

FINAL Site Inspection Report Buckley Army Aviation Support Facility Aurora, Colorado

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

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Prepared for:



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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFB	Air Force Base
AFFF	aqueous film-forming foam
amsl	above mean sea level
ANG	Air National Guard
AOI	Area of Interest
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
bgs	below ground surface
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COARNG	Colorado Army National Guard
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DoD	Department of Defense
DOT	Department of Transportation
DQO	data quality objective
DUA	data usability assessment
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FedEx	Federal Express
FEMA	Federal Emergency Management Agency
FTA	Fire Training Area
GPRS	Ground Penetrating Radar Systems
GSE	Ground Services Equipment
HA	Health Advisory
HDPE	high-density polyethylene
HEF	High Expansion Foam
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
NAD83	North American Datum 1983

NELAP	National Environmental Laboratory Accreditation Program
NOAA	National Oceanic and Atmospheric Administration
ng/L	nanograms per liter
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
ROD	Record of Decision
SACWSD	South Adams County Water and Sanitation District
SFB	Space Force Base
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TOC	total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WWTP	wastewater treatment plant

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 6 July 2022 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**.

The PA identified two 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 screening levels (SLs) for relevant compounds. This SI was completed at the Buckley Army Aviation Support Facility (AASF) in Aurora, Colorado and determined further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for AOI 1 and AOI 2. The Buckley AASF will also be referred to as the “facility” throughout this document.

The Buckley AASF is a tenant of the Buckley Space Force Base (SFB) located in Aurora, Colorado. The facility is located west of the Buckley SFB runway and includes hangar space for aircraft maintenance and storage, office and administrative buildings, a readiness center, a flight ramp, a helipad, and a taxiway connecting the facility flight ramp to the Buckley SFB runway. An additional joint-use building shared by the Colorado ARNG (COARNG) and Buckley SFB that is predominantly used by Buckley SFB is located on a flight ramp approximately 0.5 miles north of the COARNG Buckley AASF complex. The larger Buckley SFB property, which is zoned entirely for Buckley SFB use, encompasses 3,540 acres. The COARNG Buckley AASF is leased from the Buckley SFB (AECOM Technical Services, Inc. [AECOM], 2021).

The PA identified two AOIs for investigation during the SI phase. SI sampling results from the two AOIs were compared to OSD SLs. **Table ES-2** summarizes the SI results for each AOI. Based on the results of the SI, particularly the detections in groundwater at BKLY-MW003, there is evidence of contaminated groundwater entering the facility at the upgradient boundary that is not attributable to ARNG activities. Based on the results of this SI, further evaluation under CERCLA is warranted in a Remedial Investigation (RI) for AOI 1 and AOI 2.

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	Building 1510		NS		Proceed to RI
2	Former Tri-Max™ Storage Area		NS		Proceed to RI

Legend:

-  = detected; exceedance of the screening levels
-  = detected; no exceedance of the screening levels
-  = not detected
- NS = not sampled

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 6 July 2022 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 Buckley Army Aviation Support Facility (AASF) in Aurora, Colorado. The Buckley 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 Buckley AASF (AECOM Technical Services, Inc. [AECOM], 2021) that identified two 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

The Buckley AASF is a tenant of the Buckley Space Force Base (SFB) located in Aurora, Colorado (**Figure 2-1**). The Colorado ARNG (COARNG) has maintained a presence at Buckley SFB since 1977, when Building 1500 was constructed to be the facility hangar. Since 1977, the facility has been improved with numerous buildings and developments, with the most recent being the construction of Building 1510, a new facility main hangar. Buckley AASF is designed to house, equip, support, and maintain military aircraft. The facility is located west of the Buckley SFB runway and includes hangar space for aircraft maintenance and storage, office and administrative buildings, a readiness center, a flight ramp, a helipad, and a taxiway connecting the facility flight ramp to the Buckley SFB runway. An additional joint-use building shared by the COARNG and Buckley SFB is located on a flight ramp predominantly used by Buckley SFB, located approximately 0.5 miles north of the COARNG Buckley AASF complex. The larger Buckley SFB property, which is zoned entirely for Buckley SFB use, encompasses 3,540 acres. The COARNG Buckley AASF is leased from the Buckley SFB.

The DA opened Buckley Field in 1942 to train the Army Air Corps, and they transferred the field to the Department of the Navy in 1945. The Navy deactivated the facility in 1959, and operation of the facility transferred to the State of Colorado as Buckley Air National Guard (ANG) Base. Buckley ANG Base was used for military aviation and support activities for the Colorado ANG. The base was reassigned from the ANG to the Air Force Space Command and renamed Buckley Air Force Base in 2001. In 2021, Buckley Air Force Base was renamed Buckley Space Force Base.

2.2 Facility Environmental Setting

Buckley SFB is situated on high ground dividing the Sand Creek and Toll Gate Creek drainage basins. The ground surface elevation of Buckley SFB ranges from 5,700 feet above mean sea level (amsl) at the southeast corner to 5,480 feet amsl at the northwest corner. The COARNG Buckley AASF is situated at approximately 5,585 feet amsl, towards the center of the SFB property (USEPA, 2019) (**Figure 2-2**). A new building to the southeast of Building 1510 was observed to be under construction during the time of the site investigation.

Most of the operational portions of Buckley AASF facility are paved with asphalt or concrete. Scrub vegetated areas surround the improved portions of the facility, particularly to the north, south, and east. The facility is bounded on the north, west, and south sides by a chain-link fence; the eastern boundary of the property is open to the greater Buckley SFB area. Buckley SFB is a fenced facility and access is through a security check point. According to facility personnel, Buckley AASF is provided drinking water by the City of Aurora, and sanitary sewers connect the facility to the Denver Metro Wastewater Reclamation District.

2.2.1 Geology

Buckley AASF is located within the Denver Basin, a shallow, bowl-shaped basin covering an area of approximately 6,700 square miles. The basin is filled with sedimentary rocks formed by deposition resulting from the uplift and erosion of the Rocky Mountains to the west.

These sedimentary deposits are comprised of six geologic formations, which follow in descending order: the Castle Rock Conglomerate, the Dawson Arkose, the Denver, Arapahoe, and Laramie formations, and the Fox Hills Sandstone. The Cretaceous Pierre Shale Formation, consisting primarily of relatively impermeable shale, is located beneath the Fox Hills Sandstone

within the Denver Basin. Of the six geologic formations found in the Denver Basin, only the Denver, Arapahoe, and Laramie formations and the Fox Hills Sandstone are found under the larger Buckley SFB property (USEPA, 2019).

The majority of the Denver Formation is composed of approximately 70 percent (%) shale and claystone, with the remaining materials composed of coarse-grained sediments irregularly dispersed in lenticular beds. Under Buckley SFB, the Denver Formation is approximately 850 feet thick and crops out in the northeastern, eastern, and southwestern parts of the base, including beneath much of the AASF (USEPA, 2014). Where the Denver Formation is not present at the surface, it is often covered with a thin mantle of aeolian (windblown) deposits of loess and fine sand that are generally less than 10 feet thick. Additionally, alluvial deposits from the erosion of the Denver Formation are present along the valleys of the Sand and Toll Gate creeks and their tributaries, as well as in buried paleochannels (USEPA, 2019). A 2019 Record of Decision (ROD) for a property within the Buckley SFB encountered alluvial, and possibly aeolian, soils from ground surface to approximately 12 feet below ground surface (bgs). Below the alluvium is predominately the weathered claystone and siltstone of the Denver Formation, with minor weathered, interbedded sandstone (USEPA, 2019). Local geologic units are shown on **Figure 2-3**.

During the SI, sands and low to medium plasticity fines (silts with clay) were observed as the dominant lithology of the unconsolidated sediments below the Buckley AASF. The borings were terminated at depths between 45 and 57.5 feet bgs, with the bottom of the wells set between 40 and 51.5 feet bgs. The sands were described as poorly graded, with intervals of silty clay and silty sands with varying percentages of gravel observed in each of the borings. A sample for grain size analyses was collected at BKLY-MW002 and analyzed via American Society for Testing and Materials (ASTM) Method D-422. The results indicate that the soil samples are comprised primarily of silt (31.74%) medium sand (28.07%), and clay (20%). These results and facility observations are consistent with the reported alluvial and weathered rock deposits at the facility. Boring logs are presented in **Appendix E** and grain size results are presented in **Appendix F**.

2.2.2 Hydrogeology

Groundwater under the greater Buckley SFB area exists within the unconsolidated aeolian and alluvial surficial deposits, as well as in the Denver Formation, where it is primarily present in the discontinuous layers of coarse-grained materials (sand and sandstones) within the fine-grained materials (clay, silt, claystones, and siltstones). Groundwater in the Denver Formation may also exist in fractured sections of siltstones and claystones. Generally, unconfined groundwater conditions exist in the weathered, upper part of the Denver Formation and overlying surficial deposits, whereas semiconfined or confined conditions are present in the deeper portions of the Denver Formation, particularly where it is overlain by other bedrock formations. Aquifer recharge across Buckley SFB occurs through direct infiltration of precipitation and/or irrigation and drainage ditch water. Groundwater discharge occurs primarily through seepage at streams and as evapotranspiration where groundwater is present at formation outcrops (USEPA, 2014). The Denver, Arapahoe, and Laramie-Fox Hills Aquifers are the three principal bedrock aquifers at Buckley SFB (in descending order). Due to the thickness and hydrogeologic conditions of the Denver Formation, surficial releases are unlikely to impact the deeper aquifers. The Denver Formation is 600 to 1,000-feet thick (Aerostar SES LLC, 2019).

Regional groundwater flow is generally to the northwest, following the trend of stream drainages toward the South Platte River north of Denver (**Figure 2-3**) (URS, 2007). Groundwater flow direction at a former landfill adjacent to the southwest of the facility is towards the west-northwest and is presumed to be the same at the facility (USEPA, 2014). Water levels collected

during an SI conducted by the Air Force at Buckley SFB in 2019, then Buckley Air Force Base (AFB), also indicated a northwesterly groundwater flow direction (Aerostar SES LLC, 2019).

The Denver Basin aquifer system, which includes the Denver, Arapahoe, and Laramie-Fox Hills aquifers, is a secondary source of municipal or irrigation water for suburban Denver and surrounding rural communities. Unconfined shallow groundwater within the unconfined aquifers in and around Buckley AASF is used primarily for irrigation. The City of Aurora, which supplies drinking water for Buckley AASF and surrounding residents, draws most of its water from surface sources (USEPA, 2019).

The shallow Denver Aquifer groundwater at Buckley AASF is not known to be used as a water source for drinking or irrigation for the COARNG or off-site receptors. Numerous wells of various use exist in all directions within a 4-mile radius surrounding the facility. In 2018, low levels of PFAS were detected in water samples collected from shallow wells serving the South Adams County Water and Sanitation District's (SACWSD) water supply. The locations of the affected wells are unknown; however, the SACWSD treatment facility and service area is within 10 miles northwest of Buckley SFB.

According to the 2014 ROD for the previously mentioned former landfill located approximately 0.2 miles south of Buckley AASF, depth to groundwater was observed between 40 and 50 feet bgs in the southeastern portion of the landfill. Depths to water measured at Buckley AASF in July 2022 during the SI ranged from 34.13 to 45.33 feet bgs. Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate the groundwater flow direction at the AASF is primarily to the northwest.

2.2.3 Hydrology

Surface water flow across most of the facility follows topography and drains via overland sheet flow to the north, to a stormwater retention pond located north of Building 1510 on the northern boundary of the COARNG property. The southern portion of the facility flight ramp drains to a surface impoundment located east of Building 1515. Three storm drains located across the flight ramp connect to underground storm sewer pipes that presumably discharge to the aforementioned stormwater retention pond. A fourth storm drain on the flight ramp located adjacent to the aircraft wash rack connects to sanitary sewer pipes that continue off-facility. A drainage swale on the northeast boundary of the flight ramp flows north and discharges overland along the slope located south of the retention pond. A drainage swale adjacent to the southern boundary of the flight ramp drains southwest towards the surface impoundment east of Building 1515. An oil-water separator (OWS) is located east of Building 1510, at the adjacent parking pad, as well as at the southwest corner of the building on the flight ramp (COARNG, 2017).

A small stream designated as a freshwater emergent wetland by the US Fish and Wildlife Service (USFWS) National Wetlands Inventory passes through the eastern and northern portions of the SFB, and it ultimately discharges to the East Toll Gate Creek west of the facility (USFWS, 2020). The East Toll Gate Creek is located approximately 0.2 miles west of the western AASF boundary and flows to the northwest. East Toll Gate Creek confluences with Sand Creek approximately 5.5 miles northwest of the facility, and it ultimately discharges to the South Platte River further northwest. Lake Williams, a small, occasionally dry reservoir, is also located within the greater Buckley SFB, approximately 1 mile northeast of the AASF property (USFWS, 2020). However, surface water from the AASF does not drain to the lake. Overflow from Lake Williams drains through a series of two unnamed tributaries to Sand Creek (USEPA, 2019). Surface water features are shown on **Figure 2-5**.

Flood Insurance Rate Maps for Arapahoe County identify the entire Buckley SFB as an area of minimal flood hazard. The nearest flood zone is associated with the East Toll Gate Creek

floodplain and is located approximately 0.2 miles northwest of the facility (Federal Emergency Management Agency [FEMA], 2020).

2.2.4 Climate

Data from the Denver International Airport weather station located approximately 11 miles northeast of the Buckley AASF, indicate that the annual average temperature between 2000 and 2022 was 50.5 degrees Fahrenheit (°F). The warmest months are July and August, with average temperatures of 75.6 °F and 73.2 °F, respectively. December is the coldest month, with an average temperature of 30.9 °F. Average annual precipitation measured from 2000 to 2022 at the airport was 13.18 inches, with the most rain occurring May through July. The average annual snowfall from 2000 to 2022 at the airport is 52.6 inches. The majority of snowfall occurs between December and March (National Oceanic and Atmospheric Administration [NOAA], 2022).

