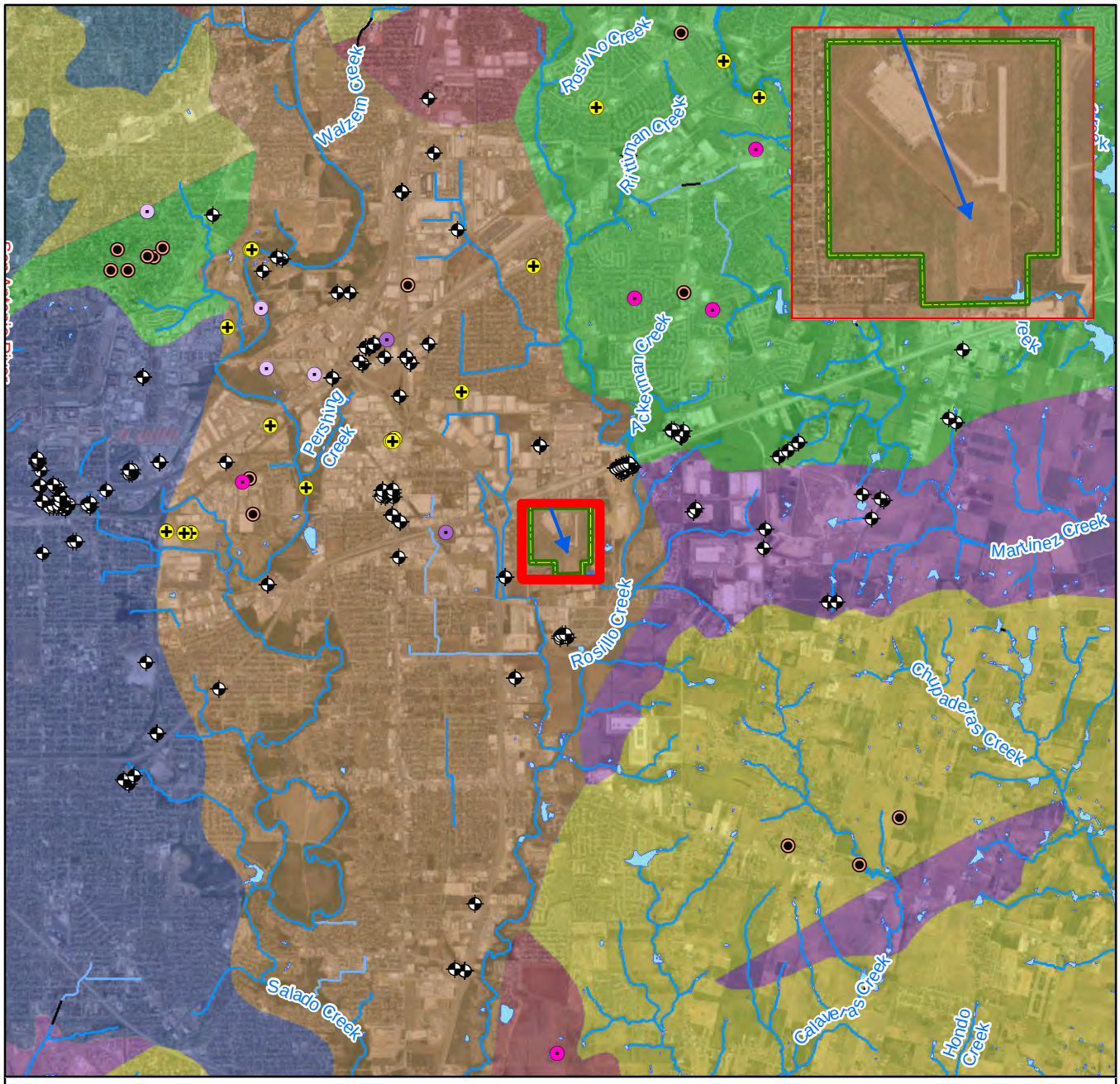
Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



Legend

- Facility Boundary
- Water Body
- River/Stream
- Canal/Ditch
- Pipeline
- Groundwater Flow Direction

0 0.75 1.5 3 Miles

Geology

- Fluviatile Terrace Deposits
- Wilcox Group
- Midway Group
- Navarro Group and Marlbrook Marl
- Uvalde Gravel

Wells

- Domestic Well
- Industrial Well
- Irrigation Well
- Stock Well
- Public Supply Well
- Monitoring Well

CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	3/20/2023	GIS BY	MS	3/20/2023
SCALE	1:95,040	CHK BY	MB	3/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/20/2023

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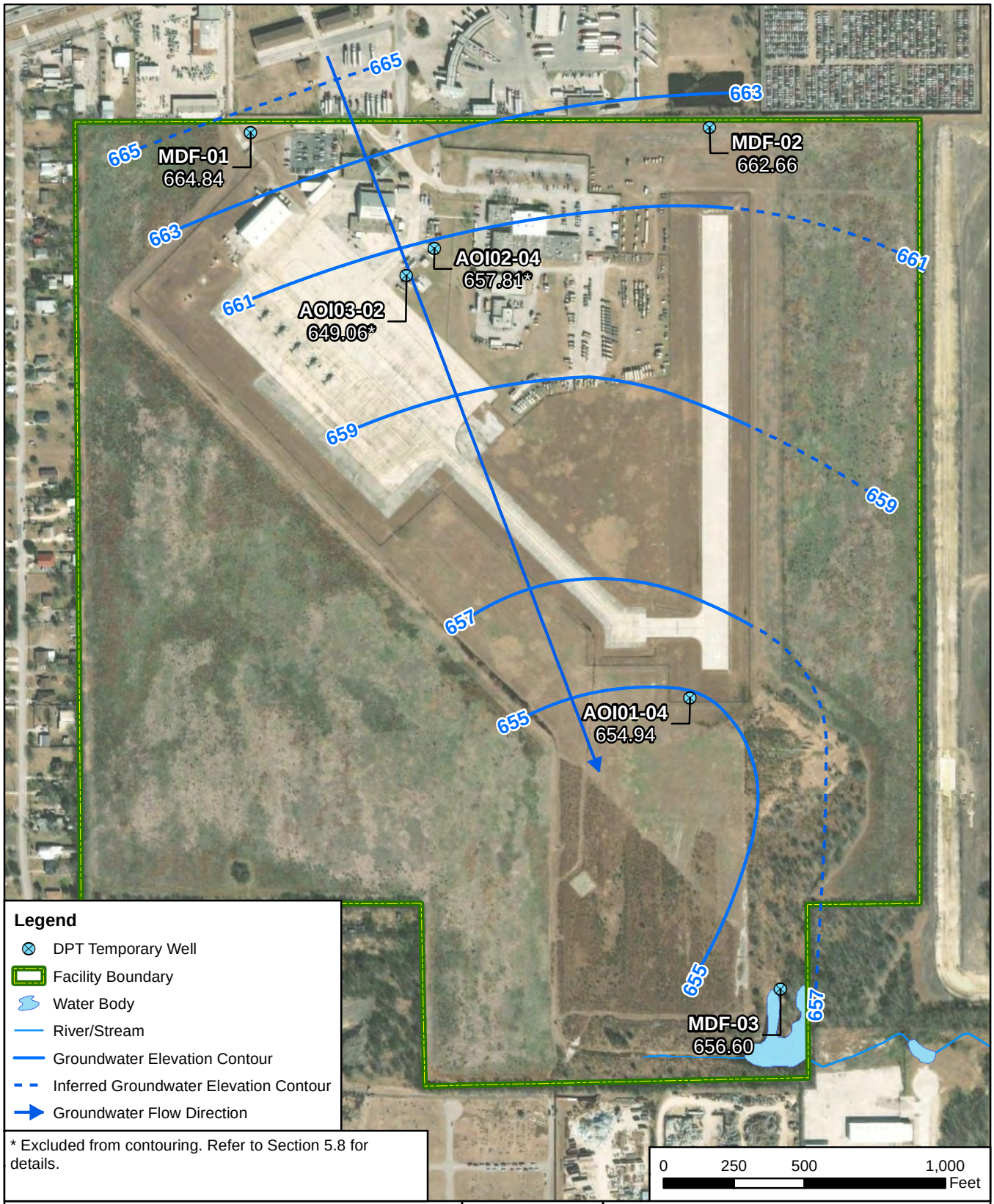
Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3



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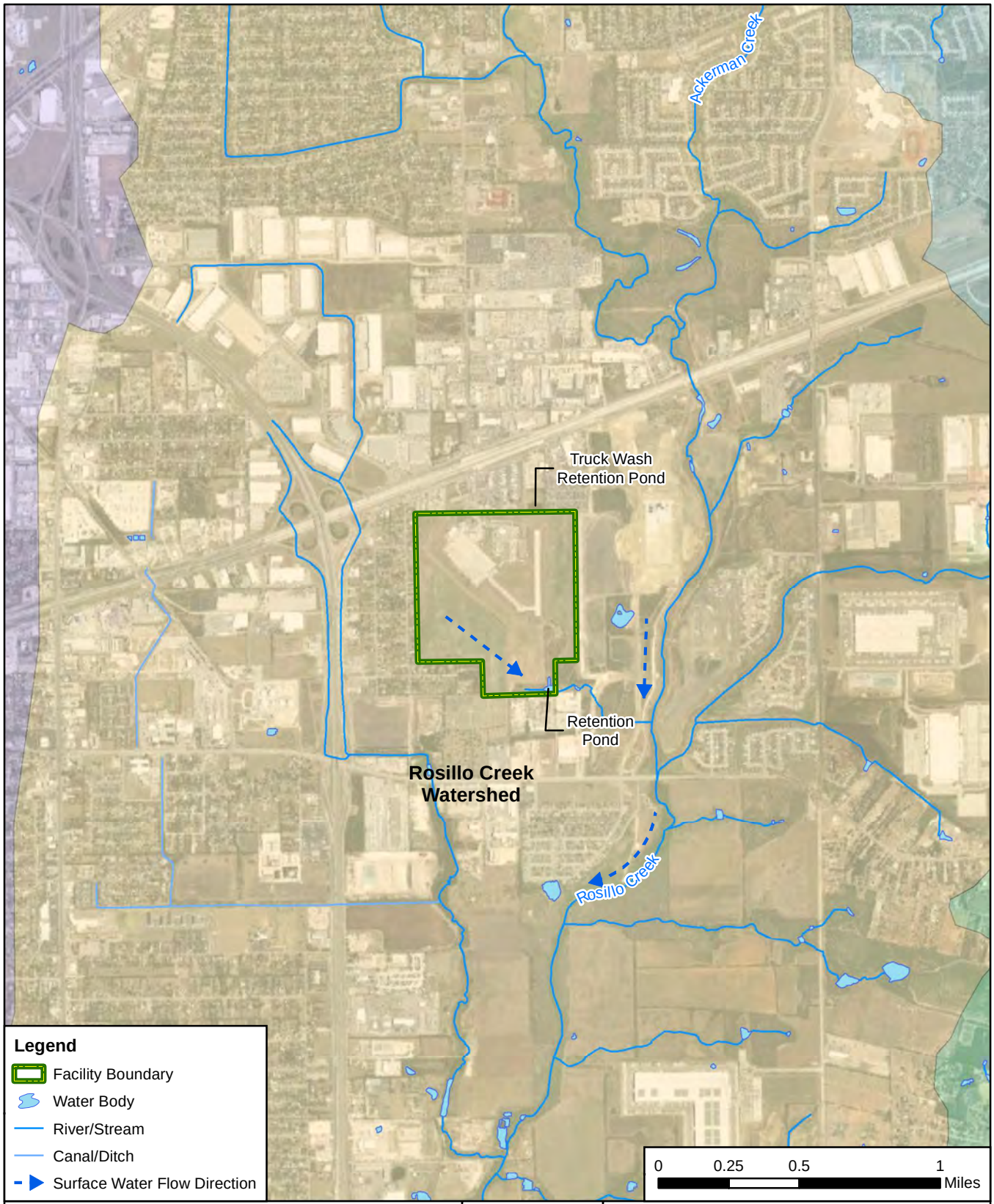
SCALE	1:6,000	CHK BY	MB	3/17/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/17/2023

