

# FINAL Preliminary Assessment Report Buckley Army Aviation Support Facility, Aurora, Colorado

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

February 2021

Prepared for:



Army National Guard Bureau  
111 S. George Mason Drive  
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UNCLASSIFIED

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## Acronyms and Abbreviations

°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
ANG	Air National Guard
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COANG	Colorado Air National Guard
COARNG	Colorado Army National Guard
CSM	conceptual site model
EDR™	Environmental Data Resources, Inc.™
FEMA	Federal Emergency Management Agency
ft	feet
FTA	fire training area
GSE	Ground Services Equipment
HA	Health Advisory
HEF	High Expansion Foam
IED	Installations & Environment Division
msl	mean sea level
NOAA	National Oceanic and Atmospheric Administration
OWS	Oil-water separator
PA	Preliminary Assessment
PFAS	per- and poly-fluoroalkyl substances
PFBS	perfluorobutane sulfonate
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
ROD	Record of Decision
SDS	Safety Data Sheet
SI	Site Inspection
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WWTP	Wastewater treatment plant

## Executive Summary

The Army National Guard (ARNG) is performing Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide. A PA for per- and poly-fluoroalkyl substances (PFAS)-containing materials was completed at Buckley Army Aviation Support Facility (Buckley AASF; also referred to as the “facility”), in Aurora, Colorado. The performance of this PA included the following tasks:

- Reviewed available administrative record documents and Environmental Data Resources, Inc. (EDR)<sup>TM</sup> report packages to obtain information relevant to potential PFAS releases, such as: drinking water well locations, historical aerial photographs, Sanborn maps, and environmental compliance actions in the area surrounding the facility;
- Conducted interviews with Colorado ARNG (COARNG) personnel, including current and former Environmental Protection Specialists, the Environmental Compliance Manager, the Facility Unit Environmental Compliance Officer, and the Facility Maintenance Supervisor;
- Identified Area(s) of Interest (AOIs) and developed a preliminary conceptual site model (CSM) to summarize potential source-pathway-receptor linkages of potential PFAS in soil, groundwater, surface water, and sediment for each AOI.

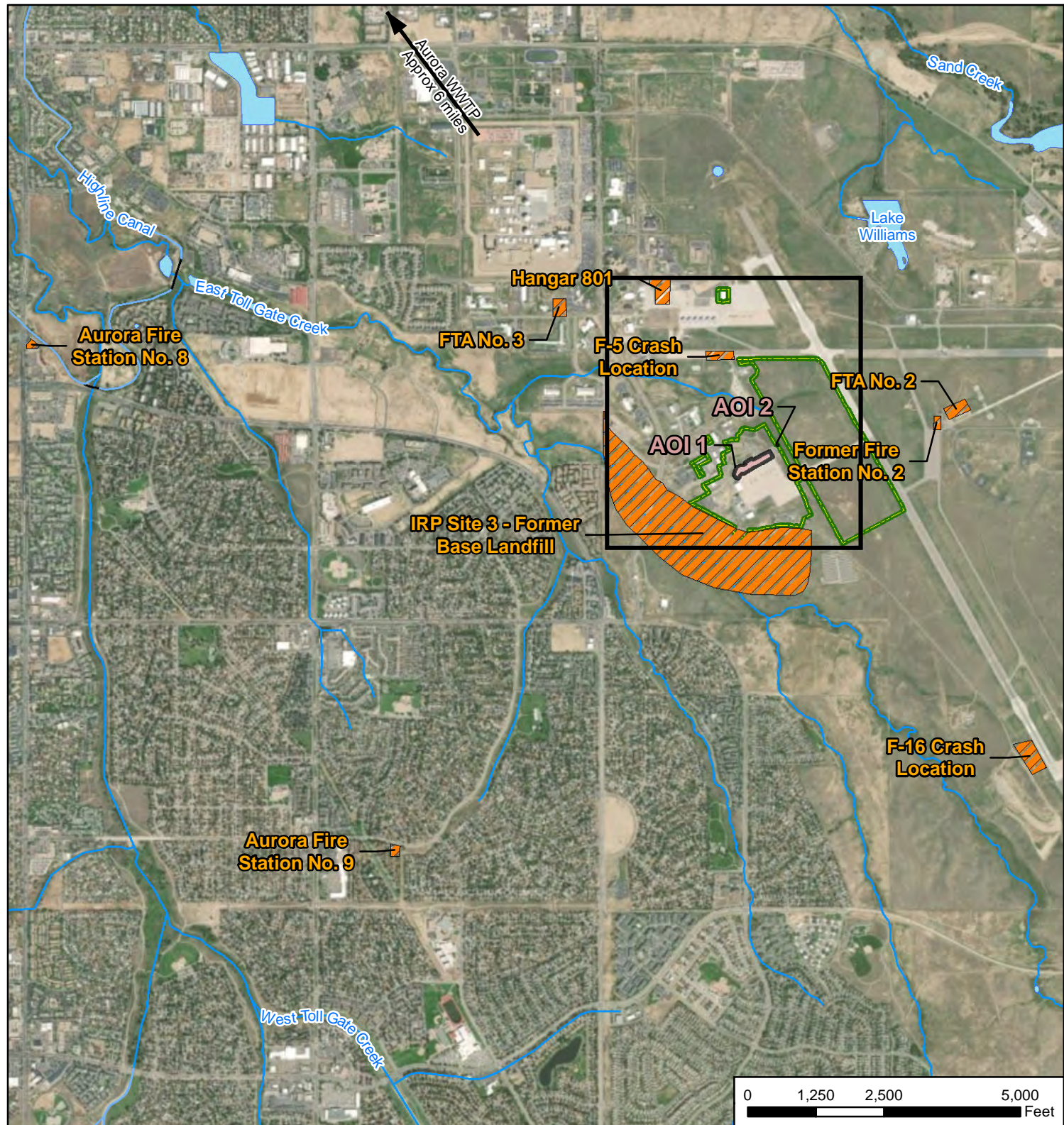
Two AOIs related to potential PFAS release were identified at Buckley AASF based on PA data (**Figure ES-1**) and are summarized in **Table ES-1** below:

**Table ES-1: AOIs at Buckley AASF**

Area of Interest	Name	Used by	Potential Release Dates
AOI 1	Building 1510	COARNG	2006, 2019
AOI 2	Former Tri-Max <sup>TM</sup> Storage Area	COARNG	Unknown - 2019

Based on the possible PFAS releases at AOI 2 and the uncertain content of High Expansion Foam (HEF) at AOI 1, there is potential for exposure to PFAS contamination in surface soil to site and construction workers, and trespassers via ingestion and inhalation; in subsurface soil to construction workers via ingestion and inhalation; and in surface water to site construction workers and off-facility recreational users via ingestion. There is also the potential for residents to consume produce grown off-facility that has been exposed to PFAS via the agricultural use of biosolids for fertilizer generated at the Robert W. Hite Treatment Facility and potentially containing PFAS from impacted wastewater from the facility. Additionally, domestic and irrigation wells downgradient of Buckley AASF create a potentially complete pathway for PFAS exposure to off-facility residents via ingestion of groundwater. Numerous adjacent sources were identified where PFAS releases to the environment occurred outside of the COARNG property boundary. The preliminary CSM for Buckley AASF, which presents the potential receptors and media impacted, is shown on **Figure ES-2**.

Based on the US Environmental Protection Agency (USEPA) Unregulated Contaminant Monitoring Rule 3 data, it was indicated that no PFAS were detected in a public water system above the USEPA’s Lifetime Health Advisory level within 20 miles of the facility. PFAS analyses performed in 2016 had method detection limits that were higher than currently achievable. Thus, it is possible that low concentrations of PFAS were not detected during the UCMR3 but might be detected if analyzed today.



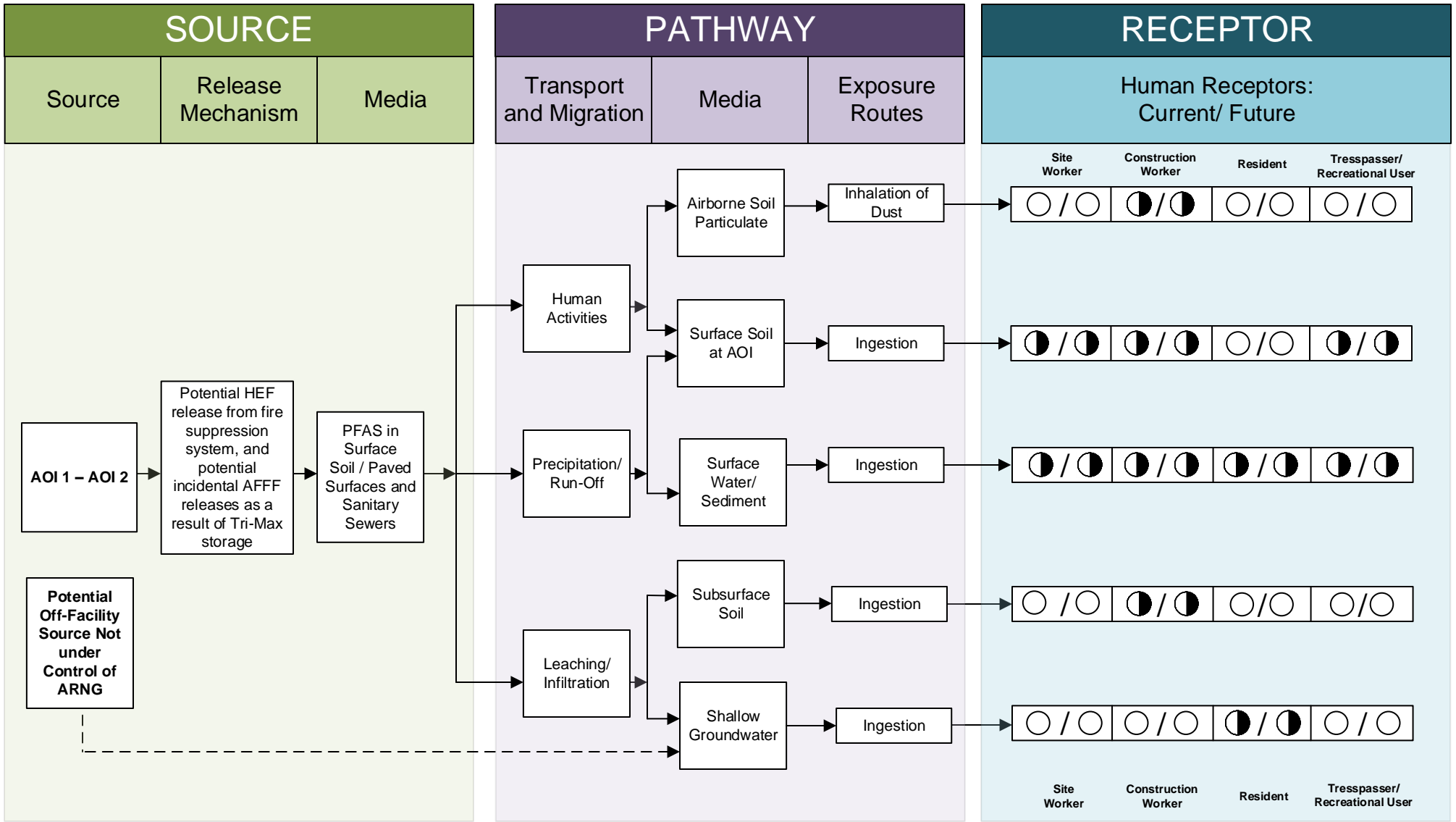
CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Buckley AASF, CO			
REVISED	4/8/2020	GIS BY	MS	4/8/2020
SCALE	1:30,000	CHK BY	JW	4/8/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	PM	RG		4/8/2020

- Area of Interest
- Potential PFAS Release
- No Suspected Release
- Facility Boundary
- Water Body
- River/Stream
- Canal/Ditch
- Pipeline



<b>Summary of Findings</b>	
	12420 Milestone Center Drive Germantown, MD 20876
Figure ES-1	

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**LEGEND**

- □ Flow-Chart Stops
- Flow-Chart Continues
- - - → Partial / Possible Flow
- Incomplete Pathway
- ◐ Potentially Complete Pathway
- Complete Pathway

**Notes:**

1. The resident and recreational user receptors refer to an off-site resident and recreational user.
2. The site worker and construction worker receptors refer only to COARNG Buckley AASF site and construction workers.
3. Dermal contact exposure pathway is incomplete for PFAS.