2.2.5 Current and Future Land Use

The Buckley AASF is designed to house, equip, support, and maintain military helicopters for the COARNG. Buckley AASF and the area surrounding the larger Buckley SFB complex includes industrial and agricultural land to the north, commercial and residential land to the west, residential and agricultural land to the south, and agricultural land to the east (USEPA, 2019). Reasonably anticipated future land use at the AASF and the surrounding area is not expected to change from the current land use described above.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

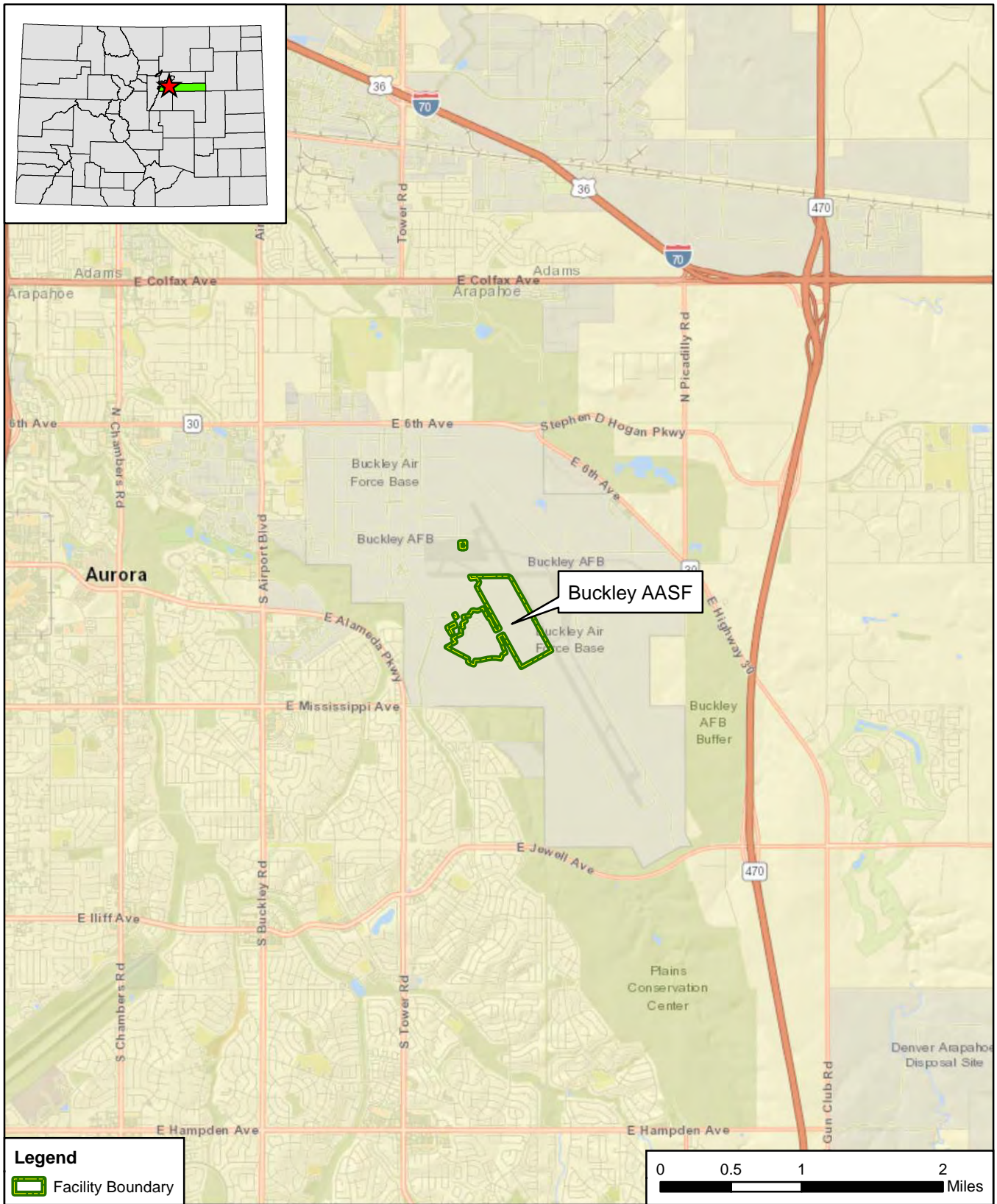
A wildlife survey has not occurred at the facility, and the facility does not have any significant areas of habitat. The following species have not been identified at the facility but may be present in the surrounding area.

The following mammals, birds, fishes, insects, and flower plants are federally endangered, threatened, proposed, and/ or are listed as candidate species in Arapahoe County, Colorado (USFWS, 2022).

- **Mammals:** Grey Wolf, *Canis lupus* (endangered)
- **Birds:** Piping Plover, *Charadrius melodus* (threatened); Whooping Crane, *Grus americana* (endangered)
- **Fishes:** Pallid Sturgeon, *Scaphirhynchus albus* (endangered)
- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Flowering Plants:** Ute Ladies'-tresses, *Spiranthes diluvialis* (threatened); Western Prairie Fringed Orchid, *Platanthera praeclara* (threatened)

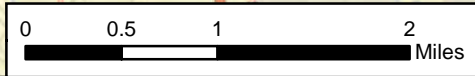
2.3 History of PFAS Use

Two AOIs were identified in the PA where AFFF may have been used, stored, disposed, or released historically at the Buckley AASF (AECOM, 2021). PFAS-containing materials may have historically been released at the facility during a High Expansion Foam (HEF) system test at Building 1510 in 2006 or during outside storage of Tri-Max™ units prior to 2019. The potential release areas were grouped into two AOIs based on preliminary data and presumed groundwater flow directions. A description of each AOI is presented in **Section 3**.

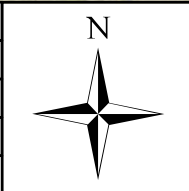


Legend

Facility Boundary



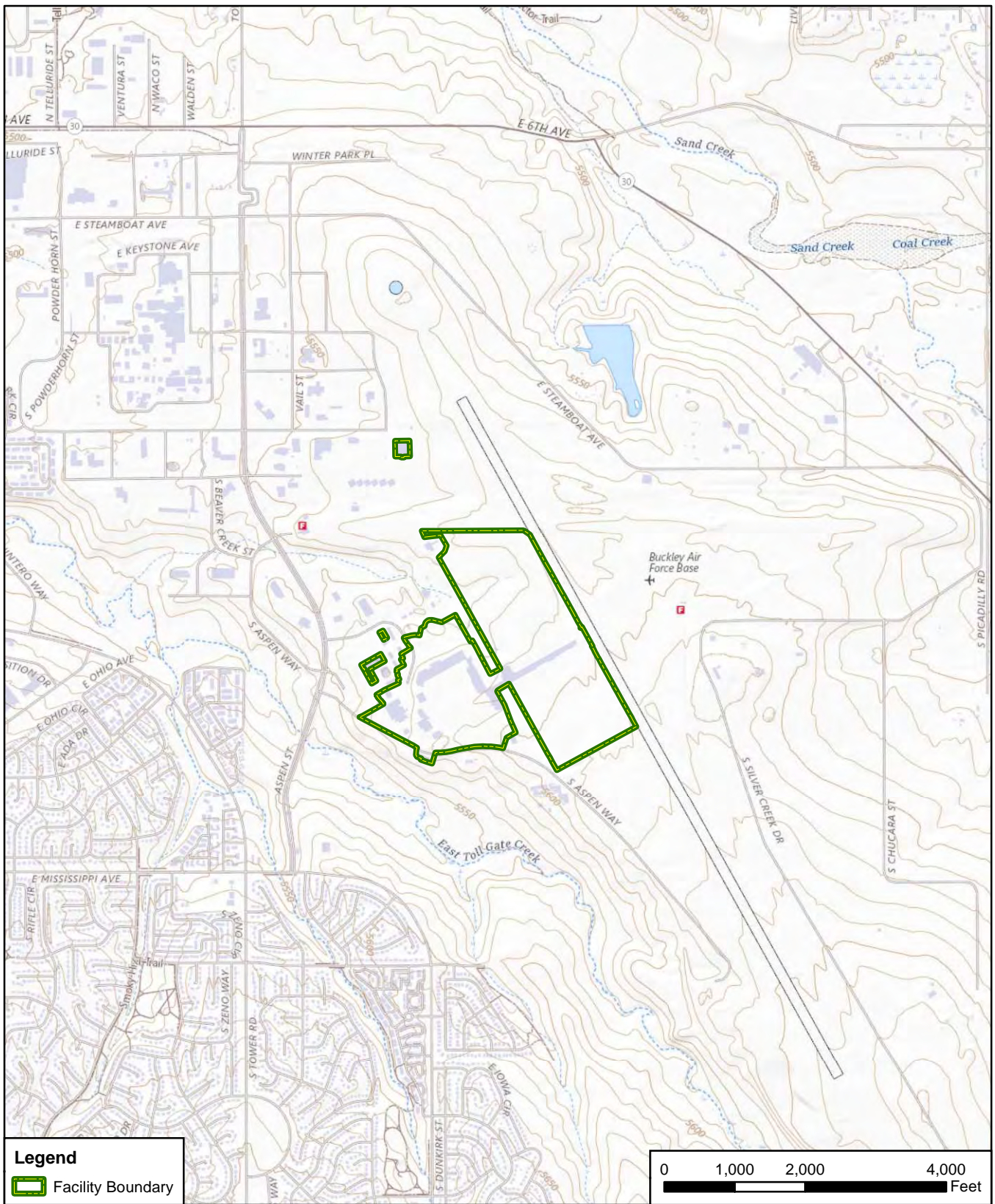
CLIENT	ARNG			
PROJECT	Site Inspection at Buckley AASF, CO			
REVISED	11/30/2022	GIS BY	MS	11/30/2022
SCALE	1:63,360	CHK BY	AD	11/30/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	11/30/2022



Facility Location

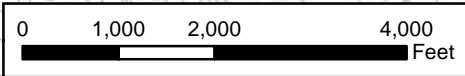
AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

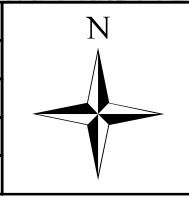


Legend

Facility Boundary



CLIENT	ARNG			
PROJECT	Site Inspection at Buckley AASF, CO			
REVISED	11/30/2022	GIS BY	MS	11/30/2022
SCALE	1:24,000	CHK BY	AD	11/30/2022
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program.		PM	CM	11/30/2022

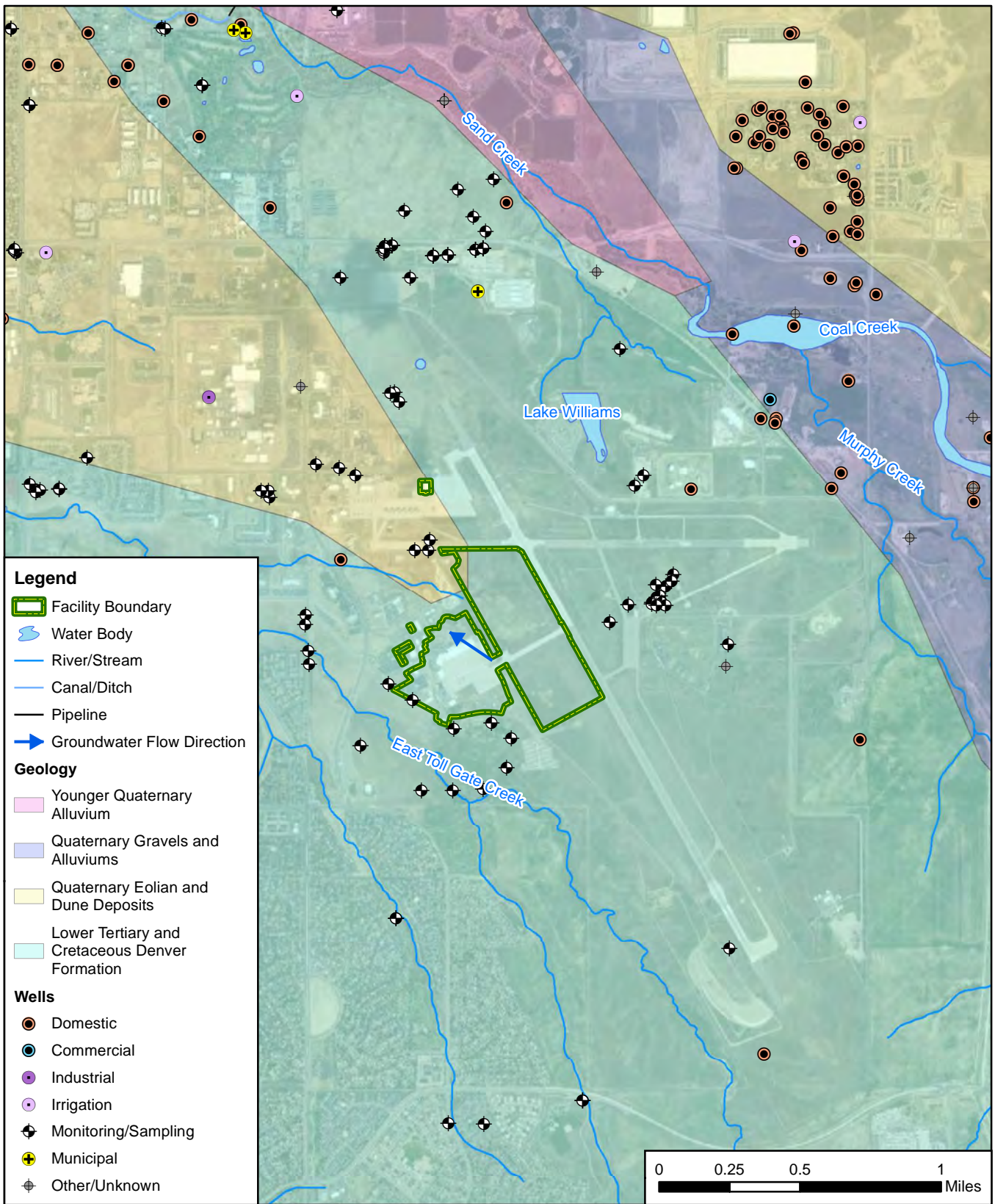


Facility Topography

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



Legend

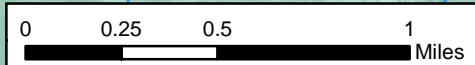
- Facility Boundary
- Water Body
- River/Stream
- Canal/Ditch
- Pipeline
- Groundwater Flow Direction