Groundwater Elevations, April 2022

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4



CLIENT	ARNG			
NOTES	Site Inspection at Martindale AASF, TX			
REVISED	1/20/2023	GIS BY	MS	1/20/2023
SCALE	1:31,680	CHK BY	MB	1/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/20/2023

Surface Water Features

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Figure 2-5

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3. Summary of Areas of Interest

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, four potential release areas were identified at Martindale AASF and grouped into three AOIs (AECOM, 2020). The potential release areas are shown on **Figure 3-1**.

3.1 AOI 1 Grass Fire Near Flight Line

AFFF was used to put out a grass fire near the southwest end of the flight line during one event that took place between 1999 and 2014. An unknown quantity of AFFF was released during this emergency firefighting response. Releases at the grassy areas on either side of the flight line would impact surface soil and potentially infiltrate to the subsurface and groundwater via rainwater leaching.

3.2 AOI 2 Area East of the Maintenance Hangar

AFFF was potentially released at the area east of the Maintenance Hangar during Tri-Max™ maintenance events performed by an outside contractor. The AFFF fluids stored in the Tri-Max™ units were disposed of during these maintenance events. Additionally, a firetruck, which was historically stored further east of the Maintenance Hangar, likely contained AFFF tanks, and AFFF could have leaked on to the gravel surface beneath the truck.

Releases at the area east of the Maintenance Hangar may have infiltrated into surrounding grassy areas when washed off the concrete surface, and potential releases at the firetruck may have infiltrated into the gravel and soil beneath it. Releases in either area have the potential to leach into the subsurface and shallow groundwater during precipitation events.

3.3 AOI 3 Wash Rack

AFFF was potentially released at the wash rack during Tri-Max™ maintenance events performed by an outside contractor. The AFFF fluids stored in the Tri-Max™ units would have been disposed of during these maintenance events when old AFFF was replaced with new AFFF in the units.

Releases at the wash rack would have traveled to the OWS and then, depending on the position of a diverter valve, either traveled through underground piping to the sanitary sewer, or traveled through a series of manholes before discharging to Rosillo Creek and then to Salado Creek. Releases at the wash rack have the potential to infiltrate into soil and further into the subsurface via leaks in underground piping.

3.4 Adjacent Sources

Four off-facility potential sources were identified adjacent to the Martindale AASF during the PA and are not associated with ARNG activities. The adjacent potential sources are shown on **Figure 3-1** and described in the following sections for informational purposes only and were not investigated as part of this SI.

3.4.1 Republic Services Landfill

The Republic Services Landfill is located about 2 miles east of the facility. This landfill could be a potential source of PFAS, but it is located cross-gradient of the facility. Landfills are not usually a primary release area of PFAS, but materials disposed in landfills may create a secondary source

of contamination. Such materials may include sludge from a wastewater treatment plant that processes PFAS-laden water, used AFFF storage containers, or products associated with waterproofing such as uniforms or boots.

3.4.2 Flint Hills Resources Gas Storage Facility

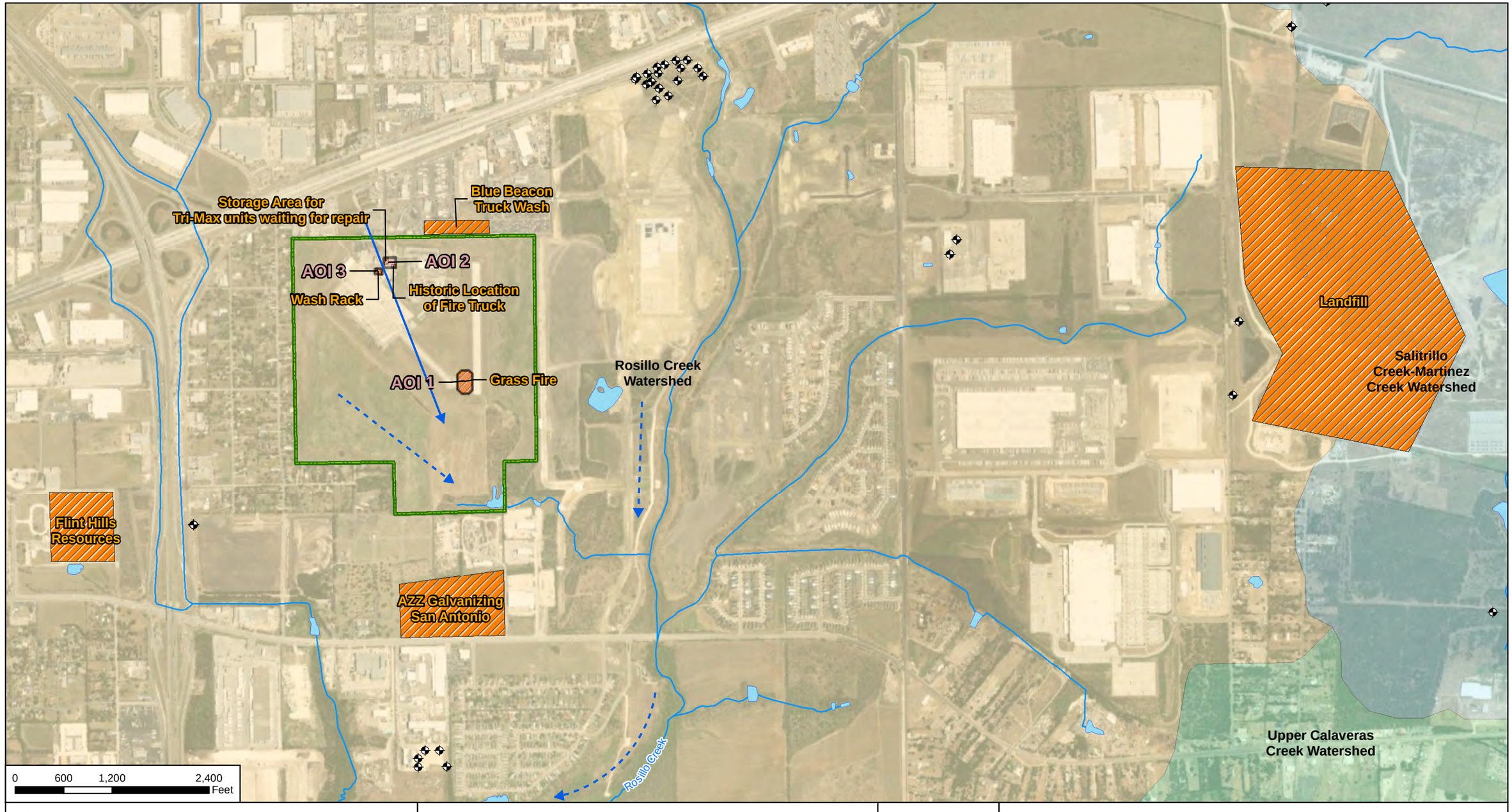
Flint Hills Resources gas storage facility is located cross-gradient, approximately 5,000 feet southwest of the Martindale AASF. A gas storage facility may have and use AFFF on-site because of the need to have effective firefighting capabilities at facilities with large quantities of bulk fuel.

3.4.3 AZZ Galvanizing San Antonio

AZZ Galvanizing is located downgradient, approximately 1,040 feet south-southeast of the facility. AZZ Galvanizing is a large quantity generator as defined by USEPA, meaning that it generates over 1,000 kilograms of hazardous waste, or over 1 kilogram of acutely hazardous waste per month. A hazardous waste summary for AZZ Galvanizing describes it as having ignitable waste, corrosive waste, arsenic, cadmium, chromium, lead, and selenium waste. The processes conducted at AZZ Galvanizing are described as metal coating and allied services. The process of metal plating and etching is known to use PFAS for corrosion prevention, mechanical wear reduction, aesthetic enhancement, surfactant, wetting agent/fume suppressant for chrome, copper, nickel, and tin electroplating, and post-plating cleaner (Interstate Technology Regulatory Council [ITRC], 2017). It is possible that the processes conducted at AZZ Galvanizing include the use of PFAS.

3.4.4 Blue Beacon Truck Wash

Blue Beacon Truck Wash of San Antonio is located at 1112 Ackerman Road in San Antonio, upgradient and directly north of the facility. The Truck Wash shares the northern boundary of the facility. A chemical inventory of the Truck Wash indicated that hydrogen fluoride, in an average daily amount of 1,000 to 9,999 pounds, was used at the site in 2010. Although the processes that occur at the truck wash are unknown, it is possible that PFAS are used in the buffing and water-proofing process. PFAS use has been linked to car wash facilities in various locations around the US.



CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	3/20/2023	GIS BY	MS	3/20/2023
SCALE	1:14,400	CHK BY	MC	3/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/20/2023

Legend

- Area of Interest
- Potential Release Area
- Facility Boundary
- Water Body
- River/Stream
- Surface Water Flow Direction
- Groundwater Flow Direction
- Monitoring Well

N

Areas of Interest

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Figure 3-1

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4. Project Data Quality Objectives

As identified during the Data Quality Objective (DQO) process and outlined in the SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2022b), the objective of the SI is to identify whether there has been a release to the environment at the AOIs identified in the PA. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for presence or absence of relevant compounds at each of the sampled AOIs.

4.1 Problem Statement

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

4.2 Information Inputs

Primary information inputs included:

- The PA for Martindale AASF (AECOM, 2020);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-QAPP Addendum (AECOM, 2022b); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 Study Boundaries

The scope of the SI was bounded 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). Temporal boundaries were limited to the spring season, which was the earliest available time field resources were available to complete the study.

4.4 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs within this document and decision rules as defined in the SI QAPP Addendum (AECOM, 2022b).

4.5 Data Usability Assessment

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

Based on the DUA, the environmental data collected during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUA and its associated data validation reports. These data are of sufficient quality to meet the objectives and requirements of the SI QAPP Addendum (AECOM, 2022b).

5. Site Inspection Activities

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

- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP)* dated March 2018 (AECOM, 2018a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b);
- *Final Preliminary Assessment Report, Martindale Army Aviation Support Facility, San Antonio, Texas* dated July 2020 (AECOM, 2020);
- *Final Site Safety and Health Plan, Martindale Army Air Field, San Antonio, Texas* dated March 2022 (AECOM, 2022a); and
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Martindale Army Air Field, San Antonio, Texas* dated April 2022 (AECOM, 2022b).

The SI field activities were conducted from 4 to 8 April 2022 and consisted of utility clearance, direct push boring, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022b), except as noted in **Section 5.8**.

The following samples were collected during the SI and analyzed for a subset of 18 compounds by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.3 Table B-15 to fulfill the project DQOs:

- Twenty-four (24) soil samples from six boring locations and eight hand auger locations;
- Five grab groundwater samples from five temporary wells;
- Fourteen (14) quality assurance (QA)/quality control (QC) samples.

Figure 5-1 provides the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**, land survey data are provided in **Appendix B3,** Nonconformance and Corrective Action Reports are provided in **Appendix B4**, and investigation-derived waste (IDW) polygons are provided in **Appendix B5**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

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

5.1.1 Technical Project Planning

The US Army Corps of Engineers (USACE) TPP Process, Engineer Manual (EM) 200-1-2 (USACE, 2016) defines four phases to project planning: 1.) defining the project phase; 2.) determining data needs; 3.) developing data collection strategies; and 4.) finalizing the data collection plan. The process encourages stakeholder involvement in the SI, beginning with

defining overall project objectives, including DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 21 September 2021, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, Texas ARNG, USACE, and Texas Commission on Environmental Quality. 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, 2022b).

A TPP Meeting 3 was held on 26 July 2023, after the field event to discuss the results of the SI. Meeting minutes for TPP 3 are included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM placed a ticket with the Texas 811 utility clearance provider to notify them of intrusive work on 28 March 2022. Additionally, AECOM contracted Ground Penetrating Radar Systems (GPRS), a private utility location service, to perform utility clearance. GPRS performed utility clearance of the proposed boring locations on 4 April 2022 with input from the AECOM field team and Martindale AASF facility staff. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared using a hand auger to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and Sampling Equipment Acceptability

A potable water source spigot at Martindale AASF was sampled on 3 March 2022 to assess usability for decontamination of drilling equipment. Water from the spigot was transferred to a tote to allow for decontamination staging in an alternate area. Water from the tote was sampled on 7 April 2022. Results of the samples collected from the spigot (MARTINDALEAAF-PW-01) and the tote (MDF-PW-01) confirmed this source and container to be acceptable for use in this investigation; therefore, they were used throughout the field activities. Specifically, the samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water samples associated with the spigot source and tote used during the SI are provided in **Appendix F**. A discussion of the results is presented in the DUA (**Appendix A**).

Materials that were used within the sampling zone were confirmed as acceptable for use in the sampling environment. The checklist of acceptable materials for use in the sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 2022b). Prior to the start of field work each day, a Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Soil samples were collected via direct push technology (DPT), in accordance with the SI QAPP Addendum (AECOM, 2022b). A GeoProbe® 7822DT dual-tube sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top 5 feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1**, and depths are provided in **Table 5-1**.

At hand auger locations, one surface soil sample was collected from 0 to 2 feet bgs. At temporary well locations, three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 1-foot above the interpreted top of the groundwater table at the time of drilling, and one subsurface soil sample at the mid-point between the surface and the groundwater table. However, due to low recovery at AOI02-04, only two samples were collected, one surface soil sample (0 to 2 feet bgs) and one subsurface soil sample (9 to 12.5 feet bgs).

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

Soil borings completed during the SI found lean clay as the dominant lithology of the unconsolidated sediments below the Martindale AASF. The borings were completed at depths between 20 and 33.5 feet bgs. Isolated layers of sand and silt were also observed in the borings with thicknesses ranging from a few inches to 5 feet. These observations are consistent with the understood depositional environment of the region.

Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15, total organic carbon (TOC) (USEPA Method 9060A), and pH (USEPA Method 9045D)in accordance with the SI QAPP Addendum (AECOM, 2022b).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike (MS)/MS duplicates (MSDs) were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. In instances when non-dedicated sampling equipment was used, such as a hand auger for the shallow soil samples, equipment rinsate blanks were collected at a rate of 5% and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6 degrees Celsius (°C) during shipment.

DPT borings were converted to temporary wells, which were subsequently abandoned in accordance with the SI QAPP Addendum (AECOM, 2022b) using bentonite chips at completion of sampling activities. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 Temporary Well Installation and Groundwater Grab Sampling

Temporary wells were installed using a GeoProbe® 7822DT dual-tube sampling system. Once the borehole was advanced to the desired depth, a temporary well was constructed of a 10-foot section of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. The temporary well was set in an open hole without filter pack and new PVC pipe and screen were used to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

Groundwater samples were collected after a period of time following well installation to allow groundwater to infiltrate and recharge the temporary well screen intervals. After the recharge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. The temporary wells were purged at a rate determined in the field to reduce turbidity and

draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) before each grab sample was collected. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2022b).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. One field reagent blank was collected in accordance with the PQAPP (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6 °C during shipment.

Groundwater was slow to recharge at temporary wells AOI01-04 and MDF-02. As a result, the field duplicate sample and MS/MSD samples from AOI01-04 were not collected immediately following the collection of the primary sample, but approximately 4 to 20 hours later, following periods of recharge. Sample dates and times are presented on **Table 5-1**. Due to low groundwater volume, only one container was able to be collected from MDF-02. At the laboratory, the sample MDF-02-GW was not spiked with extraction internal standards (EIS) because there was only one container to extract. Analysis of this sample was cancelled, as the data would not usable due to insufficient volume.

Following well surveying (described below in **Section 5.5**), temporary wells were abandoned in accordance with the SI QAPP Addendum (AECOM, 2022) by removing the PVC and backfilling the hole with bentonite chips.

5.4 Water Level Measurements

Groundwater gauging was performed between 6 April 2022 and 7 April 2022. Due to very slow recovery of water in some wells, stable water levels were not obtainable on a single day and a synoptic event was not possible. See **Section 5.8** for an explanation of this deviation. Water level measurements were taken from the northern side of each well casing. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-2**.

5.5 Surveying

The northern side of each well casing was surveyed by Texas-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2022b). Survey data from the newly installed wells on the facility were collected on 7 April 2022 in the applicable Universal Transverse Mercator zone projection with North American Datum 1983 (NAD83 [2011]) datum (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B3**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of IDW is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the SI QAPP Addendum (AECOM, 2022b) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW generated at hand augured locations were left in place at the point of source. Geographic coordinates were collected using a global positioning system (GPS) around each location where IDW was placed (i.e., an IDW polygon). The IDW polygons are displayed on the figure in **Appendix B4**.

Soil IDW (i.e., soil cuttings) generated during drilling activities were containerized in properly labeled, 55-gallon Department of Transportation (DOT)-approved steel drums and left onsite in a designated waste storage area. The soil IDW was not sampled and assumes the characteristics of the associated soil samples collected from that source location. ARNG will coordinate waste profiling, transportation, and disposal of the solid IDW.

Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) were contained in labeled, 55-gallon DOT-approved steel drums, and left onsite in a designated waste storage area. The liquid IDW was not sampled and assumes the characteristics of the associated groundwater samples collected from that source location. Based on laboratory results, containerized liquid IDW will be managed and disposed by ARNG under a separate contract for Treating Liquid Investigation-Derived Material (Purge water, drilling water, and decontamination fluids) (EA Engineering, Science, and Technology, Inc., 2021).

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

5.7 Laboratory Analytical Methods

Samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 at Pace Analytical Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP certified laboratory. Soil samples were also analyzed for TOC using USEPA Method 9060A and pH by USEPA Method 9045D.

5.8 Deviations from SI QAPP Addendum

Five deviations from the SI QAPP Addendum were identified during review of the field documentation. The deviations are noted below and documented in Nonconformance and Corrective Action Reports (**Appendix B4**):

- During the installation of temporary monitoring wells, a mid-point sample was not collected from boring AOI02-04 because the deepest interval sample required all the available soil volume to collect the parent sample, duplicate sample, and the MS/MSD. Additionally, upon review of field documentation, it was discovered that sample AOI02-04-SB-9-12.5 (including its field duplicate and matrix spike/matrix duplicate) was inadvertently shipped to the laboratory but not logged in during sample check-in and, therefore, not analyzed. Thus, only one soil sample was analyzed for AOI02-04, rather than three samples. As a result, the other soil and groundwater samples collected at AOI 2 were collectively used to determine whether further investigation of the AOI is needed in an RI. This action was documented in a nonconformance and corrective action report provided in **Appendix B4**.

- During groundwater sampling of temporary monitoring wells, groundwater was slow to recharge at MDF-02. As a result, there was only enough volume to fill one sample container. At the laboratory, the sample MDF-02-GW was not spiked with EIS since there was only one container to extract. Due to insufficient sample volume, analysis for this sample was cancelled, as the data would not be usable. This action was documented in a nonconformance and corrective action report provided in **Appendix B4**.