**Figure ES-2**  
 Preliminary Conceptual Site Model  
 Buckley AASF, CO

# 1. Introduction

## 1.1 Authority and Purpose

The Army National Guard (ARNG)-Installations & Environment Division is the lead agency in performing *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) at Impacted Sites at ARNG Facilities Nationwide*. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor AECOM Technical Services, Inc. (AECOM) under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017.

The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS), primarily in the form of aqueous film forming foam (AFFF) released as part of firefighting activities, although other PFAS sources are possible. In addition, the ARNG is assessing businesses or operations adjacent to the ARNG facility (not under the control of ARNG) that could potentially be responsible for a PFAS release.

PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. PFAS formulations contain highly diverse mixtures of compounds. Thus, the fate of PFAS compounds in the environment varies. The regulatory framework at both federal and state levels continues to evolve. The US Environmental Protection Agency (USEPA) issued Drinking Water Lifetime Health Advisories (HAs) for PFOA and PFOS in May 2016, but there are currently no promulgated national standards regulating PFAS in drinking water. In the absence of federal maximum contaminant levels, some states have adopted their own drinking water standards for PFAS. Colorado does not currently have drinking water standards for PFAS. Colorado House Bill 1279 was passed in June 2019 and prohibits the sale of PFAS-containing firefighting foam in certain circumstances, prohibits the use of PFAS-containing foam for training, and requires the Colorado Department of Health to conduct a survey to determine the amount of PFAS-containing foam currently held, used, and disposed of by state fire departments (House Bill 19-1279, 2019 Regular Session [Co. 2019]).

This report presents the findings of a PA for PFAS-containing materials at Buckley Army Aviation Support Facility (Buckley AASF; also referred to as the “facility”), in Aurora, Colorado, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] Part 300), and Army requirements and guidance.

This PA documents locations where PFAS-containing materials may have been released into the environment at Buckley AASF. The term PFAS will be used throughout this report to encompass all PFAS chemicals being evaluated, including PFOS and PFOA, which are key components of AFFF.

## 1.2 Preliminary Assessment Methods

The performance of this PA included the following tasks:

- Reviewed available administrative record documents and Environmental Data Resources, Inc. (EDR)<sup>TM</sup> report packages to obtain information relevant to potential PFAS releases, such as: drinking water well locations, historical aerial photographs, Sanborn maps, and environmental compliance actions in the area surrounding the facility;
- Conducted interviews on 18 December 2019 with Colorado ARNG (COARNG) personnel, including current and former Environmental Protection Specialists, the Environmental



Compliance Manager, the Facility Unit Environmental Compliance Officer, and the Facility Maintenance Supervisor;

- Identified Area(s) of Interest (AOIs) and developed a preliminary conceptual site model (CSM) to summarize potential source-pathway-receptor linkages of potential PFAS in soil, groundwater, surface water, and sediment for each AOI;
- AECOM did not perform a site visit at Buckley AASF.

### 1.3 Report Organization

This report has been prepared in accordance with the USEPA *Guidance for Performing Preliminary Assessments under CERCLA* (USEPA, 1991). The report sections and descriptions of each are as follows:

- **Section 1 – Introduction:** identifies the project purpose and authority and describes the facility location, environmental setting, and methods used to complete the PA
- **Section 2 – Fire Training Areas:** describes the fire training areas (FTAs) at the facility identified during interviews
- **Section 3 – Non-Fire Training Areas:** describes other locations of potential PFAS releases at the facility identified during interviews
- **Section 4 – Emergency Response Areas:** describes areas of potential PFAS release at the facility, specifically in response to emergency situations
- **Section 5 – Adjacent Sources:** describes sources of potential PFAS release adjacent to the facility that are not under the control of ARNG
- **Section 6 – Preliminary Conceptual Site Model:** describes the pathways of PFAS transport and receptors for the AOIs and the facility
- **Section 7 – Conclusions:** summarizes the data findings and presents the conclusions of the PA
- **Section 8 – References:** provides the references used to develop this document
- **Appendix A – Data Resources**
- **Appendix B – Preliminary Assessment Documentation**

### 1.4 Facility Location and Description

The Buckley AASF is a tenant of the Buckley Air Force Base (AFB) located in Aurora, Colorado (**Figure 1-1**). The COARNG has maintained a presence at Buckley AFB 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 aircrafts. The facility is located west of the Buckley AFB 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 AFB runway. An additional joint-use building shared by the COARNG and Buckley AFB is located on a flight ramp predominantly used by Buckley AFB, approximately 0.5 miles north of the COARNG Buckley AASF complex. The larger Buckley AFB property, which is zoned entirely for Buckley AFB use, encompasses 3,540 acres. The COARNG Buckley AASF is leased from the Buckley AFB. The 2000 Department of the Army license for the use of the Buckley AASF property by the COARNG is included in **Appendix A**.

The Department of the Army 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 (COANG). The base was reassigned from the ANG to the Air Force Space Command and renamed Buckley AFB in 2001.

## 1.5 Facility Environmental Setting

Buckley AASF and the area surrounding the larger Buckley AFB complex includes industrial and agricultural land to the north, commercial and residential to the west, residential and agricultural to the south, and agricultural to the east (USEPA, 2019). Buckley AFB is situated on high ground dividing the Sand Creek and Toll Gate Creek drainage basins. The ground surface elevation of Buckley AFB ranges from 5,700 feet (ft) above mean sea level (msl) at the southeast corner to 5,480 ft above msl at the northwest corner. The COARNG Buckley AASF is situated at approximately 5,585 ft above msl, towards the center of the AFB property (USEPA, 2019).

Most of the Buckley AASF facility is paved with asphalt or concrete, with the exception of grassy areas surrounding the improved portions of the facility. 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 AFB area. 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.

### 1.5.1 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 AFB property (USEPA, 2019).

The majority of the Denver Formation is composed of approximately 70 percent shale and claystone, with the remaining materials composed of coarser-grained sediments irregularly dispersed in lenticular beds. Under Buckley AFB, the Denver Formation is approximately 850 ft 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 ft 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 AFB encountered alluvial, and possibly aeolian, soils from ground surface to approximately 12 ft 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 1-2**.

## 1.5.2 Hydrogeology

Groundwater under the greater Buckley AFB 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 AFB 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 AFB (in descending order). Due to the thickness and hydrogeologic conditions of the Denver Formation, surficial PFAS releases are unlikely to impact the deeper aquifers. The Denver Formation is 600 to 1,000-ft 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 1-2**) (URS, 2007). Groundwater flow direction at a former landfill adjacent to the southwest of the facility is towards the northwest and is presumed to be the same at the facility (USEPA, 2014).

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 Denver Aquifer groundwater at Buckley AASF is not used as a water source for drinking or irrigation for the COARNG or off-site receptors. According to the 2014 ROD for the previously mentioned former landfill located approximately 0.2 miles south of Buckley AASF, depth to groundwater is estimated to be between 40 and 50 ft bgs in the southeastern portion of the landfill. EDR™ report conducted a well search for a 1-mile radius surrounding the facility (**Appendix A**). Using additional online resources, such as state and local GIS databases, wells were researched to a 4-mile radius of the facility. Numerous wells of various use exist in all directions surrounding the facility.

Based on the USEPA Unregulated Contaminant Monitoring Rule 3 data, it was indicated that no PFAS were detected in a public water system above the HA within 20 miles of Buckley AASF. PFAS analyses performed in 2016 had method detection limits that were higher than currently achievable. Thus, it is possible that low concentrations of PFAS were not detected during the UCMR3 but might be detected if analyzed today.

## 1.5.3 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 towards the stormwater retention pond, and 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 facility, 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 freshwater pond, is also located within the greater Buckley AFB, approximately 1 mile northeast of the AASF property (USFWS, 2020). Overflow from Lake Williams drains through a series of two unnamed tributaries to Sand Creek (USEPA, 2019). Nearby surface water bodies are shown on **Figure 1-3**.

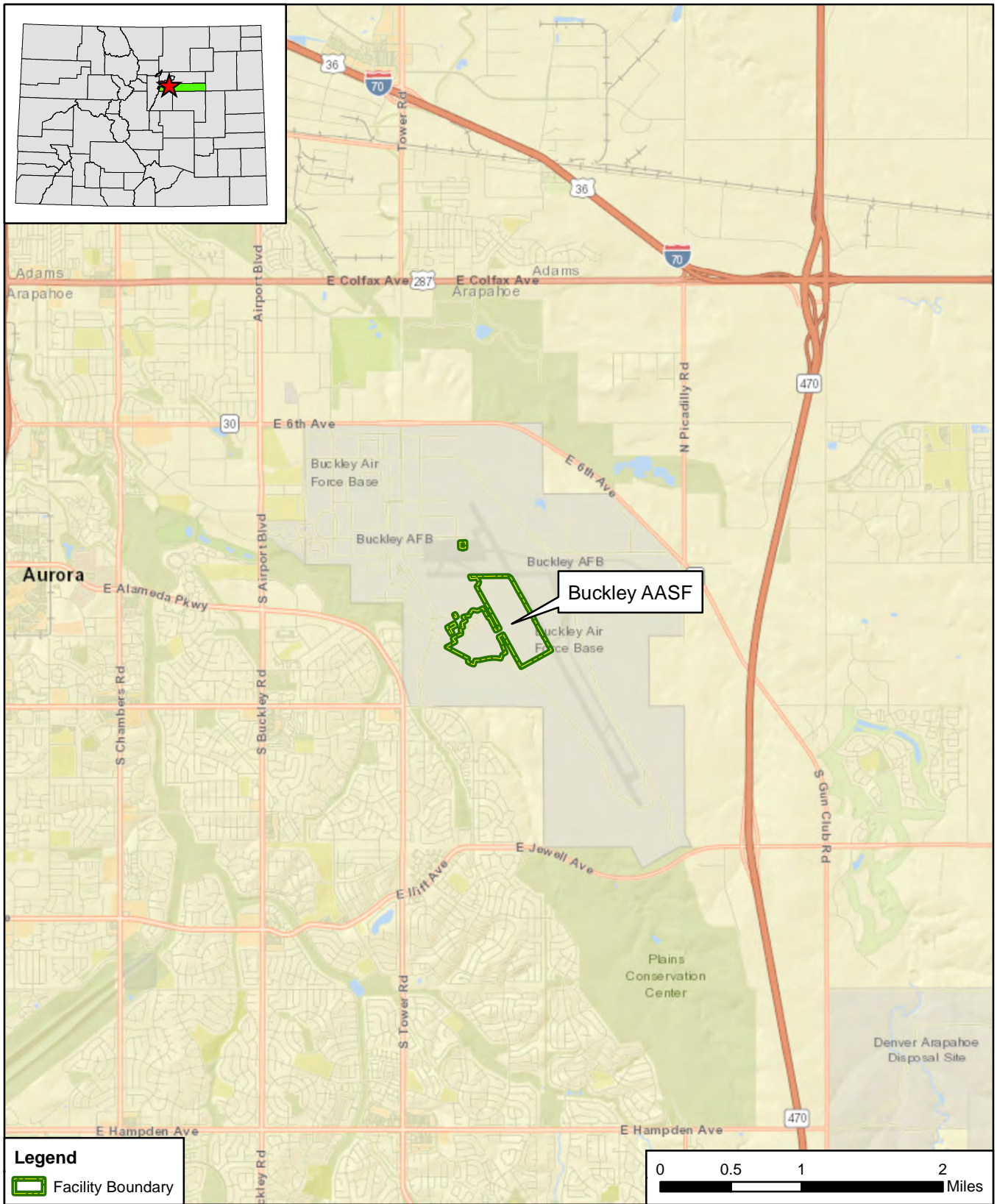
Flood Insurance Rate Maps for Arapahoe County identify the entire Buckley AFB as an area of minimal flood hazard. The nearest flood zone is associated with the East Toll Gate Creek floodplain and is located approximately 0.2 miles northwest of the facility (Federal Emergency Management Agency [FEMA], 2020).

