FINAL
Site Inspection Report
Bryant Army Airfield
Anchorage, Alaska

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

September 2023

Prepared for:

Army National Guard Bureau
111 S. George Mason Drive
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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AAC	Alaska Administrative Code
AECOM	AECOM Technical Services, Inc.
ADEC	Alaska Department of Environmental Conservation
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film-forming foam
AKARNG	Alaska Army National Guard
AOI	Area of Interest
ARNG	Army National Guard
BAAF	Bryant Army Airfield
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DNR	Department of Natural Resources
DoD	Department of Defense
DQO	data quality objective
DUA	data usability assessment
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FedEx	Federal Express
FTA	Fire Training Area
GPRS	Ground Penetrating Radar Systems
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
JBER	Joint Base Elmendorf–Richardson
LC/MS/MS	liquid chromatography with tandem mass spectrometry
mg/kg	milligrams per kilogram
MIL-SPEC	military specification
MOA	Municipality of Anchorage
MTGW	Migration to Groundwater
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment

PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RBSL	risk-based screening level
RI	Remedial Investigation
rotosonic	rotary sonic
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
USAF	US Air Force
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WELTS	Well Log Tracking System

Executive Summary

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

The PA identified three Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for AOI locations). The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for relevant compounds. This SI was completed at Bryant Army Airfield (BAAF) in Anchorage, Alaska and determined further investigation is warranted for AOI 1: BAAF Hangar 6 and BAAF Fuel Truck Shed and AOI 2: BAAF Hangar 4. No further evaluation is warranted for AOI 3: BAAF Hangar 1. BAAF will also be referred to as the "facility" throughout this document.

BAAF is located at 47430 Westbrook Ave, approximately 8 miles northeast of downtown Anchorage, Alaska. The facility is centrally located on the Fort Richardson side of Joint Base Elmendorf–Richardson (JBER). In 2010, Fort Richardson and Elmendorf Air Force Base, located contiguously to the west, were merged based on the recommendation of the 2005 Department of Defense Base Realignment and Closure Commission (US Air Force, 2018). JBER is located north and east of Anchorage, Alaska. JBER is bound by the Knik Arm of Cook Inlet to the north and the Chugach Mountains to the east (AECOM Technical Services, Inc., 2022a). The Alaska ARNG (AKARNG) has been present on the airfield alongside the Army starting in 1972. Since 1997, BAAF has been operated solely by the AKARNG, under a lease from the Army. BAAF occupies approximately 491 acres and includes a several runways, taxiways, multiple hangars, and other ground-support structures (NHG Alaska, LLC, 2012). Much of the surrounding area on BAAF is undeveloped forested land, particularly in the northern part of the facility.

The PA identified three AOIs for investigation during the SI phase. SI sampling results from the three AOIs were compared to OSD SLs. **Table ES-2** summarizes the SI results for each AOI. Based on the results of this SI, further evaluation under CERCLA is warranted in a Remedial Investigation for AOI 1 and AOI 2. No further evaluation is warranted for AOI 3.

[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	BAAF Hangar 6 and BAAF Fuel Shed	●	●	N/A	Proceed to RI
2	BAAF Hangar 4	●	N/A	◐	Proceed to RI
3	BAAF Hangar 1	◐	N/A	◐	No further action

Legend:

N/A = not applicable

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum will be referred to as "relevant compounds" throughout this document and include perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS) at ARNG facilities nationwide. The ARNG performed this SI at Bryant Army Airfield (BAAF) in Anchorage, Alaska. BAAF 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 BAAF (AECOM Technical Services, Inc. [AECOM], 2019) that identified three Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically. The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

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

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2. Facility Background

2.1 Facility Location and Description

BAAF is located at 47430 Westbrook Ave, approximately 8 miles northeast of downtown Anchorage, Alaska. The facility is located on the Fort Richardson side of Joint Base Elmendorf–Richardson (JBER). Fort Richardson and Elmendorf Air Force Base (AFB), which is contiguous to Fort Richardson to the west, were merged in 2010 based on the recommendation of the 2005 Department of Defense (DoD) Base Realignment and Closure Commission (US Air Force [USAF], 2018). JBER is located north and east of Anchorage, Alaska, and is bound by the Knik Arm of Cook Inlet to the north and the Chugach Mountains to the east. The facility is within the Municipality of Anchorage, which encompasses the City of Anchorage, BAAF (within JBER), and nearby small towns such as Girdwood and Eagle River (State of Alaska Department of Commerce, Community, and Economic Development, 2018). The facility location is depicted in **Figure 2-1**.