- Per the SI QAPP addendum, field duplicate soil samples are to be collected at a rate of 10%. During soil sampling, field duplicates were collected at a rate of 10% (3 for 25 samples). However, soil sample AOI02-04-SB-9-12.5, its field duplicate (AOI02-04-SB-9-12.5-D), and matrix spike/matrix duplicate samples (AOI02-04-SB-9-12.5-MS, AOI02-04-SB-9-12.5-MSD) were shipped to the laboratory but not logged in during sample check in due to confusion with the chain of custody. Therefore, these samples were not analyzed, resulting in a field duplicate rate of approximately 8% (2 for 24 samples). This action was documented in a nonconformance and corrective action report provided in **Appendix B4**.

- Per the SI QAPP addendum, a synoptic water level measurements were to be collected from the newly installed temporary monitoring wells. During the field event, all wells were intended to be gauged on the same day prior to well abandonment. However, wells AOI02-04 and AOI03-02 were pumped dry and not recharging at a fast enough rate to give accurate water level measurements. As a result, a synoptic gauging event was not possible in order to achieve field schedule. Wells AOI02-04 and AOI03-02 were excluded from contouring since stable static water level measurements could not be obtained due to inadequate recharge. The groundwater levels measured prior to sampling at all other wells were used to generate the facility contour map (**Figure 2-4**). This action was documented in a nonconformance and corrective action report provided in **Appendix B4**.

- Due to a laboratory error, the grain size samples collected at AOI01-04 and AOI03-02 could not be analyzed. This deviation was documented in a nonconformance and corrective action report provided in **Appendix B4**.

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Martindale AASF, Texas

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-00-02	4/4/2022 14:15	0 - 2	x				
AOI01-02-SB-00-02	4/4/2022 14:55	0 - 2	x				
AOI01-03-SB-00-02	4/4/2022 13:30	0 - 2	x				
AOI01-04-SB-00-02	4/4/2022 15:10	0 - 2	x	x	x		
AOI01-04-SB-13-15	4/4/2022 16:45	13 - 15	x			x	
AOI01-04-SB-31.5-33.5	4/4/2022 16:50	31.5 - 33.5	x				
AOI02-01-SB-00-02	4/5/2022 10:20	0 - 2	x				
AOI02-02-SB-00-02	4/5/2022 9:40	0 - 2	x	x	x		
AOI02-03-SB-00-02	4/5/2022 8:30	0 - 2	x				
AOI02-04-SB-00-02	4/5/2022 11:45	0 - 2	x				
AOI02-04-SB-00-02-D	4/5/2022 11:45	0 - 2	x				FD
AOI02-04-SB-00-02-MS	4/5/2022 11:45	0 - 2	x				MS
AOI02-04-SB-00-02-MSD	4/5/2022 11:45	0 - 2	x				MSD
AOI03-01-SB-00-02	4/5/2022 10:55	0 - 2	x				
AOI03-02-SB-00-02	4/6/2022 15:50	0 - 2	x				
AOI03-02-SB-06-08	4/6/2022 17:35	6 - 8	x				
AOI03-02-SB-12.5-15	4/6/2022 17:20	12.5 - 15	x			x	
AOI03-02-SB-12.5-15-D	4/6/2022 17:20	12.5 - 15	x	x	x		FD
AOI03-02-SB-12.5-15-MS	4/6/2022 17:20	12.5 - 15	x				MS
AOI03-02-SB-12.5-15-MSD	4/6/2022 17:20	12.5 - 15	x				MSD
AOI03-03-SB-00-02	4/5/2022 11:58	0 - 2	x	x	x		
MDF-01-SB-00-02	4/5/2022 16:55	0 - 2	x				
MDF-01-SB-08-10	4/6/2022 10:40	8 - 10	x				
MDF-01-SB-14-15.5	4/6/2022 10:35	14 - 15.5	x				
MDF-02-SB-00-02	4/5/2022 13:35	0 - 2	x				
MDF-02-SB-04-06	4/5/2022 15:55	4 - 6	x				
MDF-02-SB-08-10	4/5/2022 15:58	8 - 10	x				
MDF-03-SB-00-02	4/5/2022 12:25	0 - 2	x				
MDF-03-SB-05-07	4/5/2022 12:30	5 - 7	x				
MDF-03-SB-10-12	4/5/2022 12:35	10 - 12	x				
Groundwater Samples							
AOI01-04-GW	4/7/2022 12:25	NA	x				
AOI01-04-GW-D	4/7/2022 16:45	NA	x				FD
AOI01-04-GW-MS	4/8/2022 7:45	NA	x				MS
AOI01-04-GW-MSD	4/7/2022 16:45	NA	x				MSD
AOI02-04-GW	4/7/2022 11:45	NA	x				
AOI03-02-GW	4/7/2022 5:45	NA	x				
MDF-01-GW	4/7/2022 8:00	NA	x				
MDF-03-GW	4/6/2022 14:00	NA	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Martindale AASF, Texas

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Quality Control Samples							
MARTINDALEAAF-PW-01	3/3/2022 9:45	NA	x				spigot used for decon source water
MDF-FRB-01	4/7/2022 7:35	NA	x				
MDF-ERB-01	4/7/2022 7:30	NA	x				pump
MDF-ERB-02	4/6/2022 15:45	NA	x				hand auger
MDF-PW-01	4/7/2022 10:46	NA	x				tote with decon source water

Notes:
AASF = Army Aviation Support Facility
AOI = Area of Interest
ASTM = American Society for Testing and Materials
bgs = below ground surface
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
GW = groundwater
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MDF = Martindale Facility
MS/MSD = matrix spike/ matrix spike duplicate
PW = potable water
QSM = Quality Systems Manual
SB = soil boring
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths, Temporary Well Screen Intervals, and Groundwater Elevations
Site Inspection Report, Martindale AASF, Texas

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Depth to Water (feet btoc)	Depth to Water (feet bgs)	Groundwater Elevation (feet NAVD88)
1	AOI01-04	33.5	23.5 - 33.5[1]	671.04	670.70	16.1	15.76	654.94
	MDF-03	27.5	17.5 - 27.5[1]	667.14	666.95	10.54	10.35	656.60
2	AOI02-04	22	12 - 22	675.30	674.62	17.49	16.81	657.81
	MDF-02	20	10 - 20	675.55	675.56	12.89	12.90	662.66
3	AOI03-02	30	20 - 30	675.04	674.68	25.98	25.62	649.06
	MDF-01	31.9	21.9 - 31.9[1]	674.36	673.96	9.52	9.12	664.84

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

AASF = Army Aviation Support Facility
AOI = Area of Interest
bgs = below ground surface
btoc = below top of casing
MDF = Martindale Facility
NA = not applicable
NAVD88 = North American Vertical Datum 1988

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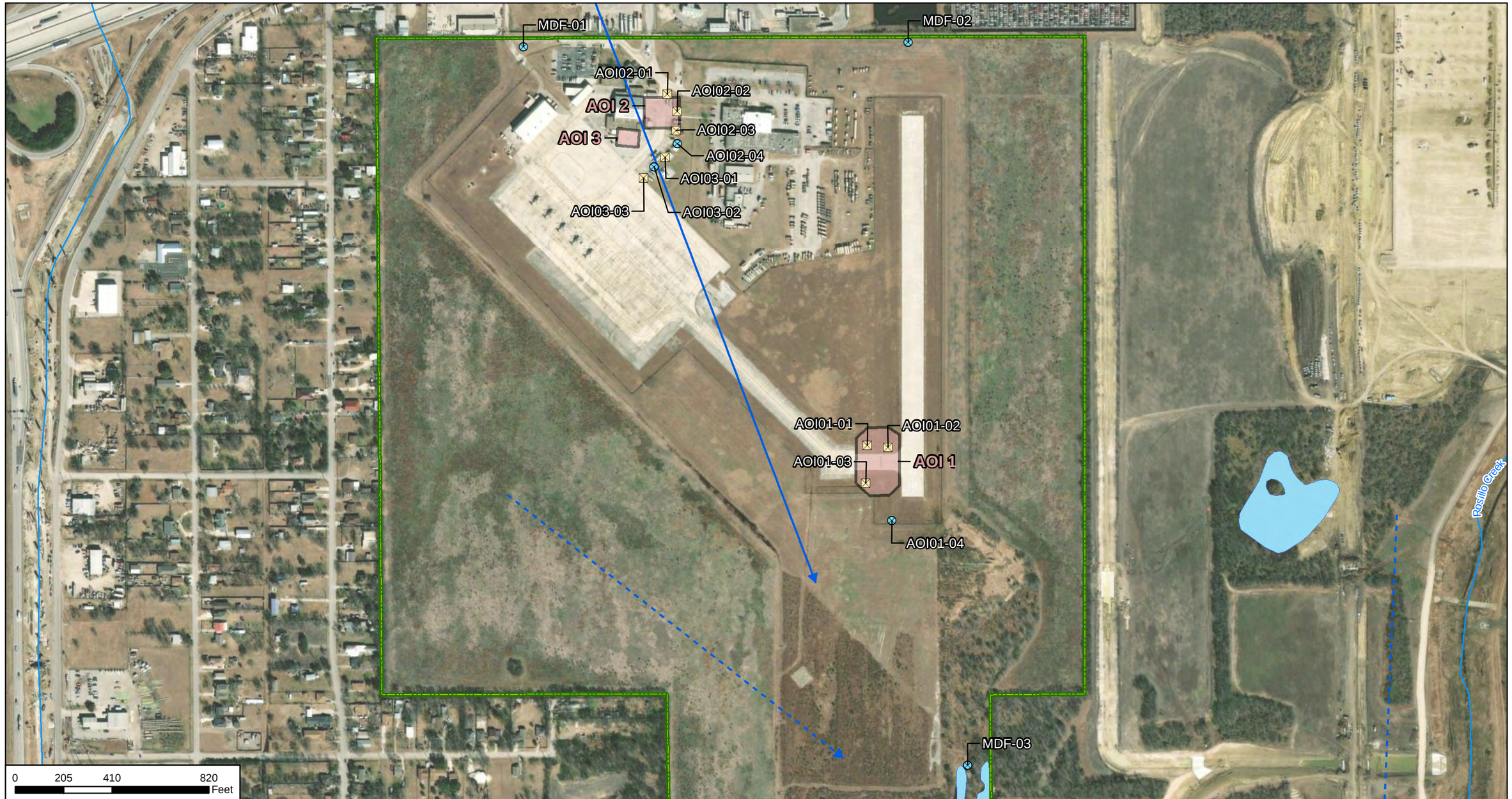

CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	3/20/2023	GIS BY	MS	3/20/2023
SCALE	1:4,922	CHK BY	MB	3/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/20/2023

Legend

- DPT Temporary Well
- Surface Soil Sample
- Area of Interest
- Facility Boundary
- Water Body
- River/Stream
- Surface Water Flow Direction
- Groundwater Flow Direction

N

Site Inspection Sample Locations

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 5-1

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6. Site Inspection Results

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Section 6.3** through **Section 6.5**. **Table 6-2** through **Table 6-5** present results in soil or groundwater for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

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

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

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

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

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

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

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

6.2 Soil Physicochemical Analyses

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

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

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1: Grass Fire Near Flight Line. The soil and groundwater results are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI01-01 through AOI01-04, and MDF-03. Subsurface soil was also sampled from MDF-03 at depths of 5 to 7 feet bgs and 10 to 12 feet bgs, and from AOI01-04 at depths of 13 to 15 feet bgs and 31.5 to 33.5 feet bgs. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results, which are highlighted below.