#### 1.5.4 Climate

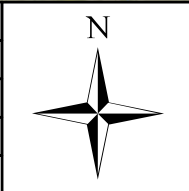
Data from the Denver International Airport weather station, located approximately 11 miles northeast of the COARNG AASF, indicate that the annual average temperature between 1981 and 2010 was 50.5 degrees Fahrenheit (°F) (National Oceanic and Atmospheric Administration [NOAA], 2020). The warmest months are July and August, with normal daily average temperatures of 74.2°F and 72.5°F, respectively. December is the coldest month, with an average temperature of 30.0°F. Average annual precipitation measured from 1981 to 2010 at the airport was 14.30 inches, with the most rain occurring May through July (NOAA, 2020). The average annual snowfall for the nearby City of Denver, as reported by the Western Regional Climate Center, is 53.8 inches (Western Regional Climate Center, 2020). The majority of snowfall occurs between February and April.

#### 1.5.5 Current and Future Land Use

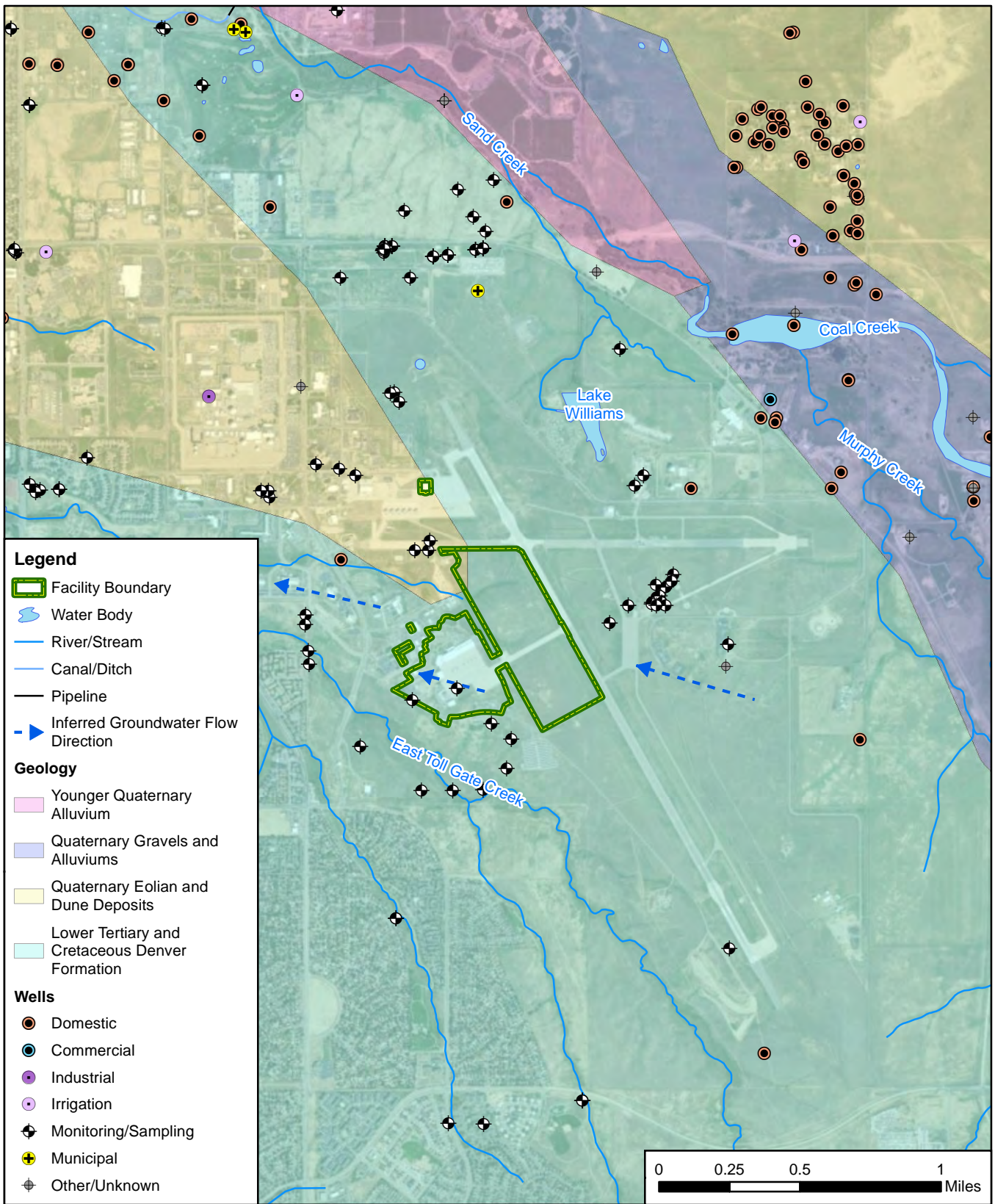
The Buckley AASF is designed to house, equip, support, and maintain military helicopters for the COARNG. Future land use at the AASF is not anticipated to change, given its recent construction. The land use of the surrounding Buckley AFB is also not anticipated to change.



<b>Legend</b>				
	Facility Boundary			
CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Buckley AASF, CO			
REVISED	1/29/2020	GIS BY	MS	1/29/2020
SCALE	1:63,360	CHK BY	JW	1/29/2020
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	1/29/2020



<b>Facility Location</b>	
<b>AECOM</b> 12420 Milestone Center Drive Germantown, MD 20876	<b>Figure 1-1</b>



**Legend**

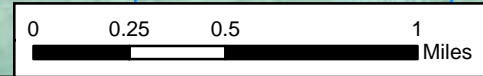
- Facility Boundary
- Water Body
- River/Stream
- Canal/Ditch
- Pipeline
- Inferred Groundwater Flow Direction

**Geology**

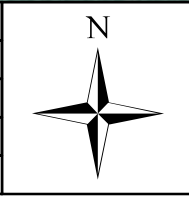
- Younger Quaternary Alluvium
- Quaternary Gravels and Alluviums
- Quaternary Eolian and Dune Deposits
- Lower Tertiary and Cretaceous Denver Formation

**Wells**

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



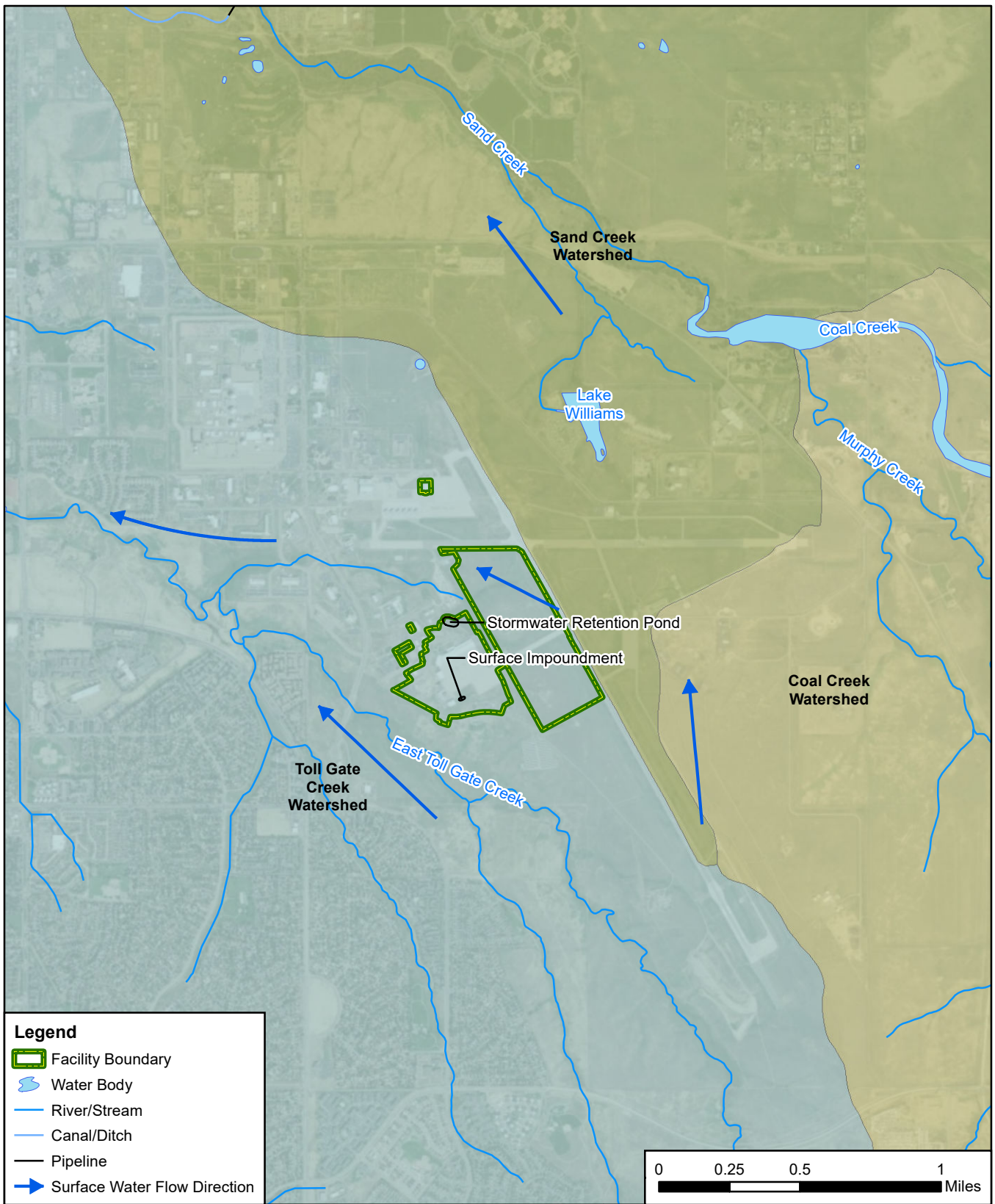
CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Buckley AASF, CO			
REVISED	4/8/2020	GIS BY	MS	4/8/2020
SCALE	1:31,680	CHK BY	JW	4/8/2020
<small>Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,</small>				
	PM	RG		4/8/2020



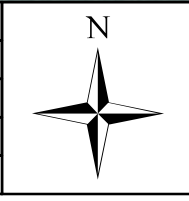
**Groundwater Features**

12420 Milestone Center Drive  
Germantown, MD 20876

**Figure 1-2**



CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Buckley AASF, CO			
REVISED	4/14/2020	GIS BY	MS	4/14/2020
SCALE	1:31,680	CHK BY	JW	4/14/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	4/14/2020



<b>Surface Water Features</b>	
<b>AECOM</b> 12420 Milestone Center Drive Germantown, MD 20876	<b>Figure 1-3</b>

## 2. Fire Training Areas

FTAs are considered areas where deliberate discharge of AFFF or other firefighting materials is performed for purposes of training personnel. No FTAs were identified at Buckley AASF during the PA through interviews and review of the Environmental Data Resources, Inc. (EDR)<sup>TM</sup> report for a 1-mile radius surrounding the facility (**Appendix A**). Using additional online resources, such as state and local GIS databases, wells were researched to a 4-mile radius of the facility. Buckley AFB has its own fire department that responds to emergencies across the greater AFB area, including the Buckley AASF. FTAs associated with the Buckley AFB fire department are located on Buckley AFB, outside of the COARNG property and are discussed as adjacent sources in **Section 5**.