The Alaska ARNG (AKARNG) leases three subdivisions on the Fort Richardson side of JBER: Camp Carroll, Camp Denali, and BAAF (NHG, 2012). Because the PA identified that there was no known use of aqueous film-forming foam (AFFF) by the AKARNG at Camp Carroll or at Camp Denali, the SI focuses on BAAF, which has a history of AFFF use (AECOM, 2019).

BAAF first appears in aerial photographs in 1953 and was used by the Army for short take-off and landing exercises. The AKARNG has been present on the airfield alongside the Army since 1972. Since 1997, BAAF has been operated solely by the AKARNG under a lease from the Army. BAAF occupies approximately 491 acres and includes a north/south runway, an east/west taxiway with a helicopter crosswind runway, multiple hangars with associated flight ramps and taxiways, and other associated ground-support structures. Large portions of the ground within the operational area of BAAF area unpaved and much of the surrounding area on BAAF is undeveloped forested land, particularly in the northern part of the facility.

2.2 Facility Environmental Setting

BAAF lies entirely within the Anchorage lowlands, an area of roughly 150 square miles of glaciated lowland between two estuaries and is an informal subdivision of the Cook Inlet-Susitna Lowland that lies southeast of the northern Knik Arm (US Geological Survey [USGS], 2018). BAAF is situated at an elevation of around 350 to 360 feet above mean sea level. Topography at the facility is flat-lying and slopes slightly towards the southwest and northeast. Glenn Highway, which bisects the Fort Richardson side of JBER, is located just southeast of BAAF. The terrain on the north side of the Glenn Highway, including at BAAF, is generally flat and composed of unconsolidated deposits, while south of the highway are the foothills and western reach of the Chugach Mountains (**Figure 2-2**).

BAAF is centrally located within the Fort Richardson boundary. The operational and support facilities of the Fort Richardson cantonment are located west of BAAF. AKARNG-leased Camp Carroll and Camp Denali are located immediately north and east of BAAF, respectively. The areas of Fort Richardson north, south, and east of BAAF consist primarily of undeveloped forest and lowlands, except for access roads connecting a number of ranges and other open ground training areas east across Glenn Highway. The nearest off-facility residential areas are located approximately 3.5 miles southwest and 5 miles northeast of BAAF.

2.2.1 Geology

The Anchorage lowland is heavily influenced by glacial and postglacial activities. Five glaciations are recognized to have advanced through the Anchorage lowland area: the Mount Susitna, the Caribou Hills, the Eklutna, the Knik and Matanuska, and the Naptowne glaciations. Deposits from at least three of the five glaciers are represented in the upper lowland area, with the Knik, Eklutna, and Naptowne depositions being the most prominent. Erosion represented by undercutting of sea-bluffs, landslides, and downcutting into material along modern stream courses are the most prevalent post-glacial activity seen. Furthermore, lacustrine and alluvial deposits consequent with or subsequent to the advances are also represented. Below the modern and glacial deposits, argillite, greywacke, and chert, as well as altered acidic and basic igneous rocks, constitute the greater part of the Mesozoic age rocks in the Anchorage lowlands area, while the bedrock is chiefly Tertiary shale (USGS, 2018; USGS, 1959).

The majority of both the surface and underlying material at JBER are several hundred feet of Pre-Wisconsin to Pleistocene-age deposits associated with glacial advance and erosion. Several miles to the east of BAAF, the lowlands are bordered by the Kenai-Chugach Mountains physiographic province. To the northwest of BAAF, just beyond the Fort Richardson cantonment area, is the Elmendorf Moraine, a terminal moraine sequence marking several Wisconsin age glacial advances. The Elmendorf Moraine trends southwest-northeast through Anchorage, to the coast, and creates an outwash plain which underlies BAAF and much of JBER (USGS, 2018). Broad till deposits comprised of poorly sorted sand and clay, with gravel, pebbles, and cobbles - referred to collectively as diamicton – are found at the surface east of BAAF and also buried in the Fort Richardson area. These deposits are associated with the advance of the Dishno Pond or other similar, Pre-Wisconsin lateral moraines (AECOM, 2018a).