- PFOS was detected below the SL in surface soil at locations AOI01-03 and MDF-03, with a maximum concentration of 0.353 J micrograms per kilogram (µg/kg). PFOA, PFHxS, PFNA, and PFBS were not detected in surface soil.
- PFOS and PFHxS were detected below their SLs in shallow subsurface soil at location MDF-03, with concentrations of 0.628 J µg/kg and 0.045 J µg/kg, respectively. PFOA, PFNA, and PFBS were not detected in shallow subsurface soil.
- PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in deep subsurface soil.

6.3.2 AOI 1 Groundwater Analytical Results

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

Groundwater was sampled from temporary monitoring wells AOI01-04 and MDF-03. PFOA was detected above the SL of 6 nanograms per liter (ng/L) in one well, with a maximum concentration of 12.2 J ng/L in the field duplicate sample AOI01-04-GW-D. PFOS was detected in temporary monitoring well MDF-03 above the SL of 4 ng/L, with a concentration of 25.9 ng/L. PFHxS, and PFBS were detected below their SLs, with maximum concentrations of 5.83 ng/L and 3.07 J+ ng/L, respectively. PFNA was not detected in groundwater at AOI 1.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOS was detected below the SL in surface soil; PFOS and PFHxS were detected below their SLs in subsurface soil. PFOA and PFOS were detected in groundwater, at concentrations above their SLs, PFHxS and PFBS were detected below their SLs in groundwater, and PFNA was not detected in groundwater. Based on the exceedances of the SLs 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: Area East of the Maintenance Hangar. The results in soil and groundwater are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.4.1 AOI 2 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI02-01 through AOI02-04, and MDF-02. Subsurface soil was also sampled from boring location MDF-02 at depths of 4 to 6 feet bgs and 8 to 10 feet bgs. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** and **Table 6-3** summarize the soil results.

PFOA, PFOS, PFHxS, and PFNA were detected below their SLs, with the following maximum concentrations: PFOA at 0.184 J µg/kg, PFOS at 2.61 µg/kg, PFHxS at 0.538 J µg/kg, and PFNA at 0.155 J µg/kg. PFBS was not detected in surface soil. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in shallow subsurface soil.

6.4.2 AOI 2 Groundwater Analytical Results

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

Groundwater was sampled from temporary monitoring well AOI02-04. PFOS was detected above the SL of 4 ng/L, with a concentration of 35.3 ng/L. PFOA, PFHxS, and PFBS were detected below their SLs, with concentrations of 2.22 J ng/L, 21.3 ng/L, and 6.59 ng/L, respectively. PFNA was not detected in groundwater at AOI02-04.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOA, PFOS, PFHxS, and PFNA were detected in surface soil, at concentrations below their SLs. PFBS was not detected in surface soil. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in shallow subsurface soil. PFOS was detected in groundwater, at a concentration above the SL. PFOA, PFHxS, and PFBS were detected below their SLs in groundwater. PFNA was not detected in groundwater. Based on the exceedance of the SL in groundwater, further evaluation at AOI 2 is warranted.

6.5 AOI 3

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 3: Wash Rack. The results in soil and groundwater are presented in **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.5.1 AOI 3 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI03-01 through AOI03-03, and MDF-01. Subsurface soil was also sampled from AOI03-02 at depths of 6 to 8 feet bgs and 12.5 to 15 feet bgs, and from MDF-01 at depths of 8 to 10 feet bgs and 14 to 15.5 feet bgs. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** and **Table 6-3** summarize the soil results, which are highlighted below.

- PFOA, PFOS, PFHxS, PFNA, and PFBS were detected below their SLs in at least two surface soil locations, with the following maximum concentrations: PFOA at 0.375 J µg/kg, PFOS at 5.18 µg/kg, PFHxS at 4.77 µg/kg, PFNA at 0.127 J µg/kg, and PFBS at 0.044 J µg/kg.
- PFOS, PFHxS, and PFBS were detected below their SLs in shallow subsurface soil, with the following maximum concentrations: PFOS at 0.070 J µg/kg, PFHxS at 0.760 J µg/kg, and PFBS at 0.167 J µg/kg.
- PFOA and PFNA were not detected in shallow subsurface soil.

6.5.2 AOI 3 Groundwater Analytical Results

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

Groundwater was sampled from temporary monitoring wells AOI03-02 and MDF-01. PFOS was detected above the SL of 4 ng/L at AOI03-02, with a concentration of 23.4 ng/L. PFOA, PFHxS, PFNA, and PFBS were detected below their SLs, with the following maximum concentrations: PFOA at 2.95 J ng/L, PFHxS at 28.9 ng/L, PFNA at 1.42 J ng/L, and PFBS at 7.05 ng/L.

6.5.3 AOI 3 Conclusions

Based on the results of the SI, PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in surface soil, at concentrations below their SLs. PFOS, PFHxS, and PFBS were detected in subsurface soil at concentrations below their SLs. PFOA and PFNA were not detected in subsurface soil. PFOS was detected in groundwater, at a concentration above the SL. PFOA, PFHxS, PFNA, and PFBS were detected below their SLs in groundwater. Based on the exceedance of the SL in groundwater, further evaluation at AOI 3 is warranted.

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

Area of Interest		AOI01										AOI02									
Sample ID		AOI01-01-SB-00-02		AOI01-02-SB-00-02		AOI01-03-SB-00-02		AOI01-04-SB-00-02		MDF-03-SB-00-02		AOI02-01-SB-00-02		AOI02-02-SB-00-02		AOI02-03-SB-00-02		AOI02-04-SB-00-02		AOI02-04-SB-00-02-D	
Sample Date		04/04/2022		04/04/2022		04/04/2022		04/04/2022		04/05/2022		04/05/2022		04/05/2022		04/05/2022		04/05/2022		04/05/2022	
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, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.538	J	ND	U	0.143	J	0.065	J
PFNA	19	ND	U	ND	U	ND	U	ND	U	ND	U	0.026	J	0.136	J	0.155	J	0.061	J	0.070	J
PFOA	19	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.184	J	0.104	J	0.176	J	0.138	J
PFOS	13	ND	U	ND	U	0.064	J	ND	U	0.353	J	0.122	J	2.61		0.279	J	0.522	J	0.274	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

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

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

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

Area of Interest		AOI02		AOI03		AOI03					
Sample ID		MDF-02-SB-00-02		AOI03-01-SB-00-02		AOI03-02-SB-00-02		AOI03-03-SB-00-02		MDF-01-SB-00-02	
Sample Date		04/05/2022		04/05/2022		04/06/2022		04/05/2022		04/05/2022	
Depth		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**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)											
PFBS	1900	ND	U	0.029	J	0.044	J	0.022	J	ND	U
PFHxS	130	ND	U	0.290	J	4.77		0.136	J	ND	U
PFNA	19	0.033	J	0.126	J	ND	U	0.127	J	ND	U
PFOA	19	ND	U	0.166	J	0.375	J	0.285	J	ND	U
PFOS	13	0.087	J	4.30		4.09		5.18		0.219	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

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Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

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

Area of Interest		AOI01						AOI02				AOI03									
Sample ID		AOI01-04-SB-13-15		MDF-03-SB-05-07		MDF-03-SB-10-12		MDF-02-SB-04-06		MDF-02-SB-08-10		AOI03-02-SB-06-08		AOI03-02-SB-12.5-15		AOI03-02-SB-12.5-15-D		MDF-01-SB-08-10		MDF-01-SB-14-15.5	
Sample Date		04/04/2022		04/05/2022		04/05/2022		04/05/2022		04/05/2022		04/06/2022		04/06/2022		04/06/2022		04/06/2022		04/06/2022	
Depth		13-15 ft		5-7 ft		10-12 ft		4-6 ft		8-10 ft		6-8 ft		12.5-15 ft		12.5-15 ft		8-10 ft		14-15.5 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	25000	ND	U	ND	U	ND	U	ND	U	ND	U	0.167	J	0.059	J	0.114	J	ND	U	ND	U
PFHxS	1600	ND	U	0.045	J	ND	U	ND	U	ND	U	0.760	J	0.039	J	0.037	J	ND	U	ND	U
PFNA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	160	ND	U	0.628	J	ND	U	ND	U	ND	U	0.070	J	ND	U	ND	U	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

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

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
MDF	Martinsdale Army Air Field
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

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

Area of Interest	AOI01	
Sample ID	AOI01-04-SB-31.5-33.5	
Sample Date	04/04/2022	
Depth	31.5-33.5 ft	
Analyte	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)		
PFBS	ND	U
PFHxS	ND	U
PFNA	ND	U
PFOA	ND	U
PFOS	ND	U

Interpreted Qualifiers

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

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
DL	detection limit
ft	feet
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
µg/kg	micrograms per kilogram