### 3. Non-Fire Training Areas

In addition to FTAs, the PA evaluated areas where PFAS-containing materials may have been broadly used, stored, or disposed. This may include buildings with fire suppression systems, paint booths, AFFF storage areas, and areas of compliance demonstrations. Information on these features obtained during the PA are included in **Appendices A** and **B**. Several non-FTAs where AFFF could have been potentially stored and/or released were identified via interviews during the PA. A description of each non-FTA is presented below, and the non-FTAs are shown on **Figure 3-1**. COARNG personnel interviewed for this PA have first-hand knowledge as employees stationed at Buckley AFB in various capacities (both as COARNG and COANG employees) spanning 1995 to 2000 and 2016 to present. The collective tenure of COARNG employees that were interviewed as a part of this PA but stationed at other COARNG locations had knowledge of the Buckley AASF spanning from 1995 to present.

#### 3.1 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 ten bay doors with access to ten 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 High Expansion Foam (HEF) deluge fire suppression system that contains 900 gallons of Ansul Jet-X 2 ¾% 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 three-minute discharge of an unknown volume of Ansul Jet-X 2 ¾% 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. According to facility staff with knowledge of the test, no HEF is known to have escaped the building during the test. 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. A video of the 2006 HEF system test provided by COARNG is included in **Appendix A**.

The Safety Data Sheet (SDS) for the Ansul product used in the Building 1510 fire suppression system does not include PFAS in its composition, but it only lists hazardous components. The Data Sheet for the product (**Appendix A**) states that Building 1510's fire suppression system uses a hydrocarbon surfactant; however, no material information definitively states that Ansul Jet-X 2 ¾% HEF Concentrate does not include PFAS.

Additionally, Buckley AASF formerly stored six Tri-Max™ wheeled fire extinguishers containing Chemguard 3% C-303 AFFF concentrate in the northeast corner of the COARNG property, east of Building 1510. In September 2019, a capture berm was assembled in the GSE Building portion of Building 1510 for the transferal of the AFFF concentrate contents of the Tri-Max™ units into storage drums. Facility personnel present during the operation stated that no spills occurred, and three drums of AFFF concentrate were generated from the Tri-Max™ units. The drums were disposed of by Buckley AFB along with other AFB waste materials. Waste manifest documents

for the disposal of the drums are included in **Appendix A**. The empty Tri-Max™ units were moved to Building 1511A for storage.

Based on the known release of HEF during the 2006 fire suppression system test and the uncertainty of PFAS content in HEF, Building 1510 is considered a potential PFAS release area.

### 3.2 Former Tri-Max™ Storage Area

As previously stated, Buckley AASF formerly stored six Tri-Max™ wheeled fire extinguishers containing Chemguard 3% C-303 AFFF concentrate in the northeast corner of the COARNG property. 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. Facility personnel present during the disposal stated that no spills occurred. Based on the outdoor storage of the Tri-Max™ units and the corrosive nature of AFFF, it is possible that incidental releases occurred in this area.

Based on the potential for incidental release of AFFF from Tri-Max™ units during their outdoor storage, the Former Tri-Max™ Storage Area is considered a potential PFAS release area.

### 3.3 Building 1511A

Building 1511A is a cold storage building at Buckley AASF and is located on the west end of the flight ramp. The building was constructed circa 2006, at the same time Building 1510 was constructed. According to facility personnel, Building 1511A is not equipped with a fire suppression system and has never been the location of an emergency requiring AFFF use in response. Empty Tri-Max™ units that formerly stored Chemguard 3% C-303 AFFF concentrate have been stored within Building 1511A since September 2019, after their contents were transferred to drums for disposal off-facility. The empty Tri-Max™ units are designated to be rinsed prior to disposal off-facility by a private contractor; however, the units had not been disposed of at the time of this PA. It is presumed that floor drains in Building 1511A connect to sanitary system sewers similarly to the floor drains in Building 1510.

Personnel whose tenure with the COARNG span the entire history of the AASF stated during interviews that no known AFFF releases have occurred at Building 1511A. Building 1511A is not considered a potential PFAS release area.

### 3.4 Building 1500

Building 1500 is located towards the southwest corner of the flight ramp, and consists of two aircraft hangars and an attached office space. It is used for the maintenance and storage of military aircraft. According to COARNG interviewees, Building 1500 was constructed in 1977 and has been used as a hangar by the COARNG since its construction.

According to COARNG interviewees, the fire suppression system at Building 1500 uses only water, and no emergency events requiring AFFF use have ever occurred at the building. In December 2017, a marine helicopter leaked approximately 0.5 gallons of oil on the paved area east of Building 1500. Personnel present during the spill stated that sorbent pads were used to clean the oil, and Halon was present as a cautionary measure in response to the spill. The specific type of Halon product present and the capacity in which it was used are unknown. Halon is a fire extinguishing agent that contains bromochlorodifluoromethane and is almost universally used as an aircraft fire extinguisher. As a chlorofluorocarbon, Halon production has ceased, but many Halon products remain in circulation until used for their intended purpose. An incident report form for the oil spill is included in **Appendix A**. No evidence indicates that AFFF has ever been used

or stored at Building 1500, and no other known emergencies have occurred at the building. Building 1500 is not considered a potential PFAS release area.

### 3.5 Building 1515

Building 1515 is another hangar at the AASF used for the maintenance and storage of military aircraft in the southwest corner of the flight ramp. Based on historical aerial imagery, Building 1515 was constructed in 2014 and was previously used as a storage area, with two smaller buildings occupying the space. The materials stored in this area prior to the construction of Building 1515 and the purpose of the previous buildings occupying the space are unknown.

According to COARNG interviewees, there is no fire suppression system at Building 1515, and no emergency events requiring AFFF use have ever occurred at the building. No evidence indicates that AFFF has ever been used or stored at Building 1515; Building 1515 is not considered a potential PFAS release area.

### 3.6 Building 1000

Building 1000 operates as a readiness center at Buckley AASF and is located west of Building 1511A, in the western portion of COARNG property. Based on historical aerial imagery, Building 1000 was constructed between 1984 and 1991, and an addition on the southern side of the building was constructed in 2004. According to COARNG interviewees, the building has operated as a readiness center for the COARNG since its construction.

No evidence indicates that AFFF has ever been stored or used at the readiness center, and the building does not include an AFFF fire suppression system. No emergency events requiring AFFF use are known to have ever occurred at the building. Building 1000 is not considered a potential PFAS release area.

### 3.7 Building 1005

Building 1005 is used as an administrative and office space for active guard duty operations, and it is the northwestern-most building associated with the Buckley AASF. Based on historical aerial imagery, Building 1005 was constructed between 1993 and 1994. According to COARNG interviewees, Building 1005 has always operated as a readiness center/administrative office space.

No evidence indicates that AFFF has ever been stored or used at Building 1005, and no emergency events requiring AFFF use are known to have ever occurred at the building. Building 1005 is not considered a potential PFAS release area.

### 3.8 Hangar 909

Hangar 909 is a joint-use building shared by the COARNG and Buckley AFB. The hangar is located on a flight ramp predominantly used by Buckley AFB, approximately 0.5 miles north of the COARNG Buckley AASF complex. Information provided in a 2015 PA for perfluorinated compounds at Buckley AFB indicates that Hangar 909 has never been equipped with fire suppression systems, and the hangar was not further investigated for PFAS (HydroGeoLogic, Inc., 2015). COARNG interviewees confirmed the findings of the PA with respect to Hangar 909 and do not consider the area to be of PFAS concern.

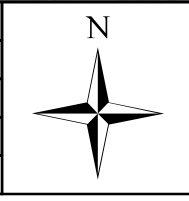
No evidence indicates that AFFF has ever been stored or used at Hangar 909; it is not considered a potential PFAS release area.

### 3.9 Flight Ramp

The Flight Ramp is located at the center of the Buckley AASF property and comprises approximately 12 acres of paved surface used for aircraft parking. Based on historical aerial imagery, the Flight Ramp was constructed between 1970 and 1979. Based on the COARNG presence at Buckley AASF since 1977, the Flight Ramp is presumed to have been operated by the COARNG for the entirety of its existence. Flight ramps may commonly be the location for incidents involving fueling or maintenance that may require fire suppression or prevention; however, facility personnel stated that no incidents have occurred on the flight ramp requiring such response. The Flight Ramp is not considered a potential PFAS release area.



CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Buckley AASF, CO			
REVISED	4/8/2020	GIS BY	MS	4/8/2020
SCALE	1:7,200	CHK BY	JW	4/8/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	4/8/2020



<b>Non-Fire Training Areas</b>	
<b>AECOM</b>	<b>Figure 3-1</b>
12420 Milestone Center Drive Germantown, MD 20876	

## 4. Emergency Response Areas

COARNG staff confirmed that no known incidents requiring AFFF fire suppression have occurred during their collective tenure spanning from 1995 to 2000 and 2016 to present as employees working at the facility, and from 1995 to present as COARNG employees with knowledge of the facility. Emergency responses to crashes sometimes require flame suppression, which may result in the release of PFAS to the environment in the form of AFFF.

## 5. Adjacent Sources

Several potential off-facility sources of PFAS adjacent to the Buckley AASF, not under the control of the COARNG, were identified during the PA through interviews, review of the EDR™ report for a 1-mile radius surrounding the facility (**Appendix A**), and historical document review. Using additional online resources, such as state and local GIS databases, wells were researched to a 4-mile radius of the facility. A description of each potential adjacent source is presented below, and the sources are shown on **Figure 5-1**.

### 5.1 Buckley Air Force Base

Fire training and other activities resulting in PFAS releases have occurred in several locations associated with the Buckley AFB. Based on a 2019 SI report for AFFF use at Buckley AFB (**Appendix A**), two 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 2019 SI report used the USEPA's Regional Screening Level calculator to identify a screening level for PFOS and PFOA in soil and sediment of 126 micrograms per kilogram (µg/kg). Screening levels used for PFOS and PFOA in groundwater and surface water were based on the USEPA HA (0.07 micrograms per liter [µg/L]). The SI report also established a screening level of 130,000 µg/kg for perfluorobutane sulfonate (PFBS) in soil and sediment, and 40 µg/L for PFBS in groundwater and surface water (Aerostar SES LLC, 2019).

The AFFF release areas at Buckley AFB investigated as part of the 2019 SI report are identified in **Table 5-1** below.

**Table 5-1: Buckley AFB AFFF Release Locations**

AFFF Release Areas	Nature of Release or Potential Release
FTA No. 2	FTA No. 2 was an unlined burn area for jet fuels and was operational between 1950 and 1972. 2019 SI sample results indicated that PFOA and PFOS concentrations exceeded their respective screening criteria in surface soil and groundwater, and that a pathway for exposure to impacted drinking water is potentially complete.
FTA No. 3	<p>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.</p> <p>2019 SI sample results indicated that PFOS concentrations exceeded screening criterion in surface soil, and PFOA and PFOS concentrations exceeded screening criteria in groundwater. The pathway for exposure to impacted drinking water is potentially complete.</p>
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

AFFF Release Areas	Nature of Release or Potential Release
	<p>nearby road. AFFF solution also migrated from the nearby road surface to stormwater sewers.</p> <p>2019 SI sample results indicated that PFOA and PFOS concentrations exceeded screening criteria in groundwater, and the pathway for exposure to impacted drinking water is potentially complete.</p>
Former Fire Station #2	<p>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.</p> <p>2019 SI sample results indicated that PFOS concentrations exceeded screening criterion in surface soil, and PFOA and PFOS concentrations exceeded screening criteria in groundwater. The pathway for exposure to impacted drinking water is potentially complete.</p>
F-5 Crash Site	<p>Approximately 100 to 200 gallons of AFFF were sprayed on a fuel spill resulting from an aircraft crash on the Buckley AFB runway in the late 1980s. 2019 SI sample results indicated that PFOS concentrations exceeded screening criteria in surface soil, and that a pathway for exposure to impacted drinking water is potentially complete.</p>
F-16 Crash Site	<p>Approximately 200 gallons of AFFF were sprayed at the location of an aircraft crash on grass adjacent to the south end of the Buckley AFB runway in 1995. 2019 SI sample results indicated that no PFAS compounds were detected over their respective screening criteria, and that the pathway for exposure to impacted drinking water is considered incomplete.</p>

## 5.2 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 of the facility, and Fire Station No. 8 is approximately 2.5 miles northwest 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 a potential PFAS release areas.