At BAAF, along with most of the Fort Richardson cantonment area and extending west near Elmendorf AFB, the Mountain View alluvial fan is the uppermost stratigraphic unit and overlies the stratified drift and outwash deposits. Deposits of the Mountain View are primarily sand and gravel with high amounts of silt and clay (10 to 15 percent [%]). Interbedded gravel-containing lenses and layers of silt and clay are common. The Mountain View alluvial fan was deposited when recurring catastrophic flooding events during the Pleistocene, caused by breaks in ice or moraine dams near the mouth of the Eagle River Valley to the north, would scour the Elmendorf Moraine and deposit this material over a south-southwest dipping fan (AECOM, 2018a). The underlying drift and outwash deposits are likely related to the Elmendorf Moraine located to the north and were formed atop the buried Dishno Pond.

The clay-dominated Bootlegger Cove Formation is an important stratigraphic unit in the Anchorage lowlands for its presence as a confining unit between aquifers, separating the Knik from overlying Naptowne glacial deposits. The Bootlegger Cove was deposited in a Pre-Wisconsin glacio-estuarine environment, in an ancestral Cook Inlet that likely once covered parts of what is now the Anchorage lowlands. The Bootlegger Cove Formation exists below Elmendorf AFB; however, it pinches out to the east and is not present beneath Fort Richardson or BAAF (AECOM, 2018a).

During the SI, borings were completed to depths of 120.7 to 132 feet below ground surface (bgs). The dominant lithology encountered below BAAF consisted of well graded sand and gravel with typically greater than 15% fines. The amount of sand to gravel composition in the borings varied, alternating between sequences of predominantly sand to mostly gravel, likely indicative of the recurring flood events that would result in the higher energy rapid deposition of poorly sorted material. Interbedded layers of fines or poorly graded sand were infrequent, but where present, may be a result of periods of lower-energy deposition at the tail end of these events. Similarly, these poorly sorted deposits can represent the broad till deposits that cover the area. These observations are consistent with the known depositional history of the area and suggest that nearly the entire section of both boring logs represent the alluvial material of the Mountain View Fan and underlying glacial drift. The bottom 10 feet of boring BAAF-MW002 contained a large amount of fines, including several thin lenses of lean clay, and was mostly absent of the gravel observed in the above sections; this could be diamicton representing the uppermost part of the of the Dishno Pond, or simply a finer-grained interval within the drift. The absence of a similar interval in boring BAAF-MW001 can be attributed to spatial differences that occur in a dynamic glacial depositional environment. Bedrock was not encountered in either of the borings. Boring logs are presented in **Appendix E**.

2.2.2 Hydrogeology

Regional groundwater flows in a northerly to northwesterly direction near BAAF towards the Knik Arm, following a regional surface drainage pattern that is facilitated by the northeast-trending front range of the Chugach Mountains and complex interactions between hydraulic boundaries in the subsurface.

At JBER, groundwater occurs primarily under water-table (unconfined) conditions in permeable deposits (AECOM, 2018a). However, a shallow, locally confined aquifer and deeper confined aquifer have been identified in parts of JBER, with clay and till forming the confining beds (USAF, 2018). Groundwater south of BAAF occurs in the locally confined aquifer, at a depth as shallow as 80 feet bgs, while in the deeper confined system, it occurs around 130 feet bgs (USAF, 2018). Moving from south to north, the locally confined aquifer changes from confined to semiconfined to unconfined and it merges with the shallow unconfined aquifer due to the upper confining till unit pinching out just south of BAAF (USAF, 2018). The clays of the Bootlegger Cove Formation are also known to serve as a confining unit between aquifers in the area of Elmendorf AFB, but they pinch out to the east and are not present at BAAF and Fort Richardson. As a result, this SI investigated the single, surficial aquifer. The aquifers in the Anchorage lowlands are recharged by infiltration of precipitation at the land surface and of surface water recharge through stream beds (USGS, 1964), such as Ship Creek. Previous investigations conducted in the vicinity of BAAF encountered groundwater at depths of approximately 130 feet bgs. These past studies also suggest groundwater flow direction at and surrounding BAAF is complex. While overall flow directions are consistent with the north-northwest regional flow, there appears to be a northeast component to groundwater flow at the west side of the airfield. To the east of BAAF, at Camp Denali, a northwest groundwater flow is much more evident (USAF, 2018; AECOM, 2018).