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

Area of Interest		AOI01						AOI02		AOI03			
Sample ID		AOI01-04-GW		AOI01-04-GW-D		MDF-03-GW		AOI02-04-GW		AOI03-02-GW		MDF-01-GW	
Sample Date		04/07/2022		04/07/2022		04/06/2022		04/07/2022		04/07/2022		04/07/2022	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)													
PFBS	601	2.19	J	3.07	J+	2.08	J	6.59		7.05		2.36	J
PFHxS	39	3.37	J	4.56	J	5.83		21.3		28.9		2.04	J
PFNA	6	ND	U	ND	UJ	ND	U	ND	U	1.42	J	ND	U
PFOA	6	10.4		12.2	J	ND	U	2.22	J	2.95	J	1.59	J
PFOS	4	2.50	J	3.11	J+	25.9		35.3		23.4		3.72	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

J+ = Estimated concentration, biased high

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

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

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
GW	groundwater
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
MDF	Martinsdale Army Air Field
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

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CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	1/20/2023	GIS BY	MS	1/20/2023
SCALE	1:7,800	CHK BY	MB	1/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/20/2023

Facility Boundary
Water Body
River/Stream

0 325 650 1,300 Feet

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

N

PFOA Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1

CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	1/20/2023	GIS BY	MS	1/20/2023
SCALE	1:7,800	CHK BY	MB	1/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/20/2023

Facility Boundary
Water Body
River/Stream

0 325 650 1,300 Feet

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

N

PFOS Detections in Soil

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12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-2

CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	1/20/2023	GIS BY	MS	1/20/2023
SCALE	1:7,800	CHK BY	MB	1/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/20/2023

Facility Boundary
Water Body
River/Stream

0 325 650 1,300 Feet

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

N

PFBS Detections in Soil

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Germantown, MD 20876

Figure 6-3

CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	1/20/2023	GIS BY	MS	1/20/2023
SCALE	1:7,800	CHK BY	MB	1/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/20/2023

Facility Boundary
Water Body
River/Stream

0 325 650 1,300 Feet

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

N

PFHxS Detections in Soil

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Germantown, MD 20876

Figure 6-4

CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	1/20/2023	GIS BY	MS	1/20/2023
SCALE	1:7,800	CHK BY	MB	1/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/20/2023

Facility Boundary
Water Body
River/Stream

0 325 650 1,300 Feet

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

N

PFNA Detections in Soil

AECOM
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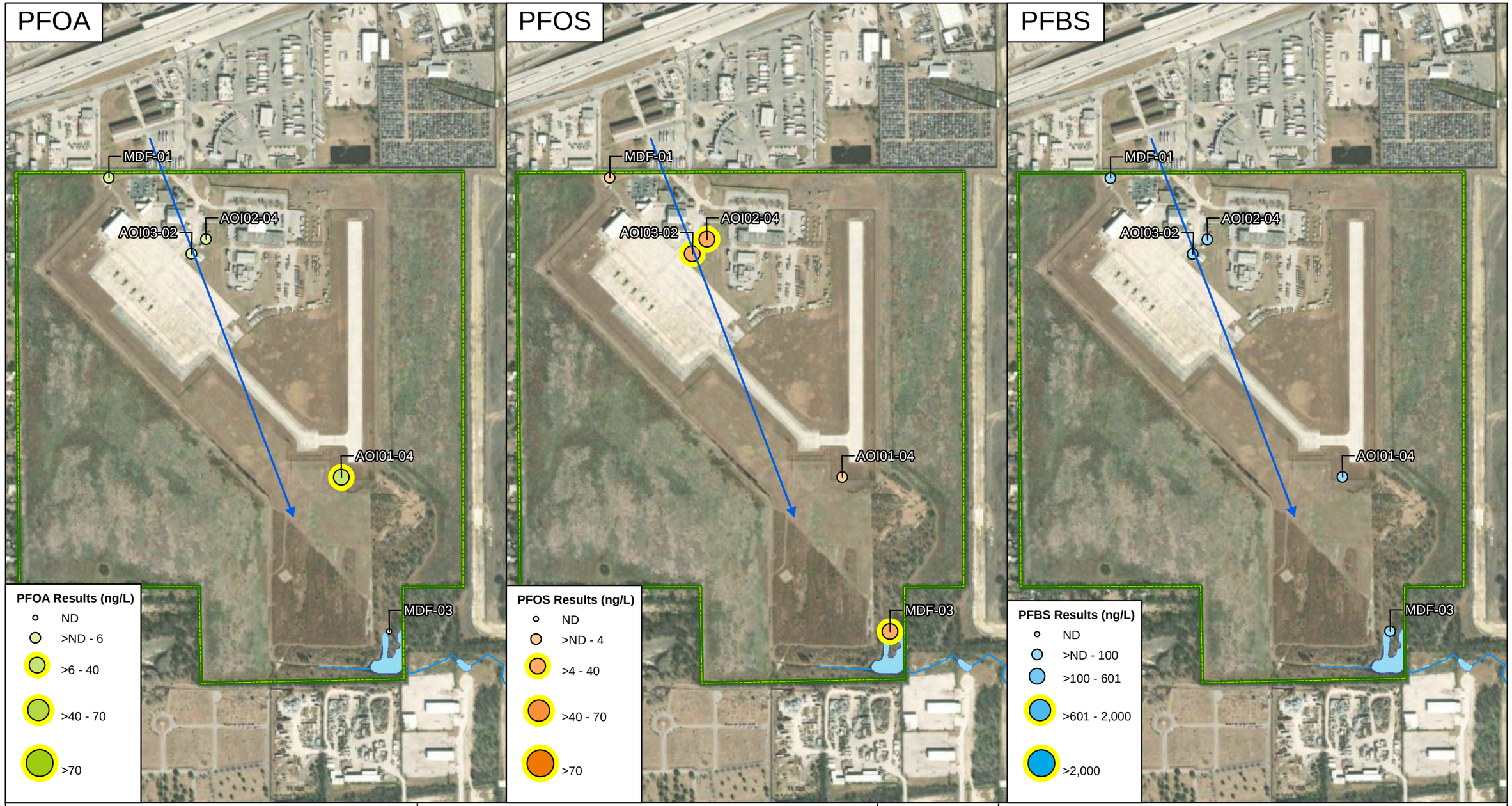
Germantown, MD 20876

Figure 6-5



CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	3/20/2023	GIS BY	MS	3/20/2023
SCALE	1:7,800	CHK BY	MB	3/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/20/2023

Facility Boundary
Water Body
River/Stream
Groundwater Flow Direction

0 325 650 1,300 Feet

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

N

PFOA, PFOS, and PFBS Detections in Groundwater

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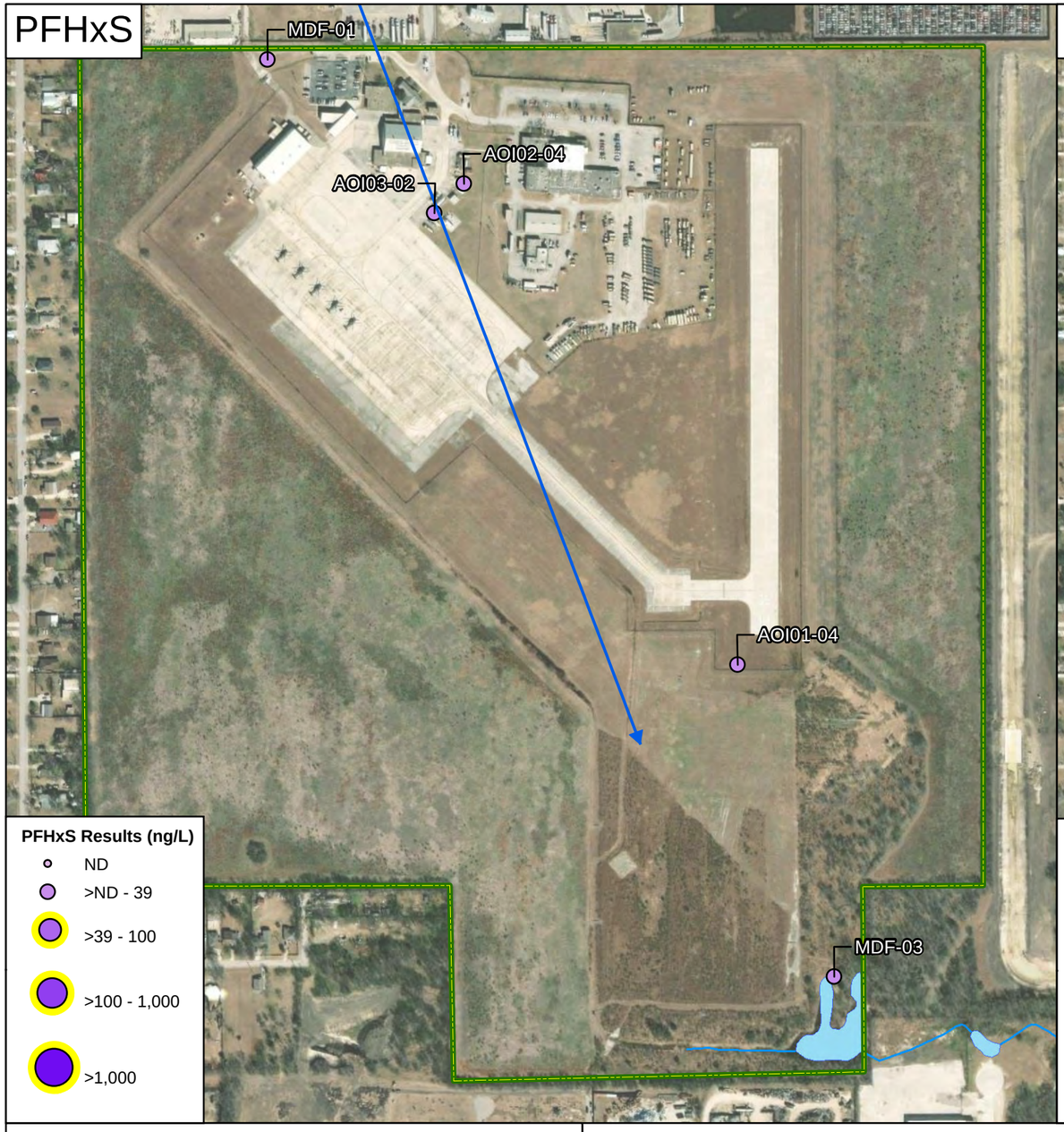
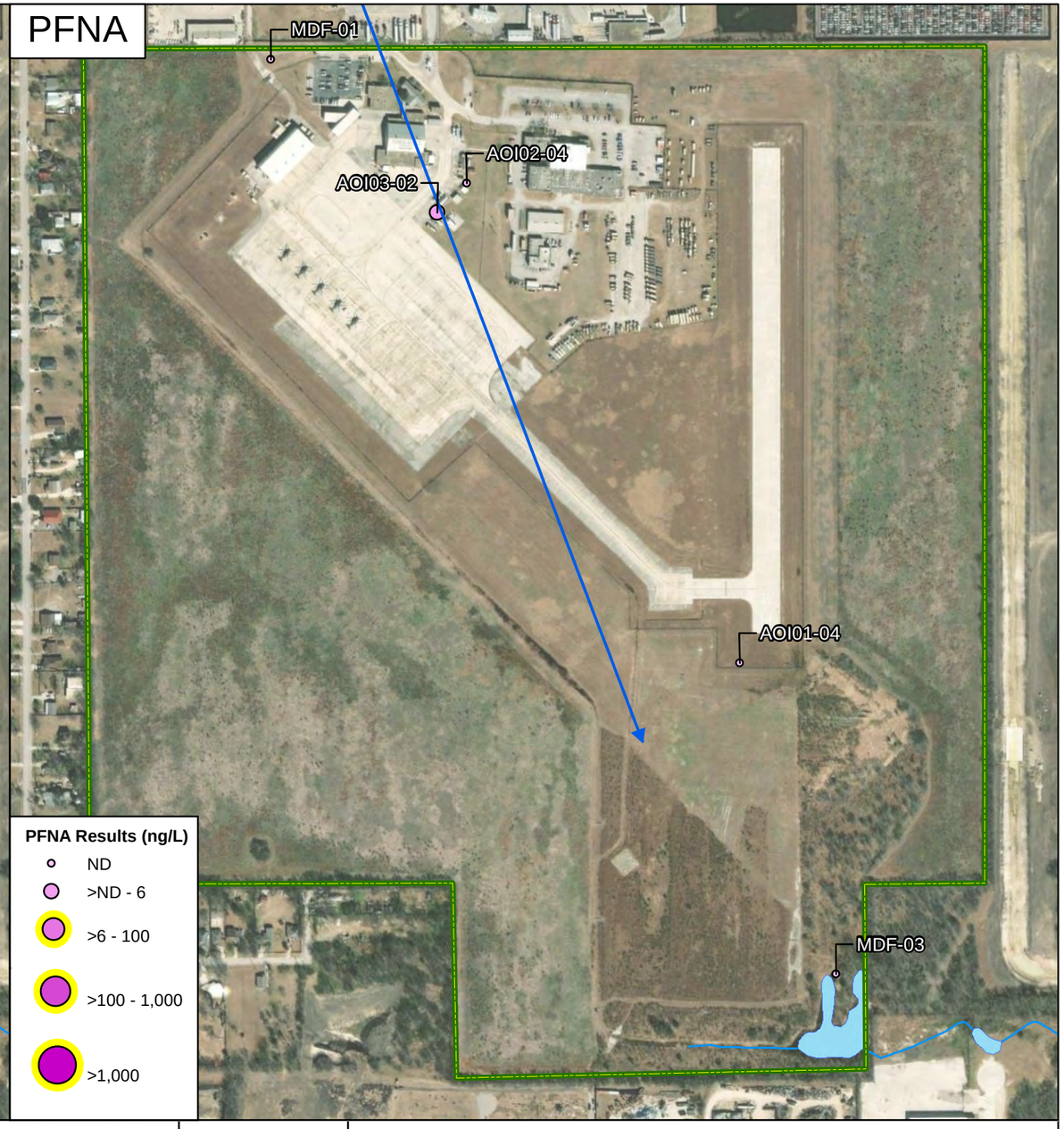
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-6