Geology

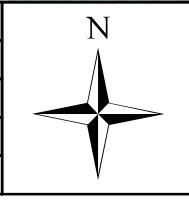
- Younger Quaternary Alluvium
- Quaternary Gravels and Alluviums
- Quaternary Eolian and Dune Deposits
- Lower Tertiary and Cretaceous Denver Formation

Wells

- Domestic
- Commercial
- Industrial
- Irrigation
- Monitoring/Sampling
- Municipal
- Other/Unknown



CLIENT	ARNG			
PROJECT	Site Inspection at Buckley AASF, CO			
REVISED	1/23/2023	GIS BY	MS	1/23/2023
SCALE	1:31,680	CHK BY	AD	1/23/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community	PM	CM	1/23/2023	



Groundwater Features

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Figure 2-3



CLIENT	ARNG			
PROJECT	Site Inspection at Buckley AASF, CO			
REVISED	8/24/2023	GIS BY	MS	8/24/2023
SCALE	1:5,280	CHK BY	CC	8/24/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/24/2023

⊗ Permanent Monitoring Well — Groundwater Elevation Contour
 Facility Boundary - - - Inferred Groundwater Elevation Contour
— River/Stream ➔ Groundwater Flow Direction

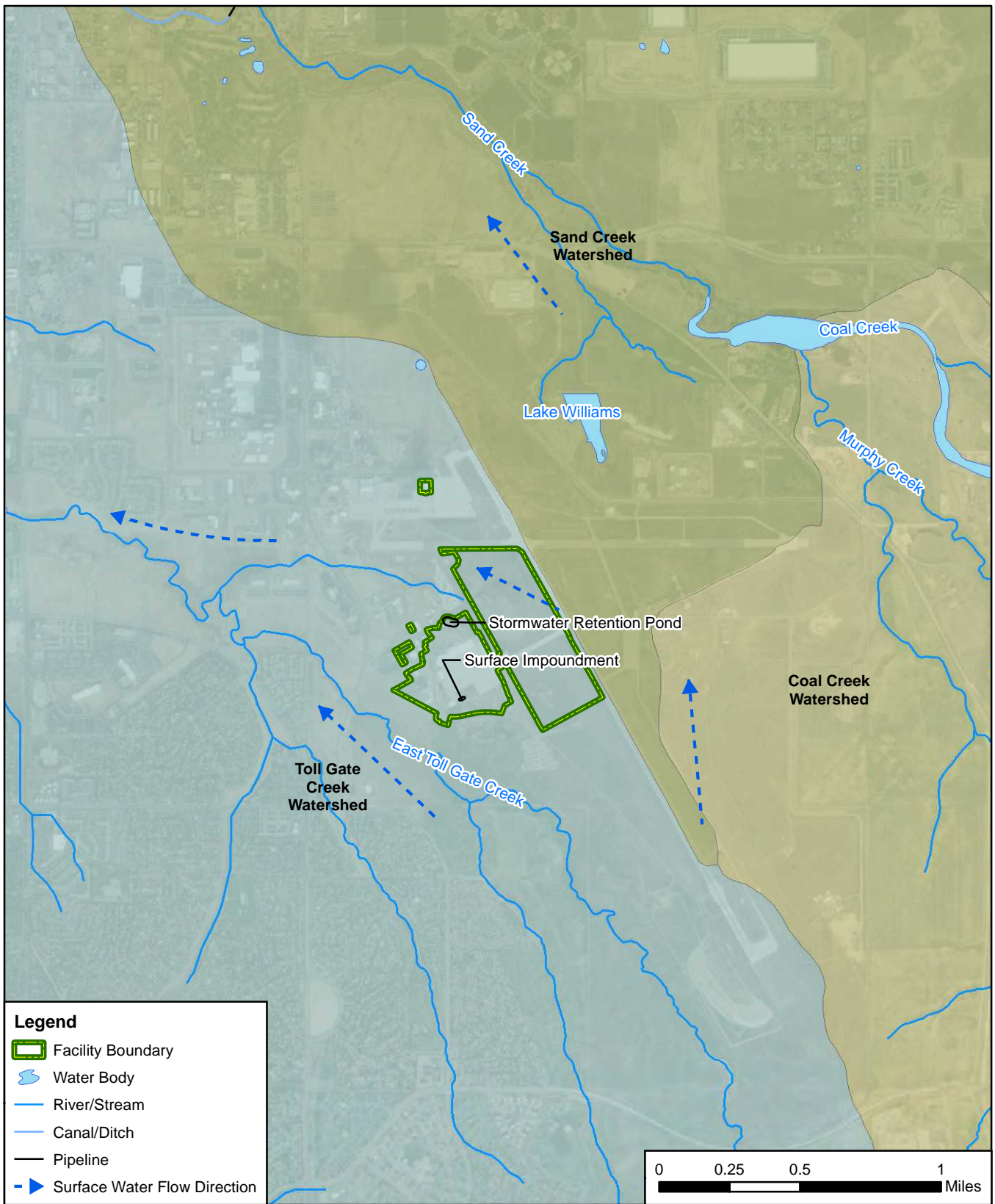
0 220 440 880
 Feet
 Groundwater elevations in ft NAVD88.



Groundwater Elevations, July 2022

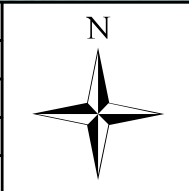
AECOM 12420 Milestone Center Drive
 Germantown, MD 20876

Figure 2-4



Legend				
	Facility Boundary			
	Water Body			
	River/Stream			
	Canal/Ditch			
	Pipeline			
	Surface Water Flow Direction			

CLIENT	ARNG			
PROJECT	Site Inspection at Buckley AASF, CO			
REVISED	11/30/2022	GIS BY	MS	11/30/2022
SCALE	1:31,680	CHK BY	AG	11/30/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community	PM	CM	11/30/2022	



Surface Water Features	
AECOM 12420 Milestone Center Drive Germantown, MD 20876	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, two potential release areas were identified at Buckley AASF and grouped into two AOIs (AECOM, 2021). The potential release areas are shown on **Figure 3-1**.

3.1 AOI 1 Building 1510

Building 1510 is the main hangar at Buckley AASF and is located on the north side of the facility flight ramp. The building was constructed in 2006 and is designed for the maintenance and storage of aircraft. Building 1510 includes 10 bay doors with access to 10 hangars as well as office and administrative space on the west end of the building. The eastern portion of the building was described during interviews with facility staff as the Ground Services Equipment (GSE) building. Building 1510 is constructed with a HEF deluge fire suppression system that contains 900 gallons of Ansul Jet-X 2.75% HEF concentrate. A 55-gallon drum containing the same HEF concentrate product is also stored within Building 1510. According to facility personnel, the HEF deluge fire suppression system was tested in 2006, following its installation. The test involved the 3-minute discharge of an unknown volume of Ansul Jet-X 2.75% HEF to the hangar area. HEF released during the test was confined to the building interior by the building walls and plastic sheeting in front of bay doors. Standing foam was drained via building floor drains that connect to sanitary system sewers and ultimately lead to the Denver Metro Wastewater Reclamation District system. Typically, floor drains in Building 1510 connect to an OWS, but a diverter was used to ensure HEF bypassed the OWS and flowed to sanitary sewers that connect to Denver Metropolitan Wastewater Reclamation District facilities. These treatment facilities discharge to the South Platte River and transfer biosolids to the Metrogro Farm. The Metrogro Farm is used to grow agricultural products and for cattle grazing.

According to facility staff with knowledge of the test, no HEF is known to have escaped the building during the test. Although the HEF system test was described as being confined to the building interior, it is possible that HEF was tracked out of the building following the system test or during cleanup activities. The HEF product released at Buckley AASF is conservatively assumed to have contained PFAS for the purpose of this investigation. If HEF released from the deluge system test were tracked outside of the building following the test, it may have migrated to the surrounding paved surfaces and/or landscaped areas on the north side of Building 1510. Surface water runoff from the paved surfaces around Building 1510 flows towards the retention pond north of Building 1510. Surface water runoff from AOI 1 may also enter the small stream in the northeastern portion of the facility, which connects to East Toll Gate Creek, Sand Creek, and ultimately, the South Platte River.

No other fire suppression system tests involving the release of HEF have occurred at Building 1510 since its construction, and facility personnel stated that the HEF system room exhibits no evidence of corrosion, leakage, or spills.

3.2 AOI 2 Former Tri-Max™ Storage Area

AOI 2 encompasses the area in the northeastern portion of the facility formerly used to store six Tri-Max™ wheeled fire extinguishers containing Chemguard 3% C-303 AFFF concentrate. It is unclear how long the Tri-Max™ units were stored in this location, but they were removed and disposed of in a controlled manner in September 2019. Although no known PFAS releases have occurred in this area, the outdoor storage of Tri-Max™ and corrosive nature of AFFF may have led to incidental releases.

Potential releases at AOI 2 would most likely have occurred to paved surfaces but may migrate a short distance to grassy areas. Surface water runoff from AOI 2 may potentially migrate towards the retention pond north of Building 1510. It is also possible that surface water runoff from the area may enter the small stream in the northeastern portion of the facility, which connects to East Toll Gate Creek, Sand Creek, and ultimately, the South Platte River.

3.3 Adjacent Sources

Multiple off-facility, potential sources were identified adjacent to the Buckley 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.

3.3.1 Buckley Space Force Base

Fire training and other activities resulting in PFAS-containing material releases have occurred in several locations associated with the Buckley SFB. Based on a 2019 SI report for AFFF use at Buckley SFB, two fire training areas (FTAs), one hangar, the former fire station, and two crash sites were identified as areas where AFFF may have been released to the environment (Aerostar SES LLC, 2019).

The AFFF release areas at Buckley SFB investigated as part of the 2019 SI report include the following locations:

- **FTA No. 2** - FTA No. 2 was an unlined burn area for jet fuels and was operational between 1950 and 1972. FTA No. 2 is located potentially upgradient of Buckley AASF, approximately 3,200 feet east.

The 2019 SI sample results indicated detections of PFOA, PFOS, and PFBS in soil with maximum concentrations of 36 J µg/kg, 7,200 µg/kg, and 8,500 J µg/kg, respectively. PFOA, PFOS, and PFBS were detected in groundwater at maximum concentrations of 19 µg/L, 190 µg/L, and 90 µg/L, respectively.

- **FTA No. 3** - Fire training exercises were performed annually at FTA No. 3 between 1972 and 1989. Jet fuel solutions were ignited and extinguished with AFFF during training events; approximately 400 gallons of AFFF were used annually. In 2006, a removal action was performed to remove soil impacted by volatile organic compounds, and in 2008, the area was paved over to become a parking lot. FTA No. 3 is located downgradient of Buckley AASF, approximately 4,200 feet northwest.

The 2019 SI sample results indicated detections of PFOA, PFOS, and PFBS in soil with maximum concentrations of 5.8 µg/kg, 9.5 µg/kg, and 930 µg/kg, respectively. PFOA, PFOS, and PFBS were detected in groundwater at maximum concentrations of 0.27 µg/L, 0.99 µg/L, and 3.6 µg/L, respectively.

- **Hangar 801** - One documented release of approximately 400 gallons of Ansulite 3% AFFF mixed with 13,000 to 14,000 gallons of water is known to have occurred at Hangar 801. Approximately 2,000 to 5,000 gallons of the AFFF solution were released to sanitary sewers and migrated to the surface of a nearby road. AFFF solution also migrated from the nearby road surface to stormwater sewers. Hangar 801 is located downgradient of Buckley AASF, approximately 3,200 feet northwest.

The 2019 SI sample results indicated no detections of PFBS in soil. PFOA and PFOS were detected in soil with maximum concentrations of 0.84 J µg/kg, and 30 µg/kg. PFBS, PFOA, and PFOS were detected in groundwater at maximum concentrations of 0.23 µg/L, 0.43 µg/L, and 5.9 µg/L, respectively.

- **Former Fire Station #2** - AFFF was stored at the former fire station, and annual spray testing was conducted on an outdoor pad adjacent to the fire station, which resulted in the release of AFFF. Former Fire Station #2 is located potentially upgradient of Buckley AASF, approximately 3,100 feet east.

The 2019 SI sample results indicated detections of PFBS, PFOA, and PFOS in soil with maximum concentrations of 2.0 J µg/kg, 3.4 µg/kg, and 590 µg/kg, respectively. PFBS, PFOA, and PFOS were detected in groundwater at maximum concentrations of 4.5 µg/L, 6.8 µg/L, and 30 µg/L, respectively.

- **F-5 Crash Site** - Approximately 100 to 200 gallons of AFFF were sprayed on a fuel spill resulting from an aircraft crash on the Buckley SFB runway in the late 1980s. The F-5 crash site is located down or cross gradient of Buckley AASF, approximately 2,000 feet north.

The 2019 SI sample results indicated detections of PFBS, PFOA, and PFOS in soil with maximum concentrations of 0.33 J µg/kg, 0.49 J µg/kg, and 200 µg/kg, respectively. PFBS, PFOA, and PFOS were detected in groundwater at maximum concentrations of 0.097 µg/L, 0.029 µg/L, and 0.044 µg/L, respectively.

- **F-16 Crash Site** - Approximately 200 gallons of AFFF were sprayed at the location of an aircraft crash on grass adjacent to the south end of the Buckley SFB runway in 1995. The F-16 crash site is located upgradient of Buckley AASF, approximately 6,300 feet southeast.

The 2019 SI sample results indicated that no PFAS compounds were detected in soil. In groundwater, PFBS was not detected, and the maximum detected concentrations of PFOA and PFOS are 0.0094 J µg/L and 0.016 J µg/L, respectively.

3.3.2 City of Aurora Fire Stations

Numerous fire stations associated with the City of Aurora Fire Department are located throughout the City of Aurora. Aurora Fire Station No. 9 and Aurora Fire Station No. 8 are the two nearest fire stations to the Buckley AASF that are associated with the City of Aurora Fire Department. Fire Station No. 9 is located approximately 1.8 miles southwest and cross gradient of the facility, and Fire Station No. 8 is approximately 2.5 miles northwest and downgradient of the facility.