JBER sources its primary drinking water from Ship Creek (Doyon, 2022; JBER 2021), discussed further in **Section 2.2.3**. On Fort Richardson, three wells located approximately 3 miles southwest of BAAF, upgradient of the facility, are used to supplement drinking water when Ship Creek levels are low (**Figure 2-3**). The wells are screened in the Knik outwash deposit within the confined aquifer (USAF, 2018). The depth of the three wells ranges from 145 to 162 feet bgs (Alaska Department of Natural Resources [DNR] Well Log Tracking System [WELTS], 2022). Nearly 600 wells span the entire Anchorage lowlands area, most of which are furnishing small domestic supplies, but about 50 wells provide public water supplies mainly for municipal use, rural housing development, and schools (USGS, 1976; USAF, 2018). Of the nearly 600 wells, only about 18 are located with 4 miles downgradient from BAAF and are completed as monitoring wells. The nearest of these wells are located approximately 2.75 miles northeast of BAAF, at the Anchorage Regional Landfill (Alaska DNR WELTS, 2022).

Groundwater in the vicinity of BAAF was anticipated to be encountered at depths of approximately 130 feet bgs. Synoptic groundwater level measurements collected during the SI in May 2022 and November 2022 were found to range between 111 to 124 feet bgs. Groundwater elevations, calculated using depth to groundwater measurements and the surveyed top of casing elevations, show a northeast groundwater flow direction over the facility during both events (**Figure 2-4**). This observed flow direction is consistent with previous JBER investigation findings that show a north-

northeast component to groundwater flow beneath BAAF (AECOM, 2018). Seasonal variability is likely, as evident by the difference in flow directions between May 2022 and November 2022.

2.2.3 Hydrology

BAAF is situated within the Outlet Ship Creek watershed. Three watersheds, which cover a combined total of 52,000 acres and drain nearly 22 miles of streams, are found on JBER. No surface water enters or flows in the immediate vicinity of BAAF. Surface water on BAAF flows to the south-southwest. Surface water on the east side of the airfield is captured by stormwater drains that convey surface water runoff to an outfall located near the southeast corner of the airfield. The nearest surface water body to BAAF is Ship Creek. Surface water features are presented on **Figure 2-5**.

Ship Creek headwaters begin in the nearby Chugach Mountains as two smaller streams, only 1 mile apart, that flow north to southwest and then west. One section of Ship Creek is located 0.15 miles east of BAAF, where it appears to be intermittent before it converges with the west-flowing branch, at approximately 2 miles southwest of the BAAF. Ship Creek continues flowing west-southwest below Elmendorf, where it drains into the Knik Arm. Ship Creek is an important hydraulic boundary at JBER due to its interaction with groundwater, functioning as both a losing and gaining stream depending on location. In the Fort Richardson area and near BAAF, Ship Creek is a losing stream, meaning that it recharges the aquifer; near Elmendorf AFB it is a gaining stream and is fed by the shallow aquifer (AECOM, 2018a). Since 1912, Ship Creek has been historically impounded in various locations as the water source for the Municipality of Anchorage (MOA) and BAAF. Currently, JBER and the MOA source surface water from the Ship Creek Reservoir at the Ship Creek Dam intake. The raw water is treated by the JBER Water Treatment Plant prior to distribution (USAF, 2018). The Ship Creek Dam is located 3 miles southeast of the facility, where Ship Creek exits the Chugach Mountains. The Ship Creek Dam is topographically higher than BAAF and upstream from possible surface water input from BAAF (Alaska Department of Environmental Conservation [ADEC], 2022).