PFHxS



PFNA



PFHxS Results (ng/L)

- ND
- >ND - 39
- >39 - 100
- >100 - 1,000
- >1,000

PFNA Results (ng/L)

- ND
- >ND - 6
- >6 - 100
- >100 - 1,000
- >1,000

CLIENT	ARNG			
PROJECT	Site Inspection at Martindale AASF, TX			
REVISED	3/20/2023	GIS BY	MS	3/20/2023
SCALE	1:5,400	CHK BY	MB	3/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/20/2023

- Facility Boundary
- Water Body
- River/Stream
- Groundwater Flow Direction

0 225 450 900 Feet

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

N

PFHxS and PFNA Detections in Groundwater

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Germantown, MD 20876

Figure 6-7

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** and **Figure 7-2**. Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to RI or interim action is determined based upon exceedances of the SLs for the relevant compounds and whether the release is more than likely attributable to the DoD. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

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

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with an incomplete pathway generally warrant no further action. However, the pathway is considered potentially complete if the relevant compounds are detected and the other four elements are satisfied, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of relevant compounds above the SLs. Areas with an identified potentially complete pathway that have detections of the relevant compounds above the SLs may warrant further investigation. Although the CSMs indicate whether potentially complete exposure pathways may exist, the recommendation for future study in an RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

In general, the potential routes of exposure to the relevant compounds are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of toxicological study. The receptors evaluated are consistent with those listed in 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 in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 1, AOI 2, and AOI 3 based on the aforementioned criteria.

7.1.1 AOI 1

AOI 1 is the area where AFFF was used to put out a grass fire near the southwest end of the flight line. PFOS was detected two orders of magnitude below the SL in surface soil at AOI 1, with a maximum concentration of 0.353 J ug/kg. Site workers and construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers and future construction workers are potentially complete.

Residential properties exist adjacent to the facility, along the western and southwestern boundaries. However, AOI 1 is over 0.2 miles from the nearest residential property. Therefore, the surface soil exposure pathway for residents via incidental inhalation of dust is considered incomplete. The relevant compounds were detected below their SLs in shallow subsurface soil at AOI 1. Construction workers could contact constituents in subsurface soil via incidental ingestion; therefore, the subsurface soil exposure pathway for future construction workers is potentially complete. There are no recreational areas immediately adjacent to the facility. Additionally, the facility is secured against trespassers; therefore, the soil exposure pathways are incomplete to recreational users/trespassers. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

AOI 2 is the area east of the Maintenance Hangar where AFFF fluids stored in Tri-Max™ units were disposed of during maintenance events. A firetruck that likely contained AFFF was also stored in this area.

The relevant compounds were detected in surface soil at AOI 2. Site workers and construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers and future construction workers are potentially complete. Residential properties exist adjacent to the facility, along the western and southwestern boundaries. However, AOI 2 over 0.2 miles the nearest residential property. Therefore, the surface soil exposure pathway for residents via incidental inhalation of dust is considered incomplete. The relevant compounds were not detected in subsurface soil at AOI 2; therefore, all exposure pathways are considered incomplete. There are no recreational areas immediately adjacent to the facility. Additionally, the facility is secured against trespassers; therefore, the soil exposure pathways are incomplete to recreational users/trespassers. The CSM for AOI 2 is presented on **Figure 7-2**.

7.1.3 AOI 3

AOI 3 is the wash rack where AFFF fluids stored in Tri-Max™ units would have been disposed of during maintenance events when old AFFF was replaced with new AFFF in the units.

The relevant compounds were detected in surface soil and subsurface soil at AOI 3. Site workers and construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers and future construction workers are potentially complete. Residential properties exist adjacent to the facility, along the western and southwestern boundaries. However, AOI 3 is at least 0.2 mile from the nearest residential property. Therefore, the surface soil exposure pathway for residents via incidental inhalation of dust is considered incomplete. The relevant compounds were detected below their SLs in shallow subsurface soil at AOI 3. Therefore, construction workers could contact constituents in subsurface soil via incidental ingestion and the subsurface soil exposure pathway for future construction workers is potentially complete. There are no recreational areas immediately adjacent to the facility. Additionally, the facility is secured against trespassers; therefore, the soil exposure pathways are incomplete to recreational users/trespassers. The CSM for AOI 3 is presented on **Figure 7-1**.

7.2 Groundwater Exposure Pathway

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

7.2.1 AOI 1, AOI 2, and AOI 3

PFOA and/or PFOS were detected above their SLs in groundwater at AOI 1, AOI 2, and AOI 3. Depth to water measured in April 2022 during the SI ranged from 9.12 to 25.62 feet bgs. Therefore, construction workers could reasonably come in contact with shallow groundwater during construction activities, and the exposure pathway via incidental ingestion for future construction workers is considered potentially complete. There are no downgradient drinking water wells within 3 miles of the facility. The nearest water supply well is located upgradient, approximately 1.5 miles north of the facility and is over 1,000 feet deep. Additionally, the shallow aquifer is not used as drinking water in the San Antonio area and is a discontinuous perched lens with little or no interconnection with the Edwards aquifer. Therefore, the pathway for exposure to off-facility residents via ingestion of groundwater is considered incomplete. Drinking water at the facility is provided by the City of San Antonio; therefore, the pathway for exposure to site workers via ingestion of groundwater is also considered incomplete. The CSMs are presented on **Figure 7-1** and **Figure 7-2**.

7.3 Surface Water and Sediment Exposure Pathway

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

7.3.1 AOI 1, AOI 2, AOI 3

PFAS are water soluble and can migrate readily from soil to surface water via leaching and run-off. Because the relevant compounds were detected in soil at the AOIs, it is possible that those compounds may have migrated from soil to surface water in drainage ditches and the retention pond. Therefore, the surface water and sediment ingestion exposure pathway for site workers and future construction workers is considered potentially complete. It is likely that surface water flows from the retention pond to Rosillo Creek, which discharges to Salado Creek, under heavy rain conditions. Additionally, depending on the position of the diverter valve at the OWS, wastewater that collects in the wash rack could discharge to Rosillo Creek. Due to potential recreation use of Rosillo Creek and Salado Creek, the surface water and sediment ingestion exposure pathway for recreational users is also considered potentially complete. The CSM for AOIs 1 and 3 is presented on **Figure 7-1** and **Figure 7-2**.