It is unknown whether the Aurora Fire Department fire stations store or use AFFF during training or emergency response. Given the tendency for local fire departments to store AFFF for emergency purposes, it is possible AFFF is stored at these locations. It is also unclear whether the fire department performs vehicle maintenance, such as nozzle tests, at the fire stations. Due to the likelihood that AFFF has been stored and/or released at the fire stations as a result of potential training and maintenance, the City of Aurora Fire Department fire stations are considered potential release areas.

3.3.3 Site 3 – Former Base Landfill

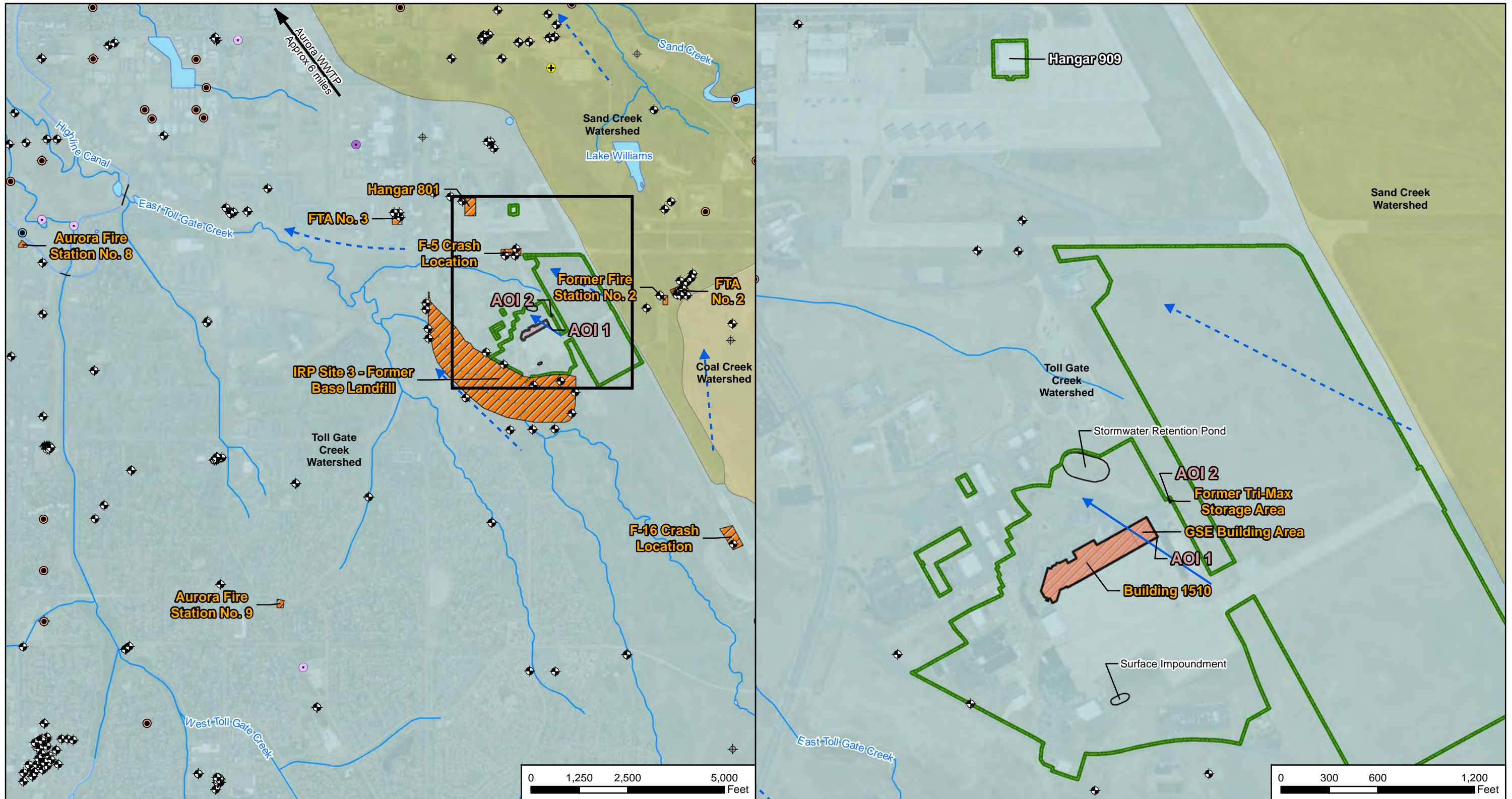
There are no landfills within the footprint of the COARNG property; however, Buckley SFB Installation Restoration Program Site 3 comprises the Former Base Landfill and is located immediately south and cross gradient of the Buckley AASF. Site 3 is a series of former disposal areas that were used between 1942 and 1982 for municipal refuse disposal. The general method of operation for the Former Base Landfill was to dig a trench, fill the trench with waste material, and cover the material with earth. Portions of Site 3 are bisected by East Toll Gate Creek (USEPA, 2014).

Landfills are not usually a primary potential release area of PFAS, but materials disposed of in landfills may create a secondary source of contamination. Such materials, to name a few, may include sludge from a wastewater treatment plant (WWTP) that processes PFAS-laden water, used AFFF storage containers, or products associated with waterproofing uniforms or boots. Known release locations on Buckley SFB may have contributed to PFAS-containing waste being disposed of at the landfill; as such, Site 3 is considered an adjacent potential release area.

3.3.4 Waste Water Treatment Plants

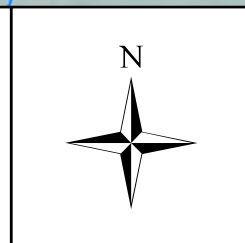
There are no WWTPs located at the Buckley AASF. The Aurora WWTP is the nearest WWTP, and it is located approximately 6.3 miles northwest and downgradient of the facility, along Sand Creek. COARNG personnel stated during interviews that sanitary system sewers at the facility connect to the Denver Metro Wastewater Reclamation District. The Denver Metropolitan Wastewater Reclamation District includes the Robert W. Hite Treatment Facility, located approximately 12.5 miles northwest and downgradient of the facility, and serves an estimated 2 million people via 60 local governments and special districts, including Aurora. Treated sludge from the Denver Metropolitan Wastewater Reclamation District facilities is used as fertilizer at the Metrogro Farm, located approximately 65 miles east of the City of Denver. Winter wheat, sorghum/sudan grass, and corn are grown at the Metrogro Farm, and pasture areas are often used for sheep and cattle grazing (Metro Wastewater Reclamation District, 2020).

WWTPs are not usually a primary potential release area of PFAS, but sludges and liquids from areas of potential release that are treated at WWTPs may create a secondary source of contamination. No known PFAS releases have occurred at the Buckley AASF, but adjacent AFFF releases could have resulted in the migration of PFAS in water to the Aurora WWTP, the Robert W. Hite Treatment Facility, and the Metrogro Farm. Agricultural products grown at the Metrogro Farm may create a potential pathway for human consumption of PFAS and expose grazing animals to PFAS. Due to the known adjacent AFFF releases surrounding the Buckley AASF, the Aurora WWTP, the Robert W. Hite Treatment Facility, and the Metrogro Farm are considered potential release areas. These locations are not shown on **Figure 3-1** due to their distance from the Buckley AASF.



CLIENT	ARNG				
PROJECT	Site Inspection at Buckley AASF, CO				
REVISED	1/23/2023	GIS BY	MS	1/23/2023	
SCALE	1:30,000	CHK BY	AD	1/23/2023	
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/23/2023	

Area of Interest	River/Stream	Commercial
Potential Release Area	Canal/Ditch	Industrial
No Suspected Release	Pipeline	Irrigation
Facility Boundary	Surface Water Flow Direction	Monitoring/Sampling
Water Body	Groundwater Flow Direction	Municipal
	Domestic	Other/Unknown



Areas of Interest

AECOM 12420 Milestone Center Drive
 Germantown, MD 20876

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, 2022a), 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 may 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 Buckley AASF (AECOM, 2021);
- The *Site Inspection Report of Aqueous Film Forming Foam Areas at Buckley Air Force Base, Arapahoe County, Colorado* (Aerostar SES LLC, 2019);
- 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, 2022a); 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 summer season, which was the earliest available time field resources were available to complete the study. Vertical boundaries were established by the depth of the observed groundwater table.

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, 2022a).

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, 2022a).

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, Buckley Army Aviation Support Facility, Aurora, Colorado* dated February 2021 (AECOM, 2021);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Buckley Army Aviation Support Facility, Aurora, Colorado* dated June 2022 (AECOM, 2022a); and
- *Final Site Safety and Health Plan, Buckley Army Aviation Support Facility, Aurora, Colorado* dated July 2022 (AECOM, 2022b).

The SI field activities were conducted from 8 to 18 July 2022 and consisted of utility clearance, sonic drilling, soil sample collection, permanent monitoring well installation, low-flow groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022a), 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:

- Sixteen (16) soil samples from 10 boring locations;
- Three grab groundwater samples from three permanent wells;
- Seventeen (17) 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**, a Field Change Request Form is provided in **Appendix B3**, a Nonconformance and Corrective Action Report is provided in **Appendix B4**, and land survey data 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 AOs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 16 March 2022, 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, COARNG, USACE, and the Colorado Department of Public Health and Environment (CDPHE). 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, 2022a).

A TPP Meeting 3 will be held after the field event to discuss the results of the SI. Meeting minutes for TPP 3 will be 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 Colorado 811 public utility clearance provider to notify them of intrusive work on 7 July 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 8 July 2022 with input from the AECOM field team and Buckley 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. All subsurface activities were completed under a Base Civil Engineering Work Clearance Request (Air Force Form 103), or “dig permit”, issued by Buckley SFB.

5.1.3 Source Water and Sampling Equipment Acceptability

Two potable water sources at Buckley AASF were sampled on 31 May 2022 to assess usability for decontamination of drilling equipment. Results of the sample collected at the spigot on the northeast exterior corner of Building 1510 (BKLY-DECON-01) confirmed this source to be acceptable for use in this investigation; therefore, it was 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 sample associated with the northeast exterior spigot source 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, 2022a). 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

Borings were installed in unpaved areas where applicable, to avoid disturbing concrete or asphalt surfaces. Soil samples were collected via sonic drilling, in accordance with the SI QAPP Addendum (AECOM, 2022a). 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 **Table 5-1**.

In general, three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 2 feet above the groundwater table, and one subsurface soil sample at a mid-point between the surface and the groundwater table no deeper than 15 ft 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 sands and low to medium plasticity fines (silts with clay) as the dominant lithology of the unconsolidated sediments below the Buckley AASF. The borings were completed at depths between 45 and 57.5 feet bgs, with the bottom of the wells set between 40 and 51.5 feet bgs. These observations are consistent with the understood alluvial deposits overlying weathered rock layers at the facility.

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), pH (USEPA Method 9045D), and grain size (ASTM Method D-422) in accordance with the SI QAPP Addendum (AECOM, 2022a).

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.

The three borings were converted to permanent wells in accordance with the SI QAPP Addendum (AECOM, 2022a). Borings were installed in unpaved areas to avoid disturbing concrete or asphalt surfaces.

5.3 Permanent Well Installation and Groundwater Sampling

During the SI, three permanent monitoring wells were installed downgradient (BKLY-MW001 and BKLY-MW002) or upgradient (BKLY-MW003) of potential source areas. The locations of the wells are shown on **Figure 5-1**.

A sonic drill rig system was used to install three 2-inch diameter monitoring wells. The monitoring wells were constructed with Schedule 40 polyvinyl chloride (PVC), flush threaded 10-foot sections of riser, 0.010-inch slotted well screen, and a threaded bottom cap. Water was not added during the drilling of the wells. A filter pack of 20/40 silica sand was installed in the annulus around the well screen to a minimum of 2-foot above the well screen. A 2-foot-thick bentonite seal was placed above the filter sand and hydrated with water. Bentonite grout was placed in the well annulus from the top of the bentonite seal to ground surface. The bentonite grout was allowed to set for 24 hours prior to well completion in accordance with the SI QAPP Addendum (AECOM, 2022a). All monitoring wells were completed with flush mount well vaults. The screen interval of each of the groundwater monitoring wells is provided in **Table 5-2**.

Development and sampling of wells was completed in accordance with the SI QAPP Addendum (AECOM, 2022a). The newly installed monitoring wells were developed no sooner than 24 hours following installation by pumping and surging using a variable speed submersible pump. Samples were collected no sooner than 24 hours following development via low-flow sampling methods using a QED Sample Pro® bladder pump with disposable PFAS-free, HDPE tubing. New tubing was used at each well, and the pumps were decontaminated between each well. The wells were purged at a rate determined in the field to reduce 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**). Water levels were measured to the nearest 0.01 inch and recorded. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there was 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, 2022a).

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.

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 18 July 2022. Groundwater elevation measurements were collected from the three new permanent monitoring wells. Water level measurements were taken from the northern side of the well casing. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-3**.

5.5 Surveying

The north side of each well casing was surveyed by Colorado-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2022a). Survey data from the newly installed wells on the facility were collected on 15 July 2022 in the applicable Universal Transverse Mercator zone projection with Colorado State Plane Central Zone North American Datum 1983 (NAD83) (1992) datum (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B4**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of investigation-derived waste (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, 2022a) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) generated during the SI activities were contained in labeled, 55-gallon Department of Transportation (DOT)-approved steel drums filled 3/4 full to account for freeze/thaw cycles 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. Eight drums of soil remain on pallets at the site, staged on the pad immediately

southeast of Building 1025. ARNG will coordinate waste profiling, transportation, and disposal of the solid IDW under a separate contract.