## 5.3 Site 3 – Former Base Landfill

There are no landfills within the footprint of the COARNG property; however, Buckley AFB Installation Restoration Program Site 3 comprises the Former Base Landfill and is located immediately south 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



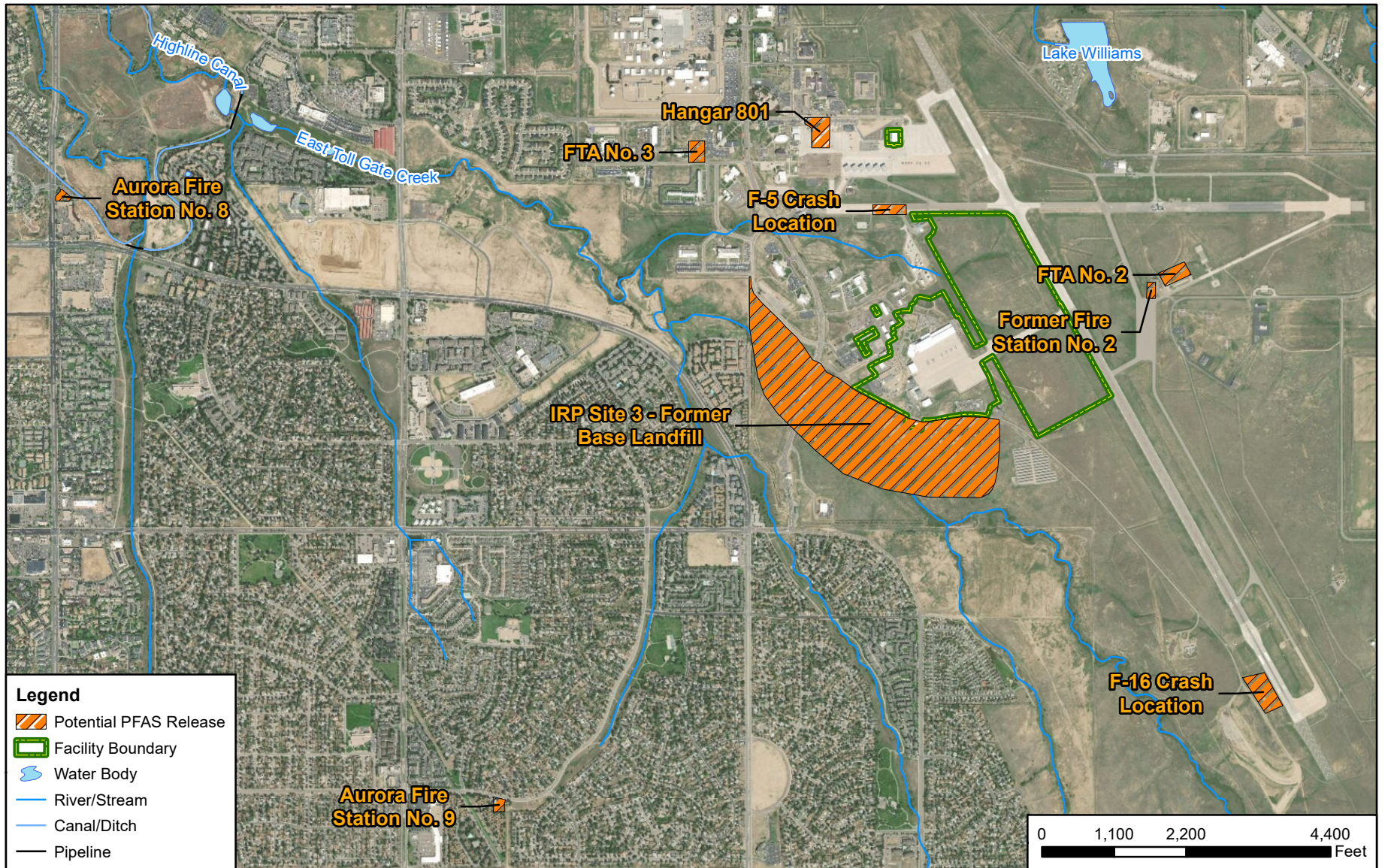
Former Base Landfill was to dig a trench, fill the trench with waste material, and cover the material with earth. Portions of Site 3 are bisected by East Toll Gate Creek (USEPA, 2014).

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 PFAS releases at locations on Buckley AFB may have contributed to waste-containing PFAS being disposed of at the landfill. As such, Site 3 is considered an adjacent potential PFAS release area.

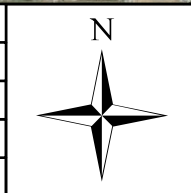
## 5.4 WWTPs

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 of the facility, along the 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 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 PFAS release areas. These locations are not shown on **Figure 5** due to their distance from the Buckley AASF.



CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Buckley AASF, CO			
REVISED	2/25/2020	GIS BY	MS	2/25/2020
SCALE	1:26,400	CHK BY	JW	2/25/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	PM	RG	2/25/2020	



TITLE	<b>Adjacent Sources</b>	
<b>AECOM</b>	12420 Milestone Center Drive Germantown, MD 20876	<b>Figure 5-1</b>

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## 6. Preliminary Conceptual Site Model

Based on the PA findings, two AOIs were identified at Buckley AASF, AOI 1 Building 1510 and AOI 2 the Former Tri-Max™ Storage Area. The AOI locations are shown on **Figure 6-1**. The following sections describe the CSM components and the specific preliminary CSM developed for each AOI. The CSMs identify the three components necessary for a potentially complete exposure pathway: (1) source, (2) pathway, (3) receptor. If any of these elements are missing, the pathway is considered incomplete.

In general, the potential PFAS exposure pathways are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of PFAS toxicological study (National Ground Water Association, 2018). Receptors at the Buckley AASF include site workers, construction workers, trespassers, and off-facility recreational users of the surrounding water bodies. The preliminary CSM diagram for the Buckley AASF indicates which specific receptors could potentially be exposed to PFAS.

### 6.1 AOI 1 Building 1510

AOI 1 comprises Building 1510, the main hangar space at Buckley AASF, where potential PFAS releases may have occurred. PFAS releases are suspected to have occurred during the HEF fire suppression system test circa 2006. 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.

Although it is unclear whether the HEF product released at Buckley AASF contains PFAS, it is conservatively assumed to do so for the purpose of this PA. 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. Surface water runoff during storm events may have also carried PFAS to the landscaped areas on the north side of Building 1510. As such, it is possible that PFAS infiltrated subsurface soil via cracks in pavement, joints between areas that are paved with different materials on the north and south side of the building, and surface soil in the landscaped areas to the north. If HEF released at the AOI infiltrated surface soil, then surface soil presents a potentially complete pathway for PFAS exposure to site workers, construction workers, and trespassers via ingestion and inhalation. If HEF infiltrated subsurface soil at the AOI, then ground-disturbing activities may result in PFAS exposure to construction workers via ingestion and inhalation. Accidental ingestion of groundwater during ground-disturbing activities is not considered a potentially complete pathway for exposure to PFAS due to the presumed 40-50 ft depth to groundwater.

During the HEF system release, HEF was directed towards sanitary sewer drains 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. As such, off-facility recreational users of the South Platte River as well as human and animal consumers of Metrogro Farm products may be exposed to PFAS via ingestion.

Surface water runoff may have also carried PFAS on paved surfaces around Building 1510 towards the retention pond north of Building 1510. If any PFAS escaped the facility via surface water runoff and entered the small stream in the northeastern portion of the facility, it is also possible that PFAS may have migrated to East Toll Gate Creek, Sand Creek, and ultimately, the South Platte River. As such, surface water is considered a potentially complete pathway for off-

facility recreational users of the surface water bodies and for Buckley AASF site workers/construction workers entering the retention pond north of Building 1510.

PFAS are water soluble and can migrate readily from soil to groundwater via leaching. According to COARNG personnel, Buckley AASF and the surrounding areas are provided municipal water by the City of Aurora. Numerous wells of various types exist within the vicinity of the Buckley AASF, however, including domestic and irrigation wells downgradient of the facility (**Appendix A**). No drinking water wells exist at the facility. Because of the presence of domestic and irrigation wells downgradient from the AASF, groundwater is considered a potentially complete pathway for PFAS exposure to off-facility residents via ingestion.

The preliminary CSM diagram for AOI 1 is shown in **Figure 6-2**.

## 6.2 AOI 2 Former Tri-Max™ Storage Area

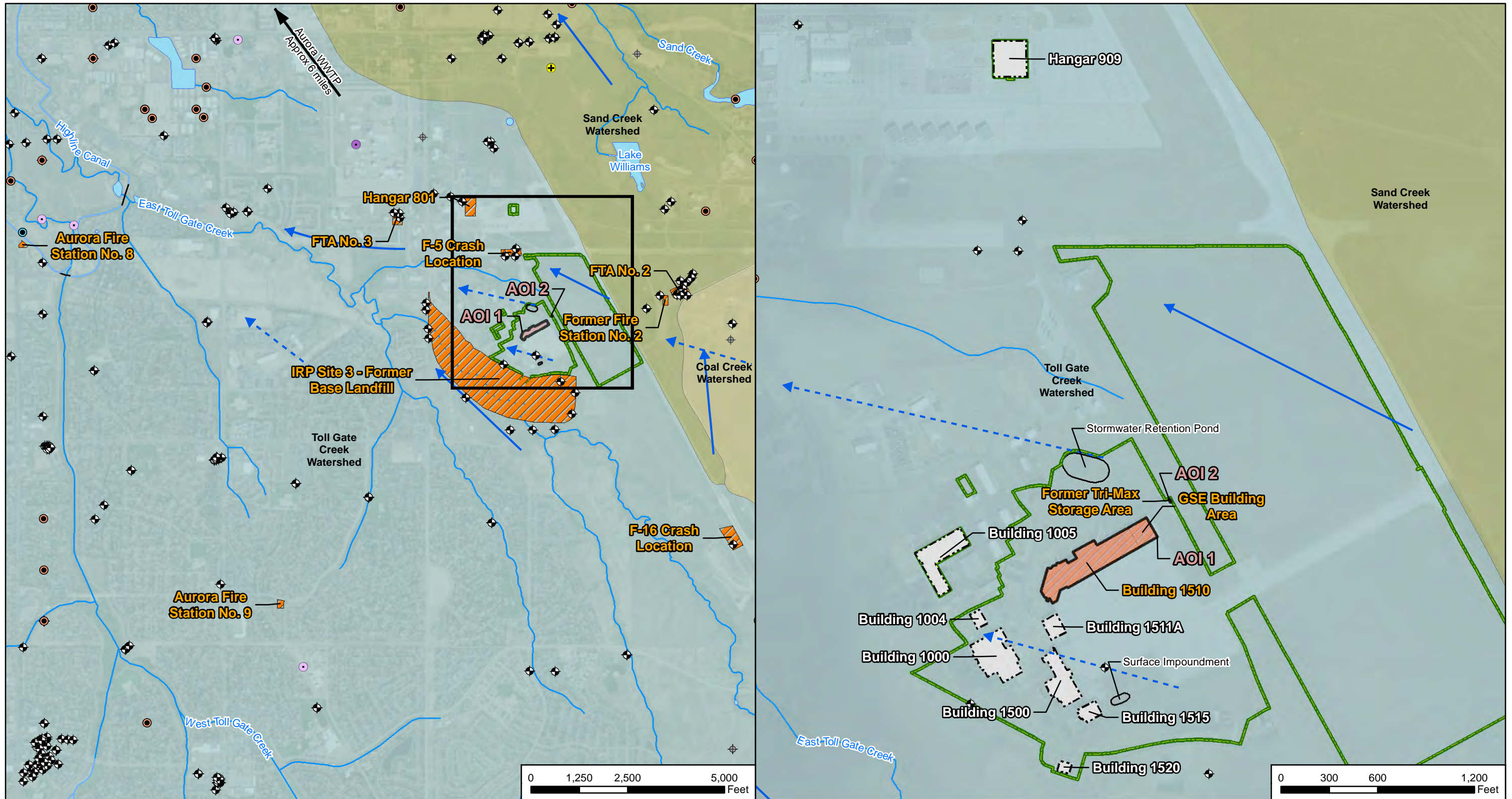
AOI 2 encompasses the area in the northeastern portion of the facility formerly used to store six Tri-Max™ wheeled fire extinguishers containing Chemguard 3% C-303 AFFF concentrate. Although no known PFAS releases have occurred in this area, the outdoor storage of Tri-Max™ and corrosive nature of AFFF may have led to incidental environmental releases of PFAS.