The Eagle River also has its headwaters in the Chugach Mountains, to the east of BAAF and the City of Anchorage. Eagle River begins at the base of the Eagle Glacier and flows northwest to where it exits the mountains, roughly 6 miles northeast of BAAF, before turning west across the outwash plains before emptying into the Knik Arm. The Eagle River is just under 3 miles north of BAAF at its closest, but it is entirely within a separate watershed. Other water bodies, such as Six Mile Creek, Six Mile Lake (Upper and Lower), and Otter Lake, are within the vicinity of BAAF and are located approximately 3 miles northwest of the facility in the Lower Eagle River Watershed. Six Mile Creek is a small creek that flows west into the Knik Arm. The Upper and Lower Six Mile Lakes are man-made lakes that receive the majority of drainage from a spring located to the west of Otter Lake (USAF, 2018).

2.2.4 Climate

The climate at BAAF is subarctic (Geodiode, 2022). In Anchorage, seasonal temperatures vary from an average high temperature of 65 degrees Fahrenheit (°F) in July to an average low temperature of 11 °F in January. The total mean annual precipitation (rainfall) is 16.57 inches. January through June are the driest months, with an average of less than half an inch of precipitation, and August is the rainiest month, with an average of 3 inches of precipitation. The average annual snowfall is 74 inches (World Climate, 2022).

Due to its latitude, BAAF experiences lengthy daylight hours in the summer and minimal daylight hours in the winter, and these hours affect the climate and habitat of the area. The frost-free growing season lasts approximately 100 days (MOA, 2018).

2.2.5 Current and Future Land Use

BAAF is situated on the Fort Richardson side of JBER. The facility is currently used by the AKARNG for helicopter and small fixed-wing aircraft operations. BAAF has multiple hangars and runways with associated flight ramps and taxiways. Ground support and administrative buildings are also present at the facility. The mission of the AKARNG at BAAF has been consistent since 1972 and, in general, the future use of the facility is not expected to change (NHG Alaska, LLC, 2012).

Areas surrounding BAAF are primarily operational and support areas of JBER. Camp Denali and Camp Carroll, also leased by AKARNG, are located to the east and north of BAAF, respectively. The areas north, south, and east of BAAF consist primarily of undeveloped forest and lowlands, except for access roads connecting a number of ranges and other open ground training areas east across Glenn Highway. The nearest off-base residential areas are located approximately 3.5 miles southwest and 5 miles northeast of BAAF.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

The following birds and mammals are federally endangered, threatened, proposed, and/ or are listed as candidate species in Anchorage, Alaska (US Fish and Wildlife Service [USFWS], 2022).

- **Birds**: Short-tailed albatross, *Phoebastria (=Diomedea) albatrus* (endangered)
- **Mammals**: Northern long-eared bat, *Myotis septentrionalis* (threatened); Little brown bat, *Myotis lucifugus* (under review)

2.3 History of PFAS Use

Three AOIs were identified in the PA where AFFF may have been used, stored, disposed, or released historically at the BAAF (AECOM, 2019). PFAS-containing materials were potentially released to surface soil within the boundary of BAAF through equipment discharge, accidental leaks and spills, and any fire training activities. The potential release areas were grouped into three AOIs based on preliminary data and presumed groundwater flow directions. These areas include:

- AOI 1: BAAF Hangar 6 and BAAF Fuel Truck Shed
- AOI 2: BAAF Hangar 4
- AOI 3: BAAF Hangar 1

During the PA, three Tri-Max™ Compressed Air Foam mobile fire extinguisher units (Tri-Max™ units) were observed at BAAF Hangar 6. According to a former AKARNG guardsman, annual fire training occurred for three years outside of BAAF Hangar 6 sometime between 2004 and 2008. Additional AFFF releases may also have occurred during storage of AFFF at BAAF Fuel Truck Shed between the 1990s to 2018. At the time of the PA, one partially filled intermediate bulk container tank, two 3% AFFF Chemguard 5-gallon buckets, and one drum of AFFF were stored in the BAAF Fuel Truck Shed, and 11 Tri-Max™ units were stored inside on the south side of BAAF Hangar 4. Additionally, at BAAF Hangar 1, one Tri-Max™ unit was staged outside on the southeast side of the hangar in the summer and brought into a partially enclosed arctic entry in the winter. In Spring 2021, after the PA visit, facility personnel reported that all Tri-Max™ units located at BAAF had been consolidated and relocated to the storage yard at the Fuel Truck Shed. The exact date the units were relocated was not known, but all were noted to still be filled with AFFF. A description of each AOI is presented in **Section 3**.