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 filled 2/3 full to account for freeze/thaw cycles, 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. Two drums of aqueous IDW remain on pallets at the facility, staged on the pad immediately southeast of Building 1025. Containerized liquid IDW will be managed and disposed of by ARNG (either by offsite disposal or onsite disposal with treatment, as appropriate) under a separate contract in accordance with SOP No. 042A (EA, 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

Two deviations from the SI QAPP Addendum were identified during review of the field documentation. The deviations are noted below and documented in a Field Change Request Form (**Appendix B3**) and a Nonconformance and Corrective Action Report (**Appendix B4**):

- During the site walk and utility clearance prior to subsurface investigations, it was deemed appropriate to revise several boring and well locations as described below:

AOI 1

- Location AOI01-02 was moved approximately 180 feet southeast because a newly constructed building blocked the original location. The new location is a low-lying area outside new construction area, where flight ramp drainage most likely encounters ground surface.
- Location AOI01-03 was moved approximately 50 feet northwest, from a hilltop to a low-lying area immediately off the southeast flight ramp.
- Location AOI01-4 was moved approximately 170 feet southwest to be within the dry retention basin at the southwest end of the flight ramp.
- Added location AOI01-5 at a low-lying area that receives drainage from the southeast side of flight line.
- BKLY-MW001 was moved approximately 108 feet southeast of the original location to be better situated downgradient from concentration of infiltration areas at AOI 1.
- BKLY-MW003 was moved approximately 420 feet southwest from the original location, west of the short line to avoid conflicts with Zulu pad and Buckley SFB Runway. The new location is positioned upslope from the flight ramp.

AOI 2

- The entire area where the Tri-Max™ units were stored is paved and drains to enclosed capture basin bordered by a concrete wall on three sides. AOI02-02 was added where runoff from near AOI02-01 and the area east of Building 1510 drains.
- BKLY-MW002 was moved approximately 100 feet west of the original location to get nearer to the downgradient low end of the retention basin.

The sample location changes and additions were made after the initial site visit to better meet data quality objectives relative to the original sample locations, which were placed only using aerial imagery. The new locations were approved in a discussion between AECOM and ARNG G-9 on June 3, 2022. The location changes are documented in a Field Change Request Form provided in **Appendix B3**.

- Upon review of field documentation, it was discovered that only one grain size analysis soil sample was collected at the site, instead of one soil sample per AOI. This omission was documented in a Nonconformance and Corrective Action Report provided in **Appendix B4**.

**Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Buckley AASF, Colorado**

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-0-0.5	7/12/2022 12:35	0-0.5	x				
AOI01-01-SB-0-0.5-D	7/12/2022 12:35	0-0.5	x				Duplicate
AOI01-02-SB-0-2	7/13/2022 13:30	0-2	x	x	x		
AOI01-02-SB-0-2-MS	7/13/2022 13:30	0-2		x	x		MS/MSD
AOI01-02-SB-0-2-MSD	7/13/2022 13:30	0-2		x	x		MS/MSD
AOI01-03-SB-0-2	7/13/2022 13:45	0-2	x				
AOI01-03-SB-0-2-MS	7/13/2022 13:45	0-2	x				MS/MSD
AOI01-03-SB-0-2-MSD	7/13/2022 13:45	0-2	x				MS/MSD
AOI01-04-SB-0-2	7/13/2022 13:55	0-2	x				
AOI01-05-SB-0-2	7/13/2022 13:50	0-2	x				
AOI02-01-SB-0-2	7/12/2022 14:35	0-2	x	x	x		
AOI02-01-SB-0-2-D	7/12/2022 14:35	0-2		x	x		Duplicate
AOI02-02-SB-0-2	7/12/2022 14:25	0-2	x				
BKLY-MW001-SB-0-2	7/13/2022 13:00	0-2	x				
BKLY-MW001-SB-13-15	7/13/2022 15:30	13-15	x				
BKLY-MW001-SB-35-37	7/13/2022 16:05	35-37	x				
BKLY-MW002-SB-0-2	7/12/2022 13:00	0-2	x				
BKLY-MW002-SB-13-15	7/12/2022 16:15	13-15	x				
BKLY-MW002-SB-13-15-D	7/12/2022 16:15	13-15	x				Duplicate
BKLY-MW002-SB-35-37.5	7/12/2022 16:20	35-37.5	x				
BKLY-MW002-SB-37.5	7/12/2022 16:25	37.5				x	
BKLY-MW003-SB-0-2	7/14/2022 8:25	0-2	x				
BKLY-MW003-SB-13-15	7/14/2022 10:40	13-15	x				
BKLY-MW003-SB-43-45	7/14/2022 10:45	43-45	x				
Groundwater Samples							
BKLY-MW001-071822	7/18/2022 14:50	NA	x				
BKLY-MW002-071822	7/18/2022 9:00	NA	x				
BKLY-MW002-071822-D	7/18/2022 9:00	NA	x				Duplicate
BKLY-MW002-071822-MS	7/18/2022 9:00	NA	x				MS/MSD
BKLY-MW002-071822-MSD	7/18/2022 9:00	NA	x				MS/MSD
BKLY-MW003-071822	7/18/2022 12:25	NA	x				
Blank Samples							
BKLY-ERB-01	7/13/2022 9:50	NA	x				
BKLY-ERB-02	7/13/2022 13:50	NA	x				
BKLY-ERB-03	7/18/2022 9:10	NA	x				
BKLY-FRB-01	7/13/2022 9:55	NA	x				
BKLY-DECON-01	5/31/2022 14:00	NA	x				
BKLY-DECON-02	5/31/2022 14:00	NA	x				
BKLY-DECON-03	7/13/2022 13:15	NA	x				

Notes:

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

BKLY-ERB-01 = collected via decontaminated hand auger
BKLY-ERB-02 = collected via drilling shoe
BKLY-ERB-03 = collected via bladder pump
BKLY-FRB-01 = collected via running drill truck
BKLY-DECON-03 = collected via driller decontamination water

Table 5-2
Soil Boring Depths and Permanent Well Screen Intervals
Site Inspection Report, Buckley AASF, Colorado

Area of Interest	Boring Location	Monitoring Well ID	Soil Boring Depth (feet bgs)	Permanent Well Screen Interval (feet bgs)
1	BKLY-MW001	BKLY-MW001	47.5	31.5-41.5
1	BKLY-MW003	BKLY-MW003	57.5	41.5-51.5
2	BKLY-MW002	BKLY-MW002	45	30-40

Notes:

AASF = Army Aviation Support Facility

bgs = below ground surface

BKLY = Buckley

ID = identification

**Table 5-3
 Depths to Water and Groundwater Elevations in Permanent Wells
 Site Inspection Report, Buckley AASF, Colorado**

Location ID	Permanent 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)
BKLY-MW001	31.5 - 41.5	5575.76	5575.85	38.28	38.37	5537.48
BKLY-MW002	30 - 40	5571.73	5571.64	33.89	33.80	5537.84
BKLY-MW003	41.5 - 51.5	5590.25	5590.50	44.76	45.01	5545.49

Notes:

bgs - below ground surface

btoc = below top of casing

ID = identification

NA = not available

NAVD88 = North American Vertical Datum 1988

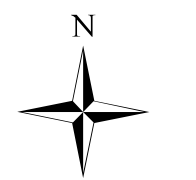
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CLIENT	ARNG			
PROJECT	Site Inspection at Buckley AASF, CO			
REVISED	1/23/2023	GIS BY	MS	1/23/2023
SCALE	1:5,280	CHK BY	AD	1/23/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/23/2023

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

0 220 440 880 Feet



Site Inspection Sample Locations

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 6.4**. **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 6 July 2022 OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the 6 July 2022 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, pH, and grain size sampling.

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport. According to the Interstate Technology Regulatory Council (ITRC), several important 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: Building 1510. 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

Soil was sampled from surface soil (0 to 2 feet bgs) from boring locations AOI01-01 through AOI01-05, BKLY-MW001, and BKLY-MW003. Soil was also sampled from shallow subsurface soil (13 to 15 feet bgs) and deep subsurface soil intervals (35 to 45 feet bgs) from boring locations BKLY-MW001 and BKLY-MW003. **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.

PFOA, PFOS, PFHxS, and PFNA were detected in surface soil at concentrations less than their respective SLs, with the highest found at AOI01-04 with a PFOS concentration of 1.94 $\mu\text{g}/\text{kg}$. PFBS was not detected in any AOI 1 surface soil samples.

At BKLY-MW001 (downgradient of AOI 1), PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in subsurface soil.

At BKLY-MW003 (upgradient of AOI 1) PFOS, PFHxS, and PFBS were detected in shallow subsurface soil at concentrations less than their respective SLs, with the highest found at BKLY-MW003 with a PFOS concentration of 0.398 $\mu\text{g}/\text{kg}$. PFOA and PFNA were not detected in any shallow subsurface soil samples. PFHxS was detected in the deep subsurface soil at BKLY-MW003, with a concentration of 0.045 $\mu\text{g}/\text{kg}$. PFOA, PFOS, PFNA, and PFBS were not detected in deep subsurface soil at BKLY-MW003.

6.3.2 AOI 1 Groundwater Analytical Results

Groundwater was sampled from permanent monitoring wells BKLY-MW001 (downgradient well) and BKLY-MW003 (upgradient well). **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

The following exceedances of the SLs were measured in groundwater at AOI 1:

BKLY-MW001 (downgradient well)

- PFOA was detected above the SL of 6 nanograms per liter (ng/L) in BKLY-MW001 at a concentration of 47.3 ng/L.
- PFOS was detected above the SL of 4 ng/L at BKLY-MW001, with a concentration of 7.31 J+ ng/L.
- PFHxS was detected above the SL of 39 ng/L at BKLY-MW001, with a concentrations of 79.8 ng/L.
- PFBS was detected below its SL in BKLY-MW001, at a concentration of 20.7 ng/L. PFNA was not detected at BKLY-MW001.

BKLY-MW003 (upgradient well)

- PFOA was detected above the SL of 6 nanograms per liter (ng/L) in BKLY-MW003 with a concentration of 9.11 ng/L.
- PFOS was detected above the SL of 4 ng/L at BKLY-MW003 with a concentration of 20.4 J+ ng/L.
- PFHxS was detected above the SL of 39 ng/L at BKLY-MW003, with a concentration of 214 ng/L.
- PFBS was detected below its SL in BKLY-MW003, at a concentration of 50.7 ng/L. PFNA was detected below its SL in BKLY-MW003, at a concentration of 1.12 J ng/L.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in soil below their SLs. PFOA, PFOS, and PFHxS were detected in groundwater in both the upgradient and downgradient wells at concentrations above their SLs. The detections in upgradient well BKLY-MW003 suggests impacted groundwater is entering the facility at the upgradient facility boundary and is not attributable to ARNG activities. 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: Former Tri-Max™ Storage Area. 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

Soil was sampled from surface soil (0 to 2 feet bgs) from boring locations AOI02-01, AOI02-02, and BKLY-MW002. Soil was also sampled from shallow subsurface soil (13 to 15 feet bgs) and deep subsurface soil intervals (35 to 37.5 feet bgs) from boring location BKLY-MW002. **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.

PFOA, PFOS, PFHxS, and PFNA were detected in surface soil, at concentrations less than their respective SLs, with the highest found at AOI02-02 with a PFOS concentration of 1.04 µg/kg.

PFBS was not detected in any AOI 2 surface soil sample. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in shallow subsurface soil.

PFOS, PFHxS, PFNA, and PFBS were detected in the deep subsurface soil at BKLY-MW002 with the highest being a PFOS concentration of 3.93 J $\mu\text{g}/\text{kg}$. PFOA was not detected in deep subsurface soil at AOI 2.

6.4.2 AOI 2 Groundwater Analytical Results

Groundwater was sampled from permanent monitoring well BKLY-MW002. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

PFOA, PFOS, PFHxS, PFNA, and PFBS were all detected above their respective SLs. The following maximum detected exceedances of the SLs are measured in groundwater at AOI 2:

- PFOA was detected above the SL of 6 ng/L, at a concentration of 1,530 ng/L.
- PFOS was detected above the SL of 4 ng/L, at a concentration of 19,900 J ng/L.
- PFHxS was detected above the SL of 39 ng/L, at a concentration of 8,170 ng/L.
- PFNA was detected above the SL of 6 ng/L, at a concentration of 847 ng/L.
- PFBS was detected above the SL of 601 ng/L at a concentration of 1,150 ng/L.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in soil below their SLs. It should be noted that the highest concentrations of target analytes in soil were from the deep soil/capillary fringe sample of BKLY-MW002 which, considering the non-detect results in surface soil at this location, suggests a groundwater source of contamination. PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in groundwater at concentrations above their SLs. Based on the exceedances of the SLs in groundwater, further evaluation at AOI 2 is warranted.