Potential PFAS releases at AOI 2 would most likely have occurred to paved surfaces, but may migrate a short distance to grassy areas. As such, it is possible that PFAS infiltrated surface and subsurface soil adjacent to the Former Tri-Max™ Storage area as well as subsurface soil beneath the storage area via cracks in pavement and joints between areas that are paved with different materials. Surface soil presents a potentially complete pathway for PFAS exposure to site workers, construction workers, and trespassers via ingestion and inhalation. Ground-disturbing activities at the AOI may also result in PFAS exposure to construction workers via ingestion and inhalation of subsurface soil. Accidental ingestion of groundwater during ground-disturbing activities is not considered a potentially complete pathway due to depth to groundwater.

Surface water runoff from AOI 2 carrying PFAS 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. If such migration occurred, then PFAS may have migrated to East Toll Gate Creek, Sand Creek, and ultimately, the South Platte River. As such, surface water is considered a potentially complete pathway for off-facility recreational users of the surface water bodies and for Buckley AASF site workers/construction workers entering the retention pond north of Building 1510.

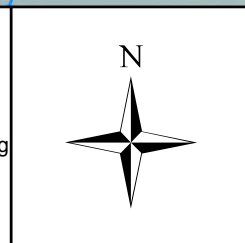
As previously stated, Buckley AASF and the surrounding areas are provided municipal water by the City of Aurora; however, domestic and irrigation wells exist downgradient of the facility (**Appendix A**). Because of the presence of these domestic and irrigation wells, groundwater is considered a potentially complete pathway for PFAS exposure to off-facility residents via ingestion.

The preliminary CSM diagram for AOI 2 is shown in **Figure 6-3**



CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Buckley AASF, CO			
REVISED	4/14/2020	GIS BY	MS	4/14/2020
SCALE	1:30,000	CHK BY	JW	4/14/2020
Base Map:	Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community			
	PM	RG		4/14/2020

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

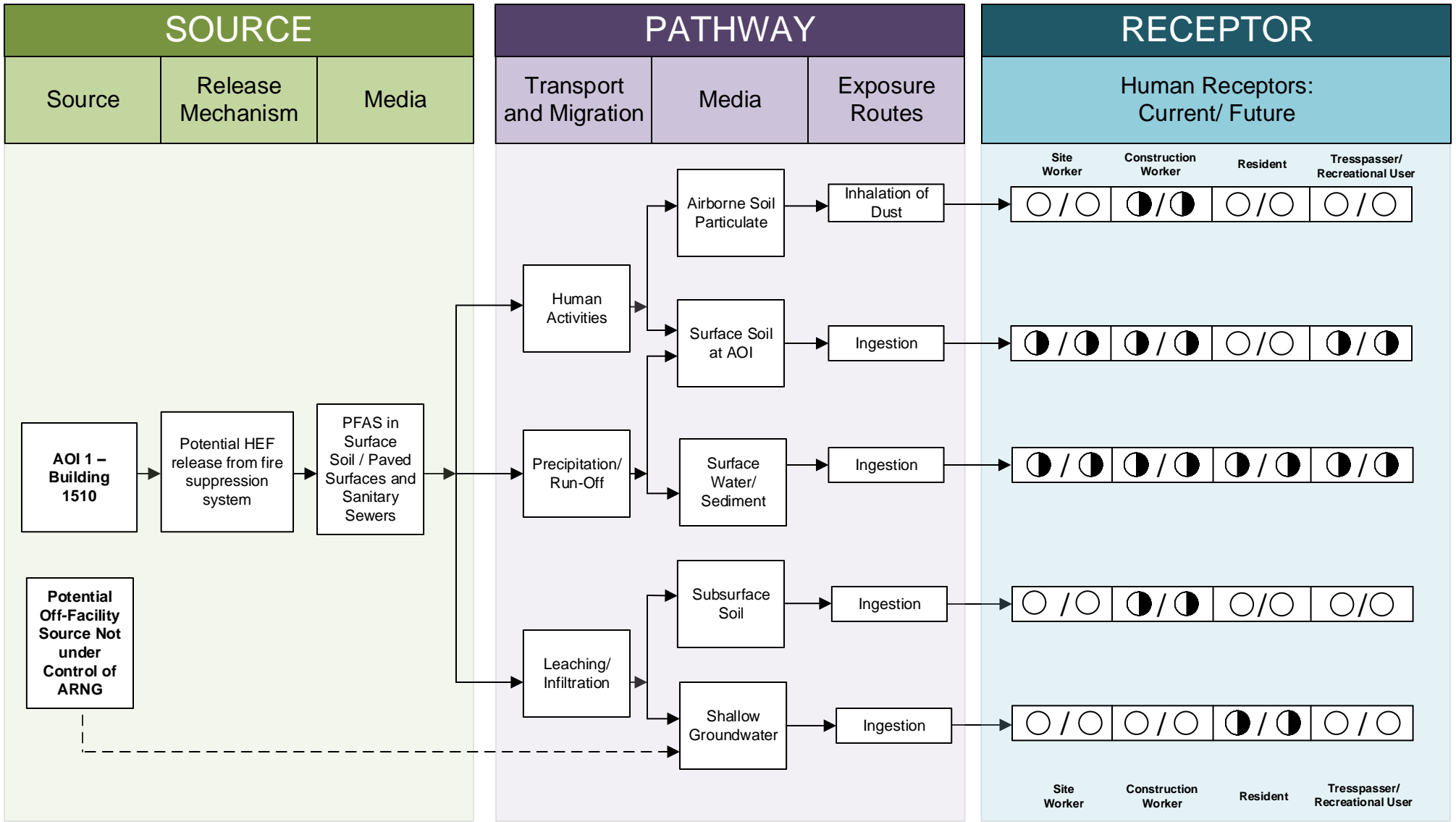


**Area of Interest**

**AECOM** 12420 Milestone Center Drive  
Germantown, MD 20876

**Figure 6-1**

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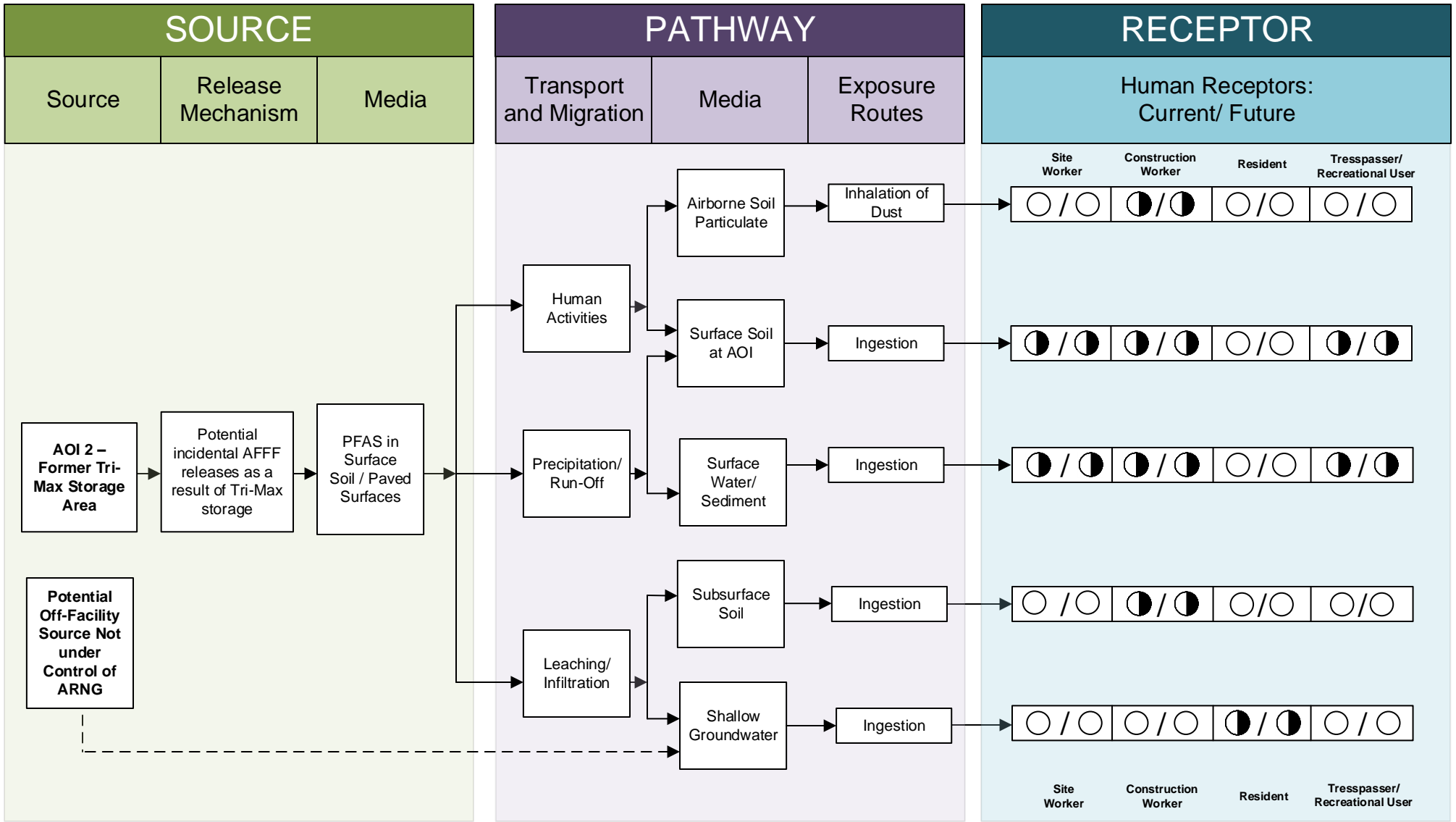
**LEGEND**

- □ Flow-Chart Stops
- > Flow-Chart Continues
- - -> Partial / Possible Flow
- Incomplete Pathway
- ◐ Potentially Complete Pathway
- Complete Pathway

**Notes:**

1. The resident and recreational user receptors refer to an off-site resident and recreational user.
2. The site worker and construction worker receptors refer only to COARNG Buckley AASF site and construction workers.
3. Dermal contact exposure pathway is incomplete for PFAS.