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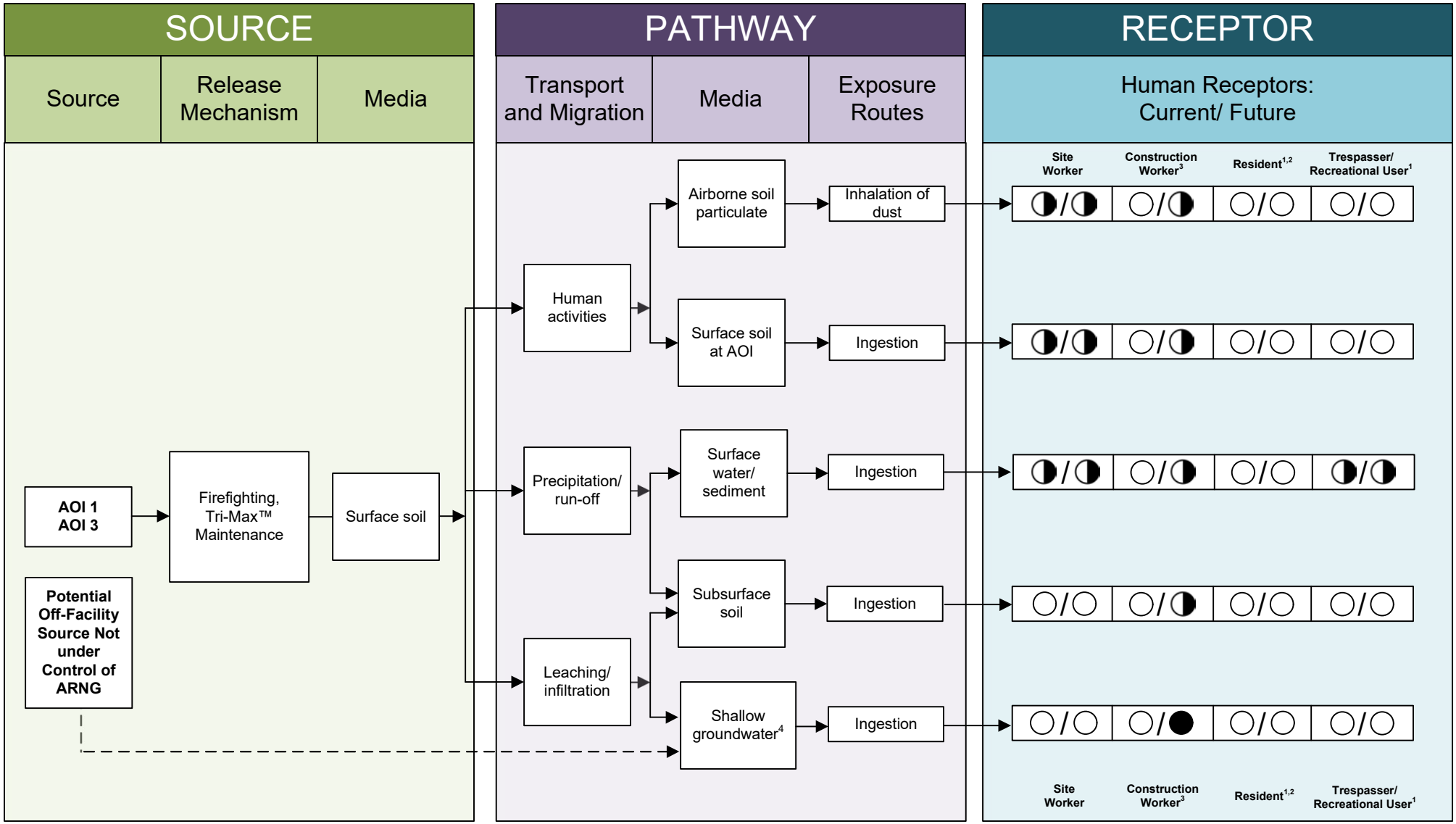


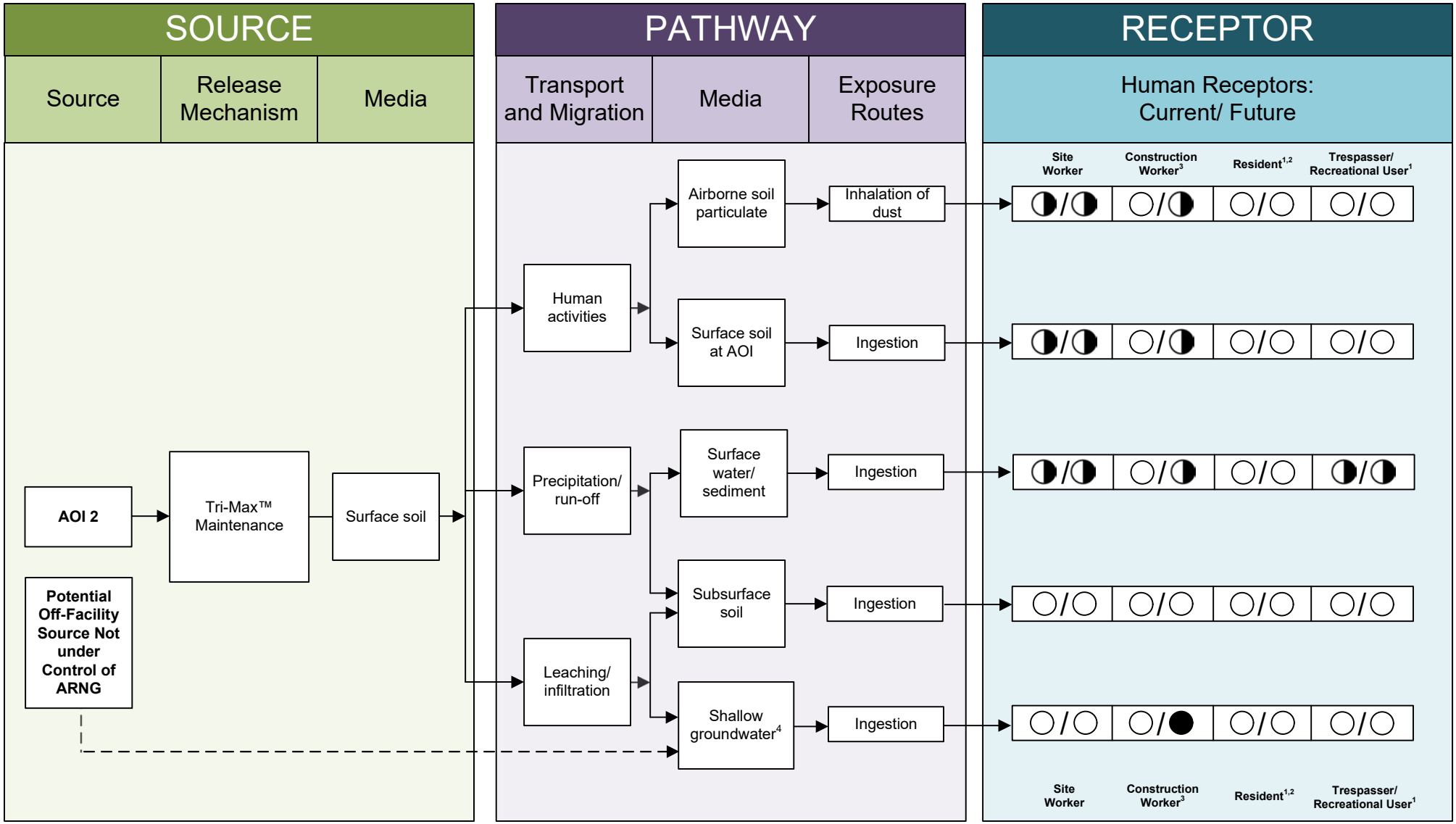
LEGEND

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

Notes:

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. No current active construction at the facility.
4. The shallow aquifer is not used for drinking water. However, construction workers could be exposed via incidental ingestion during construction activities.

Figure 7-1
Conceptual Site Model, AOI 1 and AOI 3
Martindale AASF



LEGEND

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

Notes:

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. No current active construction at the facility.
4. The shallow aquifer is not used for drinking water. However, construction workers could be exposed via incidental ingestion during construction activities.

Figure 7-2
Conceptual Site Model, AOI 2
Martindale AASF

8. Summary and Outcome

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

8.1 SI Activities

The SI field activities were conducted from 4 to 8 April 2022 and consisted of utility clearance, direct push boring, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022b), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2022b), samples were collected and analyzed for a subset of 18 compounds by LC/MS/MS compliant with QSM 5.3 Table B-15 as follows.

- Twenty-four (24) soil samples from six boring locations and eight hand auger locations;
- Five grab groundwater samples from five temporary wells;
- Fourteen (14) QA/QC samples.

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

8.2 Outcome

Based on the results of this SI, further evaluation under CERCLA is warranted in an RI for each of the three AOIs (see **Table 8-1**). Based on the CSMs developed and revised in light of the SI findings, exposure to drinking water receptors from the AOIs from sources on the facility resulting from historical DoD activities is considered incomplete. Sample analytical concentrations collected during the SI were compared to the project SLs in soil and groundwater, as described in **Table 6-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1:
    - The detected concentrations of the relevant compounds in soil at AOI 1 were below their SLs.
    - PFOA in groundwater exceeded the SL of 6 ng/L, with a maximum concentration of 12.2 J ng/L in the field duplicate sample AOI01-04-GW-D. PFOS in groundwater exceeded the SL of 4 ng/L, with a concentration of 25.9 ng/L at MDF-03. The detected concentrations of the other relevant compounds in groundwater were below their SLs.
    - Based on the exceedances of the SLs in groundwater, further evaluation at AOI 1 is warranted in an RI.

- At AOI 2:
    - The detected concentrations of the relevant compounds in soil at AOI 2 were below their SLs.
    - PFOS in groundwater exceeded the SL of 4 ng/L, with a concentration of 35.3 ng/L at location AOI02-04. The detected concentrations of the other relevant compounds in groundwater were below their SLs.
    - Based on the exceedance of the SL in groundwater, further evaluation at AOI 2 is warranted in an RI.
- At AOI 3:
    - The detected concentrations of the relevant compounds in soil at AOI 3 were below their SLs.
    - PFOS in groundwater exceeded the SL of 4 ng/L, with a concentration of 23.4 ng/L at location AOI03-02. The detected concentrations of the other relevant compounds in groundwater were below their SLs.
    - Based on the exceedance of the SL in groundwater, further evaluation at AOI 3 is warranted in an RI.

The purpose of facility boundary well MDF-02 was to determine if potential offsite migration is occurring. However, due to a laboratory error, MDF-02 groundwater results could not be obtained.

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

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

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Grass Fire Near Flight Line	◐	●	●	Proceed to RI
2	Area East of the Maintenance Hangar	◐	●	N/A	Proceed to RI
3	Wash Rack	◐	●	◐	Proceed to RI

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

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