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

Area of Interest	AOI01																AOI02						
	Sample ID	AOI01-01-SB-(0.0-0.5)		AOI01-01-SB-(0.0-0.5)-D		AOI01-02-SB-(0-2)		AOI01-03-SB-(0-2)		AOI01-04-SB-(0-2)		AOI01-05-SB-(0-2)		BKLY-MW001-SB-(0-2)		BKLY-MW003-SB-(0-2)		AOI02-01-SB-(0-2)		AOI02-02-SB-(0-2)		BKLY-MW002-SB-(0-2)	
	Sample Date	07/12/2022		07/12/2022		07/13/2022		07/13/2022		07/13/2022		07/13/2022		07/13/2022		07/14/2022		07/12/2022		07/12/2022		07/12/2022	
Depth	0-0.5 ft		0-0.5 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 *	Result	Qual	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	ND	U
PFHxS	130	ND	U	ND	U	ND	U	ND	U	0.057	J	ND	U	0.041	J	0.058	J	ND	U	0.058	J	0.063	J
PFNA	19	ND	U	ND	U	ND	U	0.038	J	0.055	J	0.069	J	0.054	J	0.059	J	0.276	J	0.382	J	0.022	J
PFOA	19	ND	U	ND	U	0.138	J	ND	U	ND	U	0.139	J	ND	U	0.240	J	0.260	J	0.237	J	ND	U
PFOS	13	0.075	J	ND	UJ	0.073	J	0.249	J	1.94		1.08		0.690	J	0.576	J	0.183	J	1.04		0.282	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

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
 ft feet
 HQ hazard quotient
 ID identification
 JTN Johnstown
 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, Buckley AASF**

Area of Interest		AOI01				AOI02	
Sample ID	BKLY-MW001-SB-(13-15)	BKLY-MW003-SB-(13-15)		BKLY-MW002-SB-(13-15)			
Sample Date	07/13/2022	07/14/2022		07/12/2022			
Depth	13-15 ft	13-15 ft		13-15 ft			
Analyte	OSD Screening Level ^a	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)							
PFBS	25000	ND	U	0.150	J	ND	U
PFHxS	1600	ND	U	0.223	J	ND	U
PFNA	250	ND	U	ND	U	ND	U
PFOA	250	ND	U	ND	U	ND	U
PFOS	160	ND	U	0.398	J	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

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
ft	feet
HQ	hazard quotient
ID	identification
JTN	Johnstown
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 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Buckley AASF**

Area of Interest	AOI01				AOI02			
	Sample ID	Sample Date	Depth	Analyte	Result	Qual	Result	Qual
	BKLY-MW001-SB-(35-37)	07/13/2022	35-37 ft					
	BKLY-MW003-SB-(43-45)	07/14/2022	43-45 ft					
	BKLY-MW002-SB-(35-37.5)	07/12/2022	35-37.5 ft					
	BKLY-MW002-SB-(35-37.5)-D	07/12/2022	35-37.5 ft					
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)								
PFBS	ND	U	ND	U	0.021	J	0.037	J
PFHxS	ND	U	0.045	J	0.249	J	0.054	J
PFNA	ND	U	ND	U	0.106	J	ND	UJ
PFOA	ND	U	ND	U	ND	U	ND	U
PFOS	ND	U	ND	U	3.93	J	0.827	J

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

AOI Area of Interest
 D duplicate
 DL detection limit
 ft feet
 ID identification
 JTN Johnstown
 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, Buckley AASF**

Area of Interest		AOI01				AOI02			
		Sample ID		Sample Date		Sample ID		Sample Date	
Analyte	OSD Screening Level *	07/18/2022		07/18/2022		07/18/2022		07/18/2022	
		Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)									
PFBS	601	20.7		50.7		1150		1040	
PFHxS	39	79.8		214		7660	J	8170	
PFNA	6	ND	U	1.12	J	847		777	
PFOA	6	47.3		9.11		1530		1410	
PFOS	4	7.31	J+	20.4	J+	19900	J	16400	

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
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
BKLY Buckley
D duplicate
DL detection limit
GW groundwater
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
USEPA United States Environmental Protection Agency
ng/l nanogram per liter

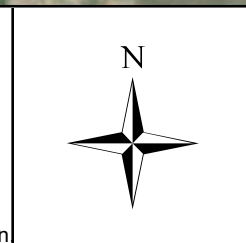


CLIENT	ARNG				
PROJECT	Site Inspection at Buckley AASF, CO				
REVISED	8/31/2023	GIS BY	MS	8/31/2023	
SCALE	1:3,600	CHK BY	AD	8/31/2023	
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/31/2023	

Facility Boundary

ND = Not Detected
 Exceedances of the OSD SL are depicted with a yellow halo.
 Depth intervals shown represent respective sampling position within a given soil boring location

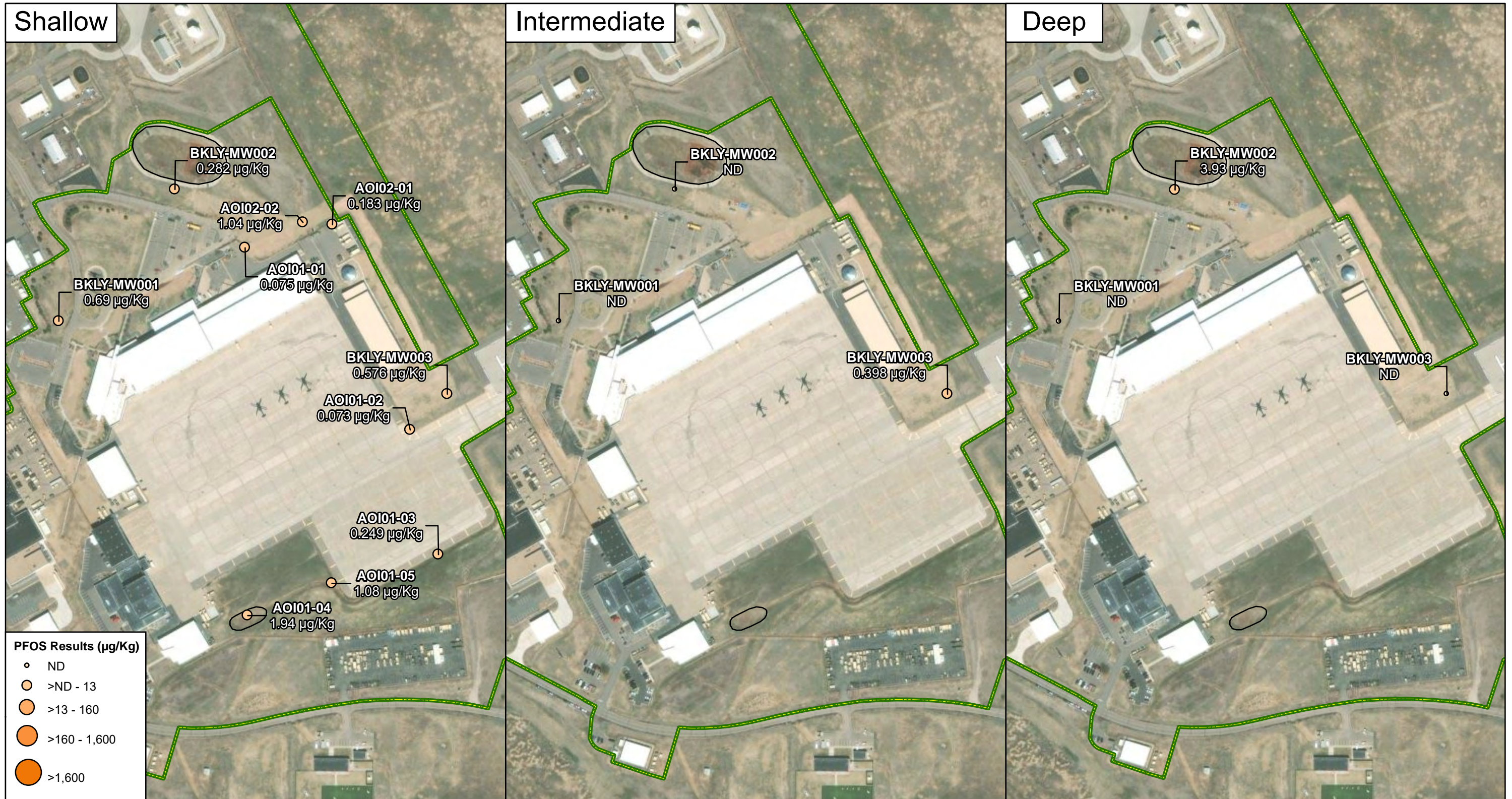
0 150 300 600
 Feet



PFOA Detections in Soil

12420 Milestone Center Drive
 Germantown, MD 20876

Figure 6-1



PFOS Results (µg/Kg)

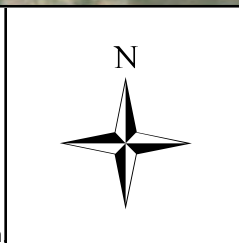
- ND
- >ND - 13
- >13 - 160
- >160 - 1,600
- >1,600

CLIENT	ARNG				
PROJECT	Site Inspection at Buckley AASF, CO				
REVISED	8/31/2023	GIS BY	MS	8/31/2023	
SCALE	1:3,600	CHK BY	AD	8/31/2023	
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/31/2023	

Facility Boundary

0 150 300 600
 Feet

ND = Not Detected
 Exceedances of the OSD SL are depicted with a yellow halo.
 Depth intervals shown represent respective sampling position within a given soil boring location



PFOS Detections in Soil

12420 Milestone Center Drive
 Germantown, MD 20876

Figure 6-2



PFBS Results (µg/Kg)

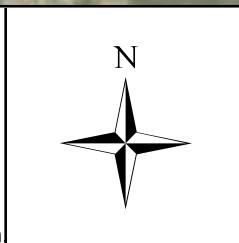
- ND
- >ND - 10
- >10 - 1,900
- >1,900 - 25,000
- >25,000

CLIENT	ARNG				
PROJECT	Site Inspection at Buckley AASF, CO				
REVISED	8/31/2023	GIS BY	MS	8/31/2023	
SCALE	1:3,600	CHK BY	AD	8/31/2023	
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/31/2023	

Facility Boundary

0 150 300 600
 Feet

ND = Not Detected
 Exceedances of the OSD SL are depicted with a yellow halo.
 Depth intervals shown represent respective sampling position within a given soil boring location



PFBS Detections in Soil

AECOM 12420 Milestone Center Drive
 Germantown, MD 20876

Figure 6-3

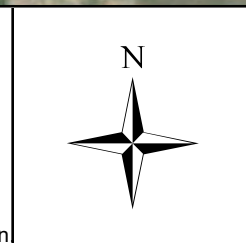


CLIENT	ARNG				
PROJECT	Site Inspection at Buckley AASF, CO				
REVISED	8/31/2023	GIS BY	MS	8/31/2023	
SCALE	1:3,600	CHK BY	AD	8/31/2023	
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/31/2023	

Facility Boundary

0 150 300 600
 Feet

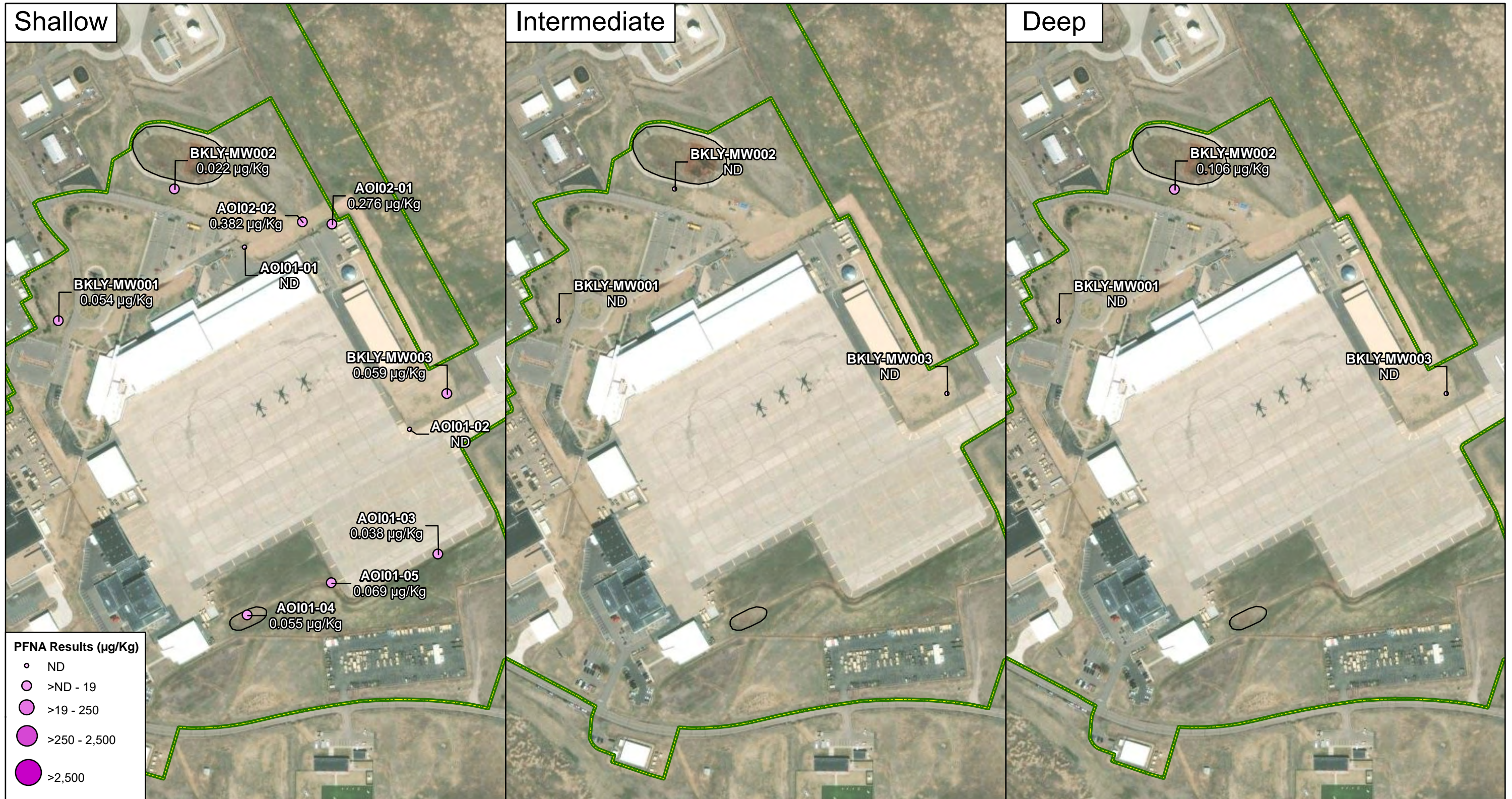
ND = Not Detected
 Exceedances of the OSD SL are depicted with a yellow halo.
 Depth intervals shown represent respective sampling position within a given soil boring location



PFHxS Detections in Soil

12420 Milestone Center Drive
 Germantown, MD 20876

Figure 6-4



PFNA Results (µg/Kg)

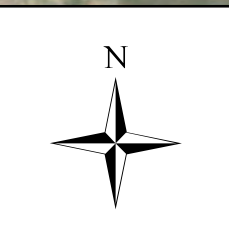
- ND
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

CLIENT	ARNG				
PROJECT	Site Inspection at Buckley AASF, CO				
REVISED	8/31/2023	GIS BY	MS	8/31/2023	
SCALE	1:3,600	CHK BY	AD	8/31/2023	
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/31/2023	