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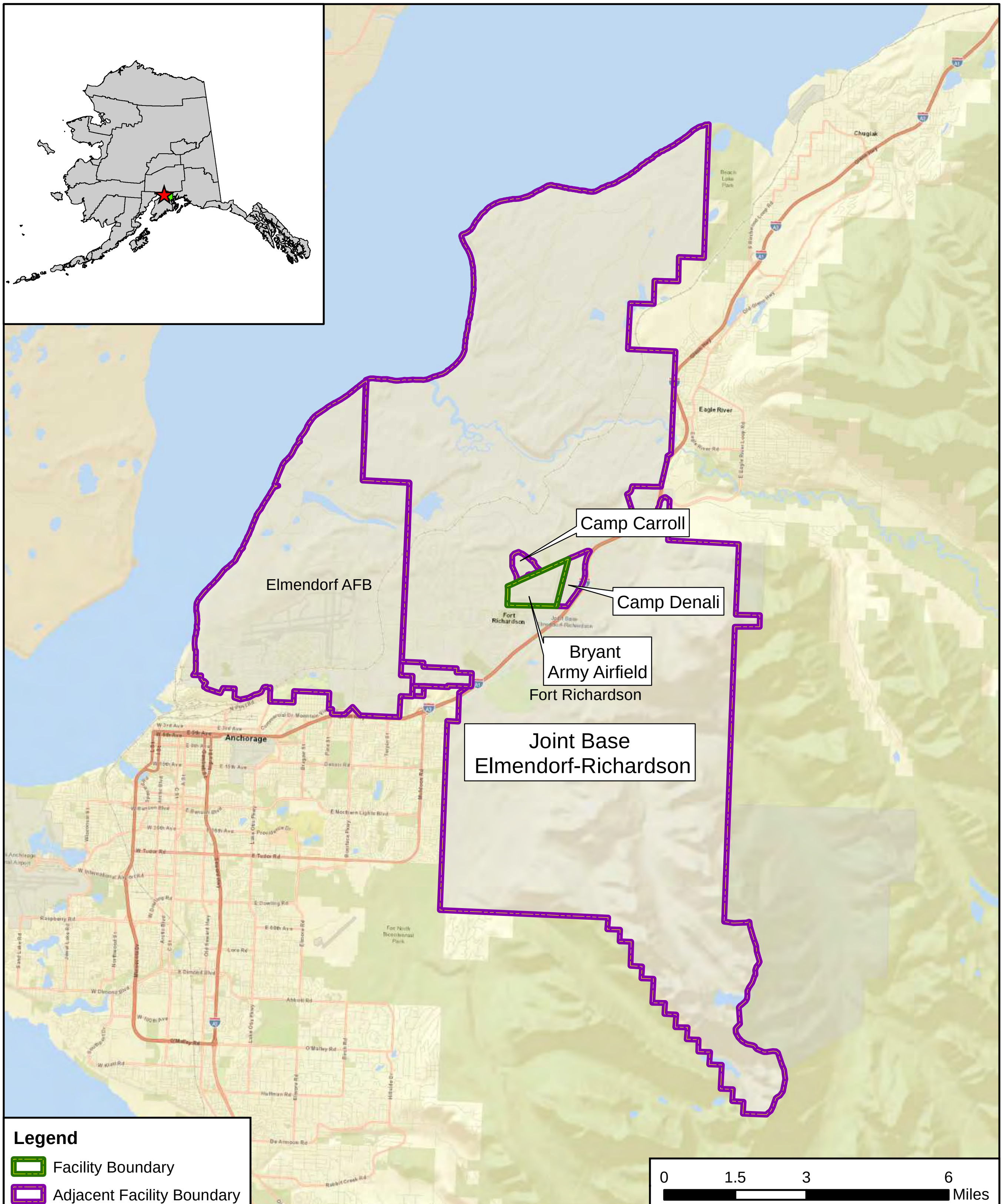