**Figure 6-2**  
 Preliminary Conceptual Site Model  
 AOI 1 – Building 1510 26



**LEGEND**

- □ Flow-Chart Stops
- > Flow-Chart Continues
- - -> Partial / Possible Flow
- Incomplete Pathway
- ◐ Potentially Complete Pathway
- Complete Pathway

**Notes:**

1. The resident and recreational user receptors refer to an off-site resident and recreational user.
2. The site worker and construction worker receptors refer only to COARNG Buckley AASF site and construction workers.
3. Dermal contact exposure pathway is incomplete for PFAS.

**Figure 6-3**  
 Preliminary Conceptual Site Model  
 AOI 2 – Former Tri-Max Storage Area 27

## 7. Conclusions and Data Uncertainty

This report presents a summary of available information gathered during the PA on the use and storage of AFFF and other PFAS-related activities at the COARNG Buckley AASF facility. The PA findings are based on personnel interviews, environmental investigations and reports, and historical documents (**Appendix A** and **Appendix B**).

### 7.1 Findings

Two AOIs related to potential PFAS releases were identified at Buckley AASF based on PA data (**Figure 7-1**) and are summarized in **Table 7-1** below:

**Table 7-1: AOIs at Buckley AASF**

Area of Interest	Name	Used by	Potential Release Dates
AOI 1	Building 1510	COARNG	2006, 2019
AOI 2	Former Tri-Max™ Storage Area	COARNG	Unknown - 2019

Based on the possible PFAS releases at AOI 2 and the uncertain content of High Expansion Foam at AOI 1, there is potential for exposure to PFAS contamination in surface soil to site and construction workers, and trespassers via ingestion and inhalation; in subsurface soil to construction workers via ingestion and inhalation; and in surface water to site construction workers and off-facility recreational users via ingestion. There is also the potential for residents to consume produce grown off-facility that has been exposed to PFAS via the agricultural use of biosolids for fertilizer generated at the Robert W. Hite Treatment Facility and potentially containing PFAS from impacted wastewater from the facility. Additionally, domestic and irrigation wells downgradient of Buckley AASF create a potentially complete pathway for PFAS exposure to off-facility residents via ingestion of groundwater. Numerous adjacent sources were identified where PFAS releases to the environment occurred outside of the COARNG property boundary. The preliminary CSM for AOIs identified at Buckley AASF are shown on **Figure 6-2** and **Figure 6-3**.

The following areas discussed in **Section 2** and **Section 3** were determined to have no suspected PFAS releases to the environment (**Table 7-1**):

**Table 7-2: No Suspected Release Areas**

No Suspected Release Area	Used by	Rationale for No Suspected Release Determination
Building 1511A	COARNG	Despite the storage of empty Tri-Max™ units within Building 1511A, no available information indicates that AFFF or HEF has been used or released at this location.
Building 1500	COARNG	Readily available information indicates no evidence of HEF/AFFF stored or use at this location.
Building 1515	COARNG	Readily available information indicates no evidence of HEF/AFFF use at this location.
Building 1000	COARNG	Readily available information indicates no evidence of HEF/AFFF stored or use at this location.
Building 1005	COARNG	Readily available information indicates no evidence of HEF/AFFF stored or use at this location.



No Suspected Release Area	Used by	Rationale for No Suspected Release Determination
Flight Ramp	COARNG	Readily available information indicates no evidence of HEF/AFFF stored or use at this location.

## 7.2 Uncertainties

A number of information sources were investigated during this PA to determine the potential for PFAS-containing materials to have been present, used, or released at the facility. Historically, documentation of PFAS use was not required because PFAS were considered benign. Therefore, records were not typically kept by the ARNG on the storage, use, or disposition of AFFF.

The conclusions of this PA are based on all available information, including: previous environmental reports, EDRs™ and interviews. Interviews of personnel with direct knowledge of a facility generally provided the most useful insights regarding a facility's historical and current PFAS-containing materials. Sometimes the provided information could not be verified with corresponding facility documents. Gathered information has a degree of uncertainty due to the absence of written documentation, the limited number of personnel with direct knowledge, the time passed since PFAS were first used by the ARNG (1969 to present), and a reliance on personal recollection. Inaccuracies may arise in potential PFAS storage and use locations. There is also a possibility the PA has missed a source of PFAS, as the science of how PFAS may enter the environment continually evolves.

In order to minimize the level of uncertainty, readily available data regarding storage of PFAS were reviewed, tenured personnel were interviewed, and multiple persons were interviewed for the same potential source area.

**Table 7-3** summarizes the uncertainties associated with areas identified within the COARNG property:

**Table 7-3: Sources of Uncertainty**

Location	Source of Uncertainty
Building 1510	Although Jet-X 2 ¾% HEF concentrate does not list PFAS compounds on its SDS, the SDS only lists hazardous components, and does not definitively state that it does not contain PFAS compounds. It is unknown if Jet-X 2 ¾% HEF escaped via runoff or on the feet of staff during the system release. Additionally, it is unknown how plastic sheeting used to confine HEF released was disposed of.
Building 1515	Historical aerial imagery indicates that the area currently comprising Building 1515 was previously used for material storage. It is unknown what type of materials were previously stored in this area.
Building 1500	Building 1500 was constructed in 1977. The collective tenure of COARNG interviewees available for this PA spans 1995-present. There is a data gap between the construction of Building 1500 and the knowledge of COARNG interviewees.
Building 1000	Historical aerial imagery shows Building 1000 being constructed between 1984 and 1991. A data gap exists between the construction of Building 1000 and the knowledge of COARNG interviewees (1984-1995) .
Building 1005	Historical aerial imagery shows Building 1005 being constructed circa 1994. A data gap exists between the construction of Building 1005 and the knowledge of COARNG interviewees (1994-1995).

Flight Ramp	COARNG interviewees stated that the fire department performs occasional water salutes on the flight ramp. It is unknown whether the fire department vehicles used to perform water salutes also carry AFFF. Also, there is a data gap regarding possible incidents on the ramp prior to 1994.
Former Tri-Max™ Storage Area	It is unknown how long the Tri-Max™ units were stored in this area prior to their disposal in September 2019.

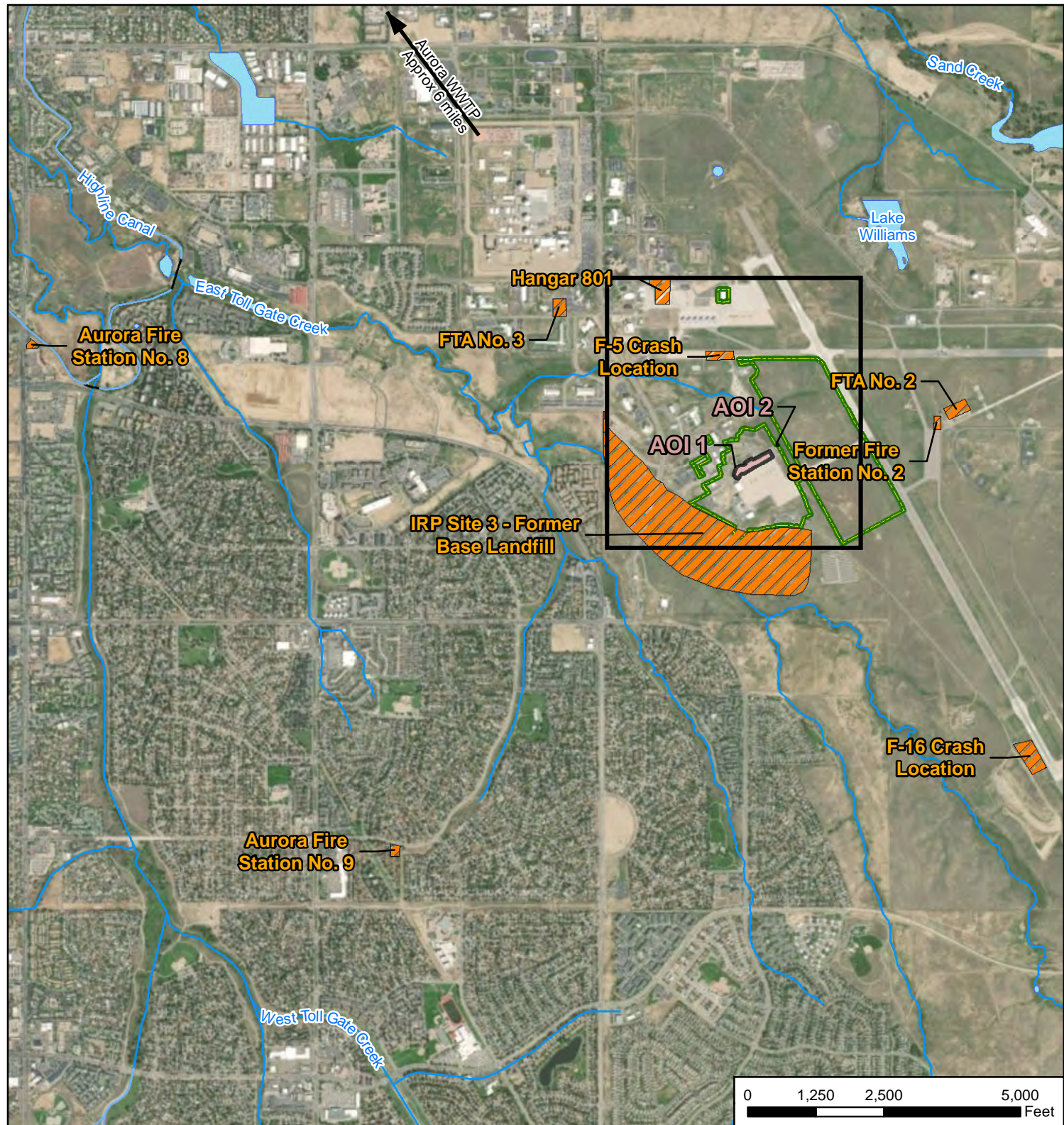
### 7.3 Potential Future Actions

Interviews with COARNG staff (whose collective tenure span from 1995 to 2000 and 2016 to present as employees working at Buckley AASF, and from 1995 to present as COARNG employees with knowledge of the facility) indicate that ARNG activities may have resulted in the release of AFFF and HEF that may contain PFAS at two AOIs identified during the PA. Based on the preliminary CSM developed for the facility, there is potential for PFAS to be exposed to human receptors (see **Section 7.1**). **Table 7-4** summarizes the rationale used to determine if the AOIs should be considered for further investigation under the CERCLA process and undergo an SI.

**Table 7-4: PA Findings Summary**

Area of Interest	AOI Location	Rationale	Potential Future Action
AOI 1 Building 1510	39°42'17.21"N; 104°45'42.64"W	HEF suppression system was released during a system test in 2006.	Proceed to an SI, focus on soil, surface water, sediment, and groundwater.
AOI 2 Former Tri-Max™ Storage Area	39°42'19.82"N; 104°45'39.18"W	AFFF was formerly stored outdoors in Tri-Max™ units	Proceed to an SI, focus on soil, surface water, sediment, and groundwater.

ARNG will evaluate the need for an SI at Buckley AASF based on the potential receptors, the potential migration of PFAS contamination off the facility, and the availability of resources.



CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Buckley AASF, CO			
REVISED	4/8/2020	GIS BY	MS	4/8/2020
SCALE	1:30,000	CHK BY	JW	4/8/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	PM	RG		4/8/2020

- Area of Interest
- Potential PFAS Release
- No Suspected Release
- Facility Boundary
- Water Body
- River/Stream
- Canal/Ditch
- Pipeline



<b>Summary of Findings</b>	
	12420 Milestone Center Drive Germantown, MD 20876
Figure 7-1	

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## **Appendix A**

### **Data Resources**

Data resources will be provided separately on CD. Data resources for Buckley AASF include:

### Facility Real Property Documents

- 2000 Department of the Army License Number DACA45-3-00-6082 for National Guard Purposes

### Facility PFAS Material Information

- 2006 Chemguard 3% AFFF C-303 Material Safety Data Sheet
- 2010 Tri-Max Chemguard 3% AFFF C-303 Material Safety Data Sheet
- 2015 Building 1510 Fire Suppression System Test Report
- 2015 Ansul Jet-X 2 ¾% HEF Concentrate Data Sheet
- 2017 Building 1510 Fire Suppression System Test Report
- 2017 Ansul Jet-X 2 ¾% HEF Concentrate Data Sheet
- 2018 Building 1510 Fire Suppression System Test Report
- 2019 Building 1510 Fire Suppression System Test Report
- 2019 Request for Contractor Triple Rinse of Empty Tri-Max Fire Extinguishers
- 2019 Non-Hazardous Waste Manifest for Disposal of AFFF Concentrate
- Buckley AASF Tri-Max Fire Extinguisher Photo 1
- Buckley AASF Tri-Max Fire Extinguisher Photo 2
- Buckley AASF Tri-Max Fire Extinguisher Photo 3
- Buckley AASF Tri-Max Fire Extinguisher Photo 4

### Adjacent Sources Information

- 2014 Record of Decision for Buckley Air Force Base Site 3 (Former Base Landfill)
- 2015 Final Buckley Air Force Base Preliminary Assessment for Perfluorinated Compounds
- 2019 Record of Decision for Buckley Air Force Base Site 1 (FT001), Former Fire Training Area 2
- 2019 Final Buckley Air Force Base Site Inspection Report of AFFF Part 1
- 2019 Final Buckley Air Force Base Site Inspection Report of AFFF Part 2

### Helicopter Fuel Leak Documentation

- 2017 US Marine Helicopter Incident Report Form
- 2017 US Marine Helicopter Leak Photos

### Previously Performed PFAS Interviews

- 2019 Interview with Buckley Air Force Base Firefighter

### EDR™ Report

- 2020 Buckley AASF EDR™ Report

## **Appendix B**

# **Preliminary Assessment Documentation**

## **Appendix B.1**

### **Interview Records**



**ARNG Preliminary Assessments for PFAS**  
**Telephone Interviews**  
**Colorado ARNG Facilities: Fort Carson, HAATS, Buckley AASF**  
**18 December 2019**  
**1000 to 1145 hrs**

Name	Affiliation	Facility Role
██████████	ARNG	NA
CPT ██████████	ARNG	NA
██████████	USACE	NA
██████████	USACE	NA
██████████	AECOM	NA
██████████	AECOM	NA
██████████	AECOM	NA
██████████	Arcadis	NA
██████████	Arcadis	NA
CPT ██████████	COARNG	Environmental Protection Specialist
██████████	COARNG	Environmental Compliance Manager
CPT ██████████	COARNG	153 <sup>rd</sup> Military Police Battalion Sustainment Officer
SGT ██████████	COARNG	Unit Environmental Compliance Officer
SSG ██████████	COARNG	1157 <sup>th</sup> Engineer Company Supply Sergeant
██████████	COARNG	Environmental Protection Specialist (retired)
1SG ██████████	COARNG	Unit Environmental Compliance Officer at HAATS
██████████	COARNG	Western Region Maintenance Supervisor at HAATS
██████████	COARNG	Facility Maintenance Supervisor at Buckley AFB

**Buckley AASF Discussion:**

SGT ██████████ (2016-present) – Six TRI-MAX™ units that formerly contained AFFF are stored in Building 1511A, the cold storage building. The TRI-MAX™ unit’s contents were transferred into drums on September 24, 2019 in the GSE building, which is a part of the larger Building 1510. A capture berm was constructed to contain any spills during the event. No AFFF was spilled during the emptying of the TRI-MAX™ units into drums. Three drums of AFFF concentrate were generated during the event. A private contractor will be used to “triple rinse” the TRI-MAX™ units in the future prior to disposal offsite.

No fire training occurs at Buckley AASF with AFFF. The TRI-MAX™ units were never used in fire training at the facility. No joint-training with other airport tenants has ever occurred at the facility. Handheld ABC fire training is the only known fire training that occurs on the facility.

No hard landings/crashes/ emergencies have occurred at the facility that have required the use of AFFF during response.

Occasionally water salutes are performed when a retiring pilot lands at the facility. Water salutes involve fire trucks spraying water during the aircraft landing, and have been performed on the flight ramp at Buckley AASF.

A marine helicopter leaked oil in front of Building 1500; however, the spill was cleaned with sorbent pads and no AFFF was used in response to the spill.

██████████ (1995-2000 [COANG stationed at Buckley]; 2001-present [COARNG stationed in Centennial, CO]) & ██████████ (1995-2001 [COARNG at Buckley]; 2001-present [COARNG stationed in Centennial, CO]) –Buckley AASF is a tenant of Buckley AFB. As such, the AASF turns over their waste to Buckley AFB for it to become manifested and disposed of jointly with that of Buckley AFB. So, the waste manifests for the disposal of the AFFF transferred from the Buckley AASF TRI-MAX™ units may have differing numbers of drums because they were disposed of along with waste generated at Buckley AFB. (Waste manifests list 18 drums of AFFF-water and 13 drums of AFFF-soil).

Buckley AASF finished construction in 2006 and was occupied by the COARNG. Since then, no known crashes or emergencies have occurred on the property requiring AFFF response.

Building 1510 is constructed with an HEF fire suppression system. A 55-gallon drum of HEF may also be stored in the building HEF room.

Buckley AFB has a crash house with a fire department. Information regarding the airport fire department would need to be obtained through their staff. POCs for the Buckley AFB are the RPM (██████████), and ██████████ (719-554-5096). Info regarding the use and storage of AFFF at Buckley AFB is unknown to COARNG interviewees.

No known training has occurred with the TRI-MAX™ units at the facility. Interviewees spoke with SGT ██████████ (10 year tenure) who also confirmed that no training has ever been performed with trimaxes.

A marine helicopter leaked oil in front of Building 1500 1-2 years ago. Sorbent pads were used to clean up the spill. Halon was used in response to the spill.

**CPT ██████████** (2009-present) – Building 1510 is constructed with an HEF fire suppression system containing Jet-X HEF concentrate. The system was tested in 2006 following its installation. The system test involved a three minute discharge of HEF (of unknown volume) to the main hangar. The test was enclosed, and all HEF released was confined to the building interior. The HEF was drained via building floor drains which connect to sanitary system sewers, and ultimately lead to the metro water district in the city of Denver. Typically, floor drains connect to an OWS, but a diverter was used to ensure HEF bypassed the OWS during the test. No HEF is known to have escaped the building during the test. No other tests have been performed that involve the release of HEF. The HEF system in the building exhibits no signs of corrosion or leakage. A video was provided to AECOM of the event. The containment structures (plastic sheeting around the edges of the hangar) appear effective.

Building 1000 is a Readiness Center.

Building 1515 is the UAV hangar and does not have a fire suppression system.

Building 1511A is the Cold Storage Building and has no fire suppression system.

Building 1500 is additional hangar space and has a water fire suppression system.

Building 1005 is used for staff operations.

There are no groundwater monitoring wells at the facility.

The city of Aurora provides drinking water to Buckley AASF.

Summary:

- There is no known use of AFFF at Buckley AASF
- 6 TRI-MAX™ units that formerly contained AFFF were emptied in September 2019 into drums in the GSE Building, that were then disposed of offsite by Buckley AFB. The empty TRI-MAX™ units remain onsite in the Cold Storage Building (Building 1511A).
- Building 1510 has an HEF fire suppression system that was tested once in 2006. The test was enclosed, and all HEF drained to sanitary system sewers. HEF is currently stored in the suppression system tank and in a 55-gallon drum within the building. No other buildings have HEF or AFFF suppression systems.
- Buckley AFB has its own fire department. Any PFAS-related investigation information/AFFF use information for Buckley AFB and other airport tenants is unknown to COARNG interviewees.

## **Appendix B.2**

# **Conceptual Site Model Information**

## Preliminary Assessment – Conceptual Site Model Information

Site Name: Buckley AASF

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**Why has this location been identified as a site?**

The site is located at an airport, and stores and maintains aviation assets.

---

**Are there any other activities nearby that could also impact this location?**

Yes, the facility is located at Buckley Air Force Base (AFB). Known AFFF releases have occurred at Buckley AFB.

---

### Training Events

Have any training events with AFFF occurred at this site? No, not at the AASF

If so, how often? NA

How much material was used? Is it documented? NA

---

**Identify Potential Pathways:** Do we have enough information to fully understand over land surface water flow, groundwater flow, and geological formations on and around the facility? Any direct pathways to larger water bodies?

### Surface Water:

Surface water flow direction? Generally north towards surface water retention pond

Average rainfall? 14.30 inches

Any flooding during rainy season? None

Direct or indirect pathway to ditches? Direct (stormwater networks, drainage ditches)

Direct or indirect pathway to larger bodies of water? Indirect (ditches connect to East Toll Gate Creek)

Does surface water pond any place on site? the surface impoundment, and off-facility at the retention pond

Any impoundment areas or retention ponds? Yes, the surface impoundment east of Bldg 1515

Any NPDES location points near the site? Unknown

How does surface water drain on and around the flight line? To the north and south depending on position

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## Preliminary Assessment – Conceptual Site Model Information

### Groundwater:

Groundwater flow direction? Inferred to flow north

Depth to groundwater? 25-30 ft bgs

Uses (agricultural, drinking water, irrigation)? Groundwater not used on facility.

Any groundwater treatment systems? Not at Buckley AASF

Any groundwater monitoring well locations near the site? at Buckley AFB

Is groundwater used for drinking water? No

Are there drinking water supply wells on installation? No

Do they serve off-post populations? NA

Are there off-post drinking water wells downgradient

Numerous wells of various types exist within the vicinity of the Buckley AASF including domestic and irrigation wells downgradient of the facility

### Waste Water Treatment Plant:

Has the installation ever had a WWTP, past or present? No, wastewater is transferred to an off-facility WWTP

If so, do we understand the process and which water is/was treated at the plant? NA

Do we understand the fate of sludge waste? Sludge from the Metro WWTP is used at MetroGro Farm

Is surface water from potential contaminated sites treated?

Surface water from the greater Buckley AFB area is treated by the Metro WWTP, which includes known AFFF release areas.

### Equipment Rinse Water

1. Is firefighting equipment washed? Where does the rinse water go?

Buckley AASF does not store firetrucks, but does have Tri-Max units. No known washing/rinsing occurs, but a rinsing is scheduled for empty Tri-Max units currently stored onsite.

2. Are nozzles tested? How often are nozzles tested? Where are nozzles tested? Are nozzles cleaned after use? Where does the rinse water flow after cleaning nozzles?

Nozzle testing does not occur.

3. Other?

## Preliminary Assessment – Conceptual Site Model Information

### Identify Potential Receptors:

Site Worker Potential receptor of PFAS in surface soil

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Construction Worker Potential receptor of PFAS in surface/subsurface soil

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Recreational User Potential receptor of PFAS in surface water off-facility

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Residential Potential receptor of PFAS in groundwater downgradient of facility

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Child Potential off-facility receptors if using surface water for recreational purposes

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Ecological Potential receptors within surface water and surface soil adjacent to the facility

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Note what is located near by the site (e.g. daycare, schools, hospitals, churches, agricultural, livestock)?

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Residential areas approximately 0.6 miles west, elementary schools and daycares located more than 1 mile from the facility.

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### Documentation

Ask for Engineering drawings (if applicable).

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Has there been a reconstruction or changes to the drainage system? When did that occur?

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Buckley AASF was constructed in 2006; however, some buildings used by the COARNG today pre-date AASF construction. Facility drainage prior to 2006 is unclear.

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