Facility Boundary

0 150 300 600
 Feet

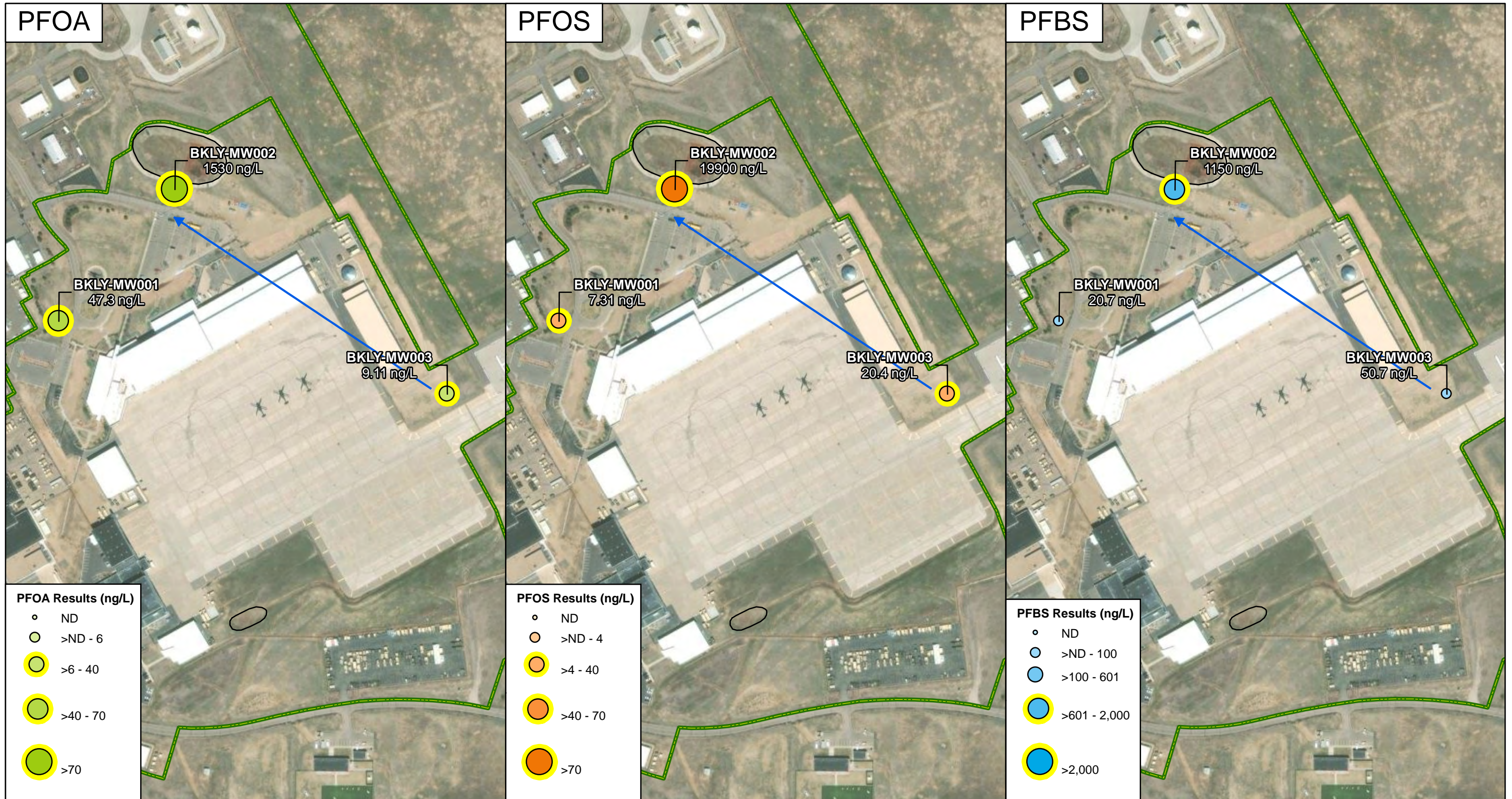
ND = Not Detected
 Exceedances of the OSD SL are depicted with a yellow halo.
 Depth intervals shown represent respective sampling position within a given soil boring location



PFNA Detections in Soil

AECOM 12420 Milestone Center Drive
 Germantown, MD 20876

Figure 6-5



PFOA Results (ng/L)

- ND
- >ND - 6
- >6 - 40
- >40 - 70
- >70

PFOS Results (ng/L)

- ND
- >ND - 4
- >4 - 40
- >40 - 70
- >70

PFBS Results (ng/L)

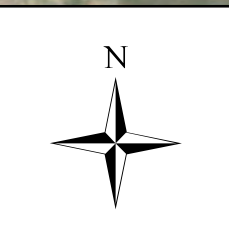
- ND
- >ND - 100
- >100 - 601
- >601 - 2,000
- >2,000

CLIENT	ARNG			
PROJECT	Site Inspection at Buckley AASF, CO			
REVISED	8/31/2023	GIS BY	MS	8/31/2023
SCALE	1:3,600	CHK BY	AD	8/31/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community	PM	CM	8/31/2023	

Facility Boundary
→ Groundwater Flow Direction

0 150 300 600
 Feet

ND = Not Detected
 Exceedances of the OSD SL are depicted with a yellow halo.

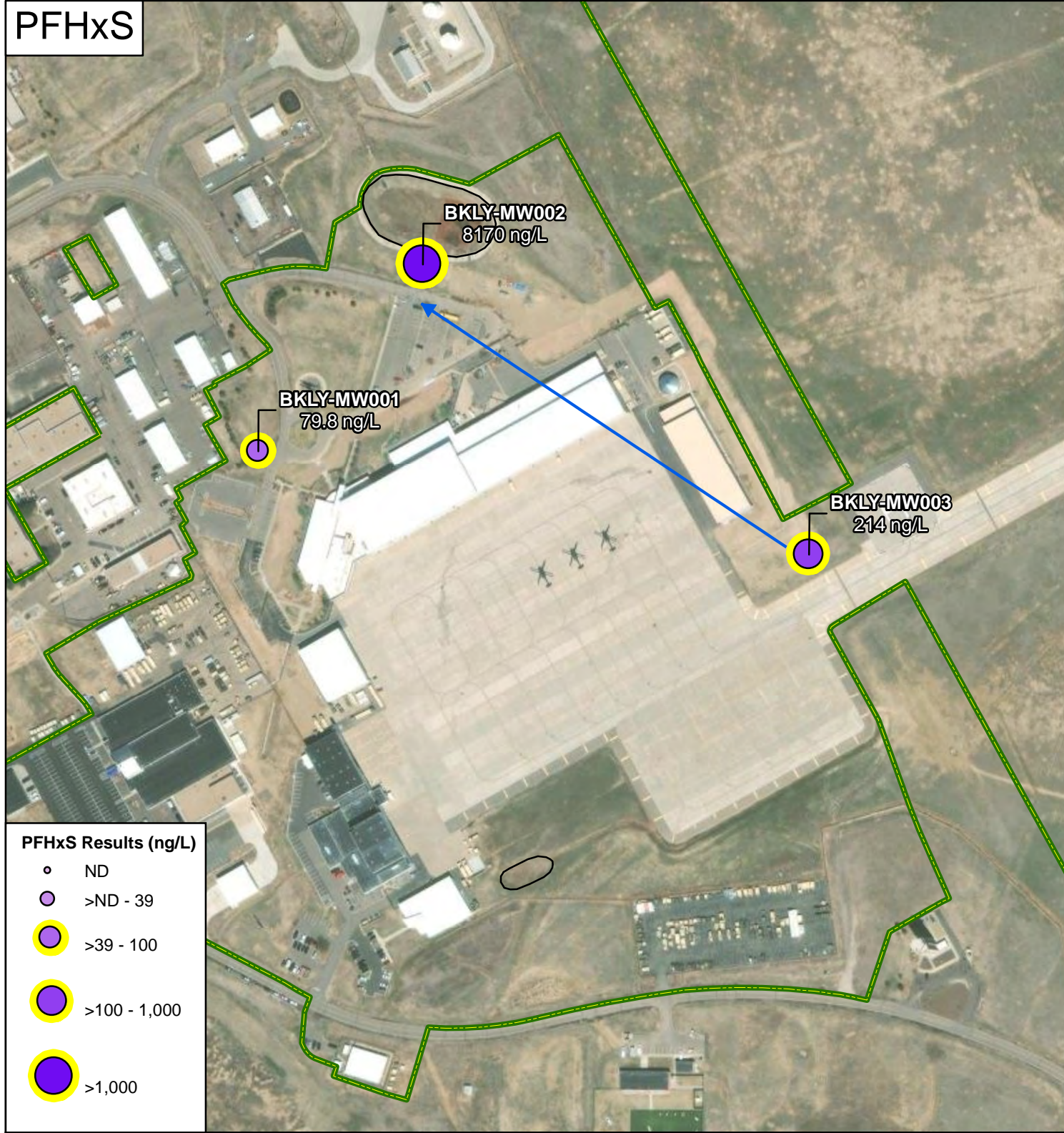


PFOA, PFOS, and PFBS Detections in Groundwater

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-6

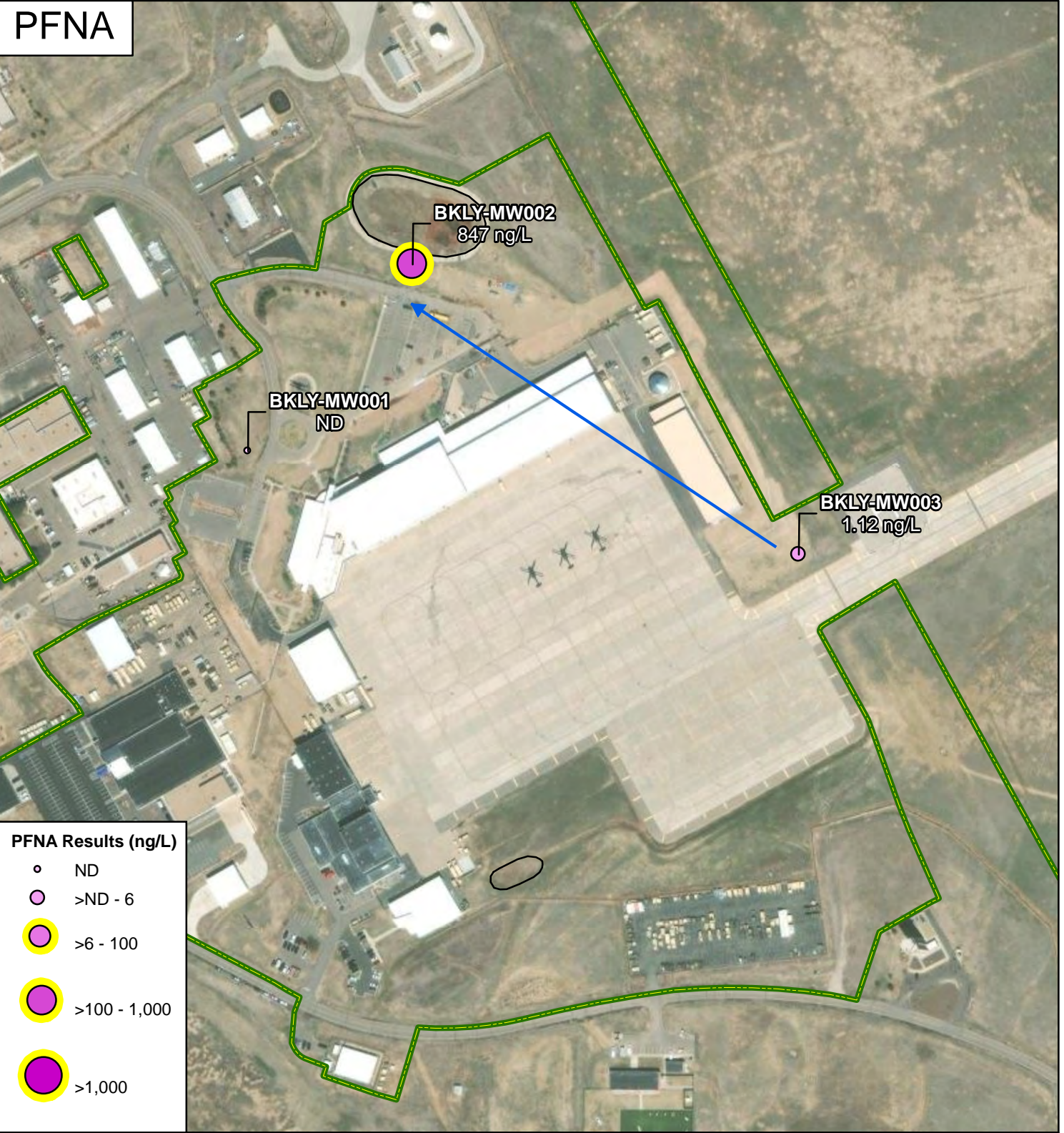
PFHxS



PFHxS Results (ng/L)

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

PFNA



PFNA Results (ng/L)

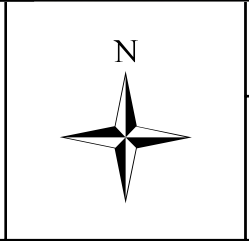
- ND
- >ND - 6
- >6 - 100
- >100 - 1,000
- >1,000

CLIENT	ARNG			
PROJECT	Site Inspection at Buckley AASF, CO			
REVISED	8/31/2023	GIS BY	MS	8/31/2023
SCALE	1:3,600	CHK BY	AD	8/31/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/31/2023

Facility Boundary
➔ Groundwater Flow Direction

0 150 300 600
 Feet

ND = Not Detected
 Exceedances of the OSD SL are depicted with a yellow halo.



PFHxS and PFNA Detections in Groundwater

12420 Milestone Center Drive
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** through **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, 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 a RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

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

7.1.1 AOI 1

AOI 1 is Building 1510, which is constructed with a HEF deluge fire suppression system that contains 900 gallons of Ansul Jet-X 2.75% HEF concentrate. A 55-gallon drum containing the same HEF concentrate product is also stored within Building 1510. The HEF deluge fire suppression system was tested in 2006 with a 3-minute discharge of an unknown volume of Ansul Jet-X 2.75% HEF to the hangar area. It is unclear whether the HEF product released at

Buckley AASF contained PFAS; however, it is conservatively assumed to have for the purpose of the investigation.

PFOA, PFOS, PFHxS, and PFNA were detected in surface soil at AOI 1. Site workers and construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the airborne soil particulate and surface soil exposure pathways for site workers and construction workers are potentially complete. Buckley SFB is a secure facility and there are no immediate nearby residential structures. Therefore, the incidental ingestion and inhalation of dust exposure pathways for the trespassers, recreational users, and residential receptors incomplete.

PFOS, PFHxS, and PFBS were detected in subsurface soil at AOI 1. Construction workers could contact constituents in subsurface soil via incidental ingestion, and therefore, the subsurface soil exposure pathway for construction workers is potentially complete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

AOI 2 encompasses the area in the northeastern portion of the facility formerly used to store six Tri-Max™ wheeled fire extinguishers containing Chemguard 3% C-303 AFFF concentrate. The Tri-Max™ units were removed and disposed of in a controlled manner in September 2019.

PFOA, PFOS, PFHxS, and PFNA 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 airborne soil particulate and surface soil exposure pathways for site workers and construction workers are potentially complete. Buckley SFB is a secure facility and there are no immediate nearby residential structures. Therefore, the incidental ingestion and inhalation of dust exposure pathways for the trespassers, recreational users, and residential receptors incomplete. PFOA, PFOS, PFHxS, and PFNA in subsurface soil at AOI 2 were only detected at depths greater than 15 feet bgs.; therefore, all exposure pathways are considered incomplete because 15 feet bgs is considered the extent of excavation for the construction worker scenario. The CSM for AOI 2 is presented on **Figure 7-2**.

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

PFOA, PFOS, and PFHxS were detected at concentrations above their SLs in groundwater samples collected at AOI 1. Buckley AASF is a secure facility with restricted access; therefore, the ingestion exposure pathway for trespassers is considered incomplete. Due to the presence of public water system wells and domestic wells within a 4-mile radius of the facility in the downgradient direction, the pathway for exposure to off-facility residents via ingestion of groundwater is considered potentially complete. Because the location of City of Aurora drinking water groundwater wells that may serve the AASF are unknown, the pathway for exposure to site workers via ingestion of groundwater is also considered potentially complete. Depth to water at AOI 1 in July 2022 during the SI was measured at 38.57 feet bgs. Therefore, the ingestion exposure pathway for construction workers is considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

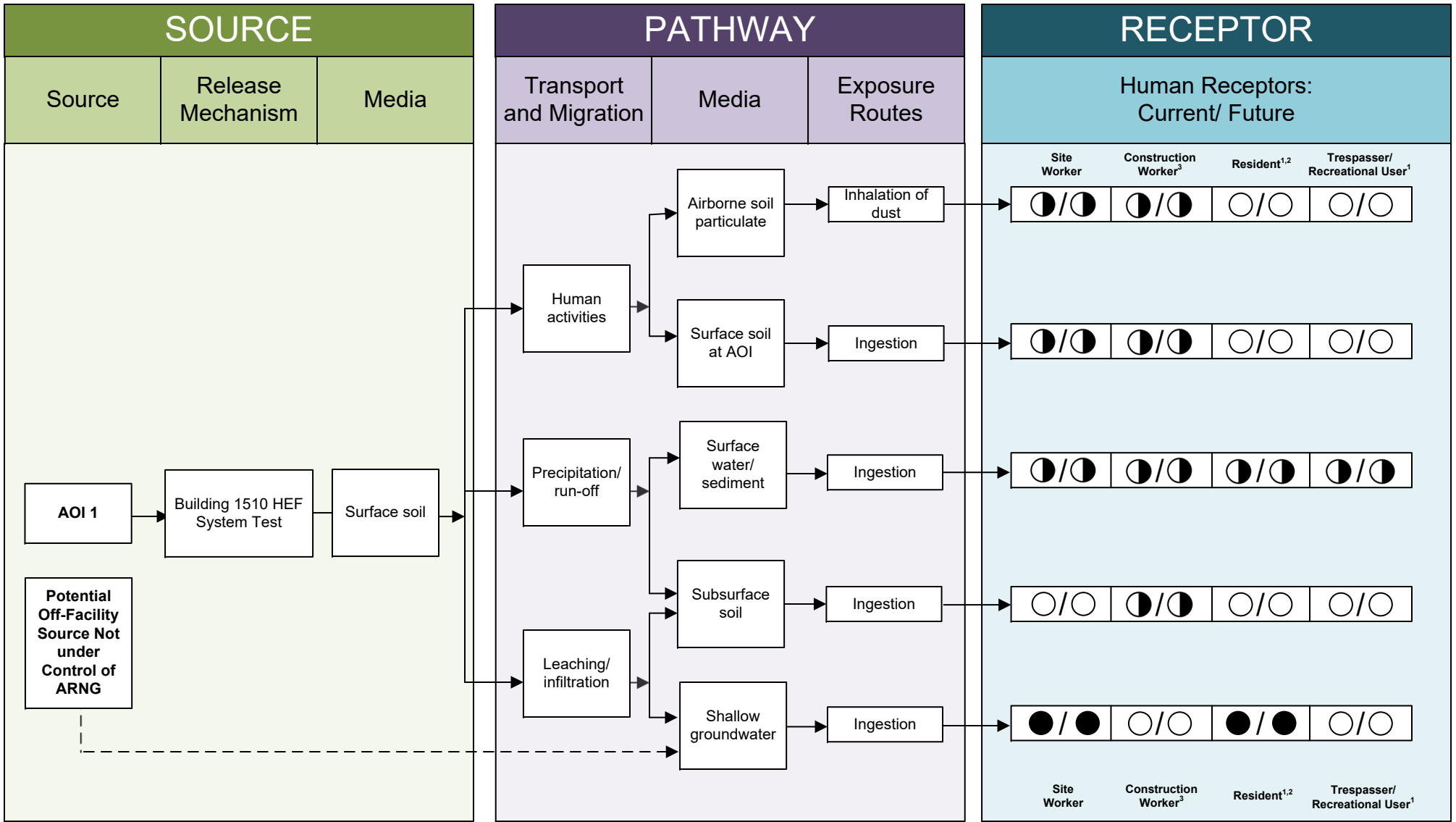
PFOA, PFOS, PFHxS, PFNA, and PFBS were detected at concentrations above their SLs in groundwater samples collected at AOI 2. Buckley AASF is a secure facility with restricted access; therefore, the ingestion exposure pathway for trespassers is considered incomplete. Due to the presence of public water system wells and domestic wells within a 4-mile radius of the facility in the downgradient direction, the pathway for exposure to off-facility residents via ingestion of groundwater is considered potentially complete. For the same reasons described above, the pathway for exposure to site workers via ingestion of groundwater is also considered potentially complete. Depth to water at AOI 2 in July 2022 during the SI was measured at 34.13 feet bgs. Therefore, the ingestion exposure pathway for construction workers is considered incomplete. The CSM for AOI 2 is presented on **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.

PFAS are water soluble and can migrate readily from soil to surface water via leaching and runoff. Because PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in soil and/or groundwater at AOI 1 and AOI 2, it is possible that those compounds may have migrated from soil and groundwater to the small emergent stream to the northeast of the facility, ultimately discharging to the East Toll Gate Creek and the South Platte River (USFWS, 2020). In addition, the City of Aurora, which supplies drinking water for Buckley AASF and surrounding residents, draws most of its water from surface sources. Therefore, the surface water and sediment ingestion exposure pathway for site workers, construction workers, residents, and recreational users is considered potentially complete. The CSM for AOI 1 is presented on **Figure 7-1**, and the CSM for AOI 2 is presented on **7-2**.

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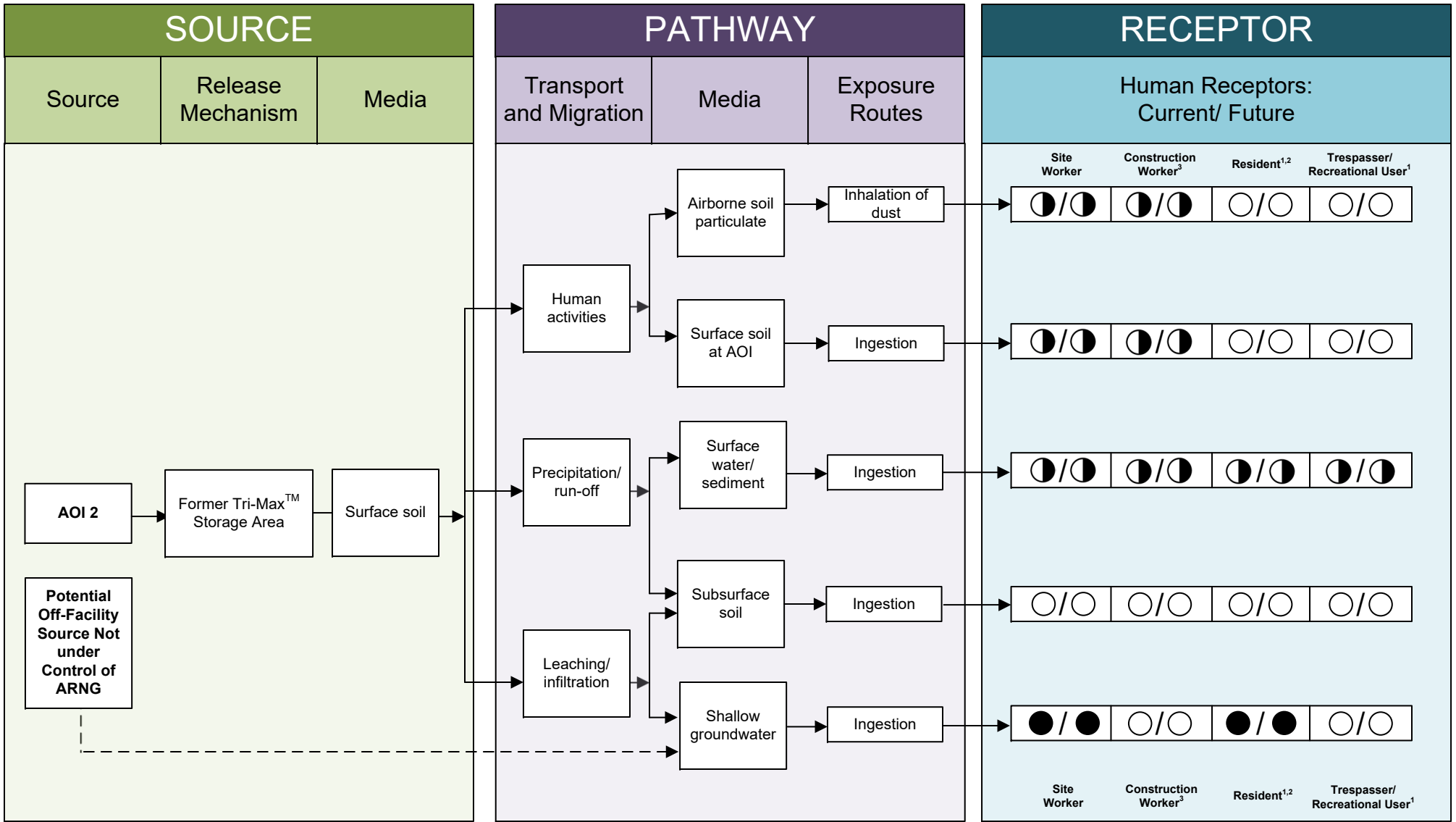
LEGEND

- 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.

Figure 7-1
Conceptual Site Model, AOI 1
Buckley 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.

Figure 7-2
Conceptual Site Model, AOI 2
Buckley 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 8 to 18 July 2022 and consisted of utility clearance, sonic drilling, soil sample collection, permanent monitoring well installation, low-flow groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022a), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2022a), 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.

- Sixteen (16) soil samples from 10 boring locations;
- Three grab groundwater samples from three permanent wells;
- Seventeen (17) quality assurance QA/QC.

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 AOI 1 and AOI 2 (see **Table 8-1**). Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to drinking water receptors from AOI 1 and AOI 2. 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 PFOA, PFOS, PFHxS, PFNA, and PFBS in soil at AOI 1 were below their SLs.
 - At downgradient location BKLY-MW001, PFOA, PFOS, and PFHxS in groundwater exceeded their SLs. PFOA exceeded the SL of 6 ng/L with a concentration of 47.3 ng/L; PFOS exceeded the SL of 4 ng/L, with a concentration of 7.31 ng/L; and PFHxS exceeded the SL of 39 ng/L, with a concentration of 79.8 ng/L
 - At upgradient location BKLY-MW003, PFOA, PFOS, and PFHxS in groundwater exceeded their SLs. PFOA exceeded the SL of 6 ng/L, with a concentration of 9.11





ng/L; PFOS exceeded the SL of 4 ng/L, with a concentration of 20.4 ng/L; and PFHxS exceeded the SL of 39 ng/L, with a concentration of 214 ng/L.

- Based on the results of the SI, particularly the detections in groundwater at BKLY-MW003, there is evidence of contaminated groundwater entering the facility at the upgradient boundary that is not attributable to ARNG activities. Further evaluation of AOI 1 is warranted in the RI.
- At AOI 2:
 - The detected concentrations of PFOA, PFOS, PFHxS, PFNA, and PFBS in soil at AOI 2 were below their SLs.
 - PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in regular and duplicate groundwater samples, at concentrations above respective SLs. PFOA exceeded the SL of 6 ng/L, with a maximum concentration of 1,530 ng/L. PFOS exceeded the SL of 4 ng/L, with a maximum concentration of 19,900 J ng/L. PFHxS exceeded the SL of 39 ng/L, with a maximum concentration of 8,170 ng/L in the duplicate sample. PFNA exceeded the SL of 6 ng/L, with a maximum concentration of 847 ng/L. PFBS exceeded the SL of 601 ng/L, with a concentration of 1,150 ng/L. Based on the results of the SI, further evaluation of AOI 2 is warranted in the RI.




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

Table 8-1 summarizes the SI results for soil and groundwater used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. The detections in upgradient well BKLY-MW003 suggests impacted groundwater is entering the facility at the upgradient facility boundary and is not attributable to ARNG activities.

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	Building 1510		NS		Proceed to RI
2	Former Tri-Max™ Storage Area		NS		Proceed to RI

Legend:

-  = detected; exceedance of the screening levels
-  = detected; no exceedance of the screening levels
-  = not detected
- NS = not sampled

9. References

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