CLIENT	ARNG			
PROJECT	Site Inspection at BAAF, AK			
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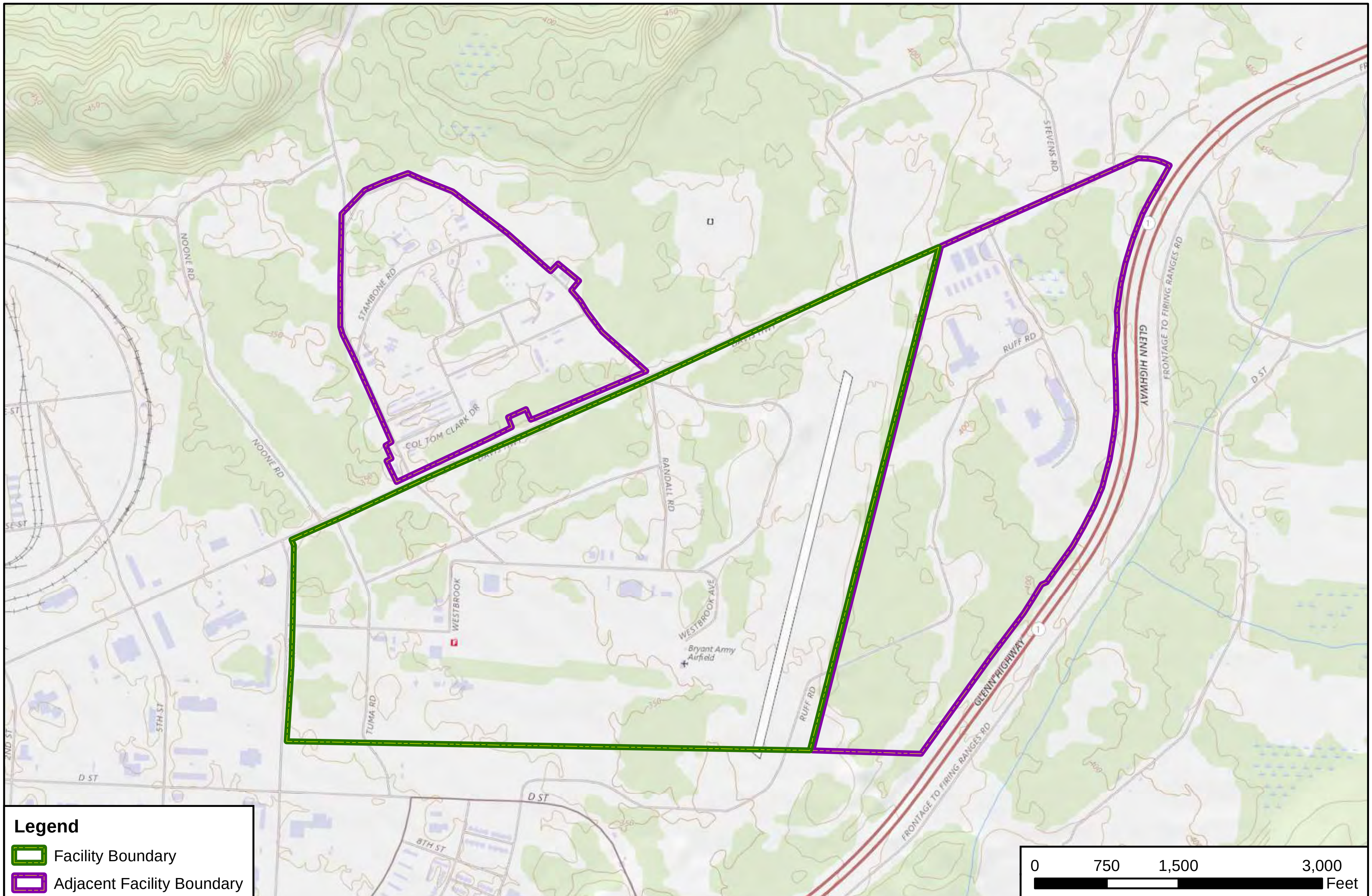
SCALE	1:190,080	CHK BY	MC	11/17/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	11/17/2022

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



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PROJECT	Site Inspection at BAAF, AK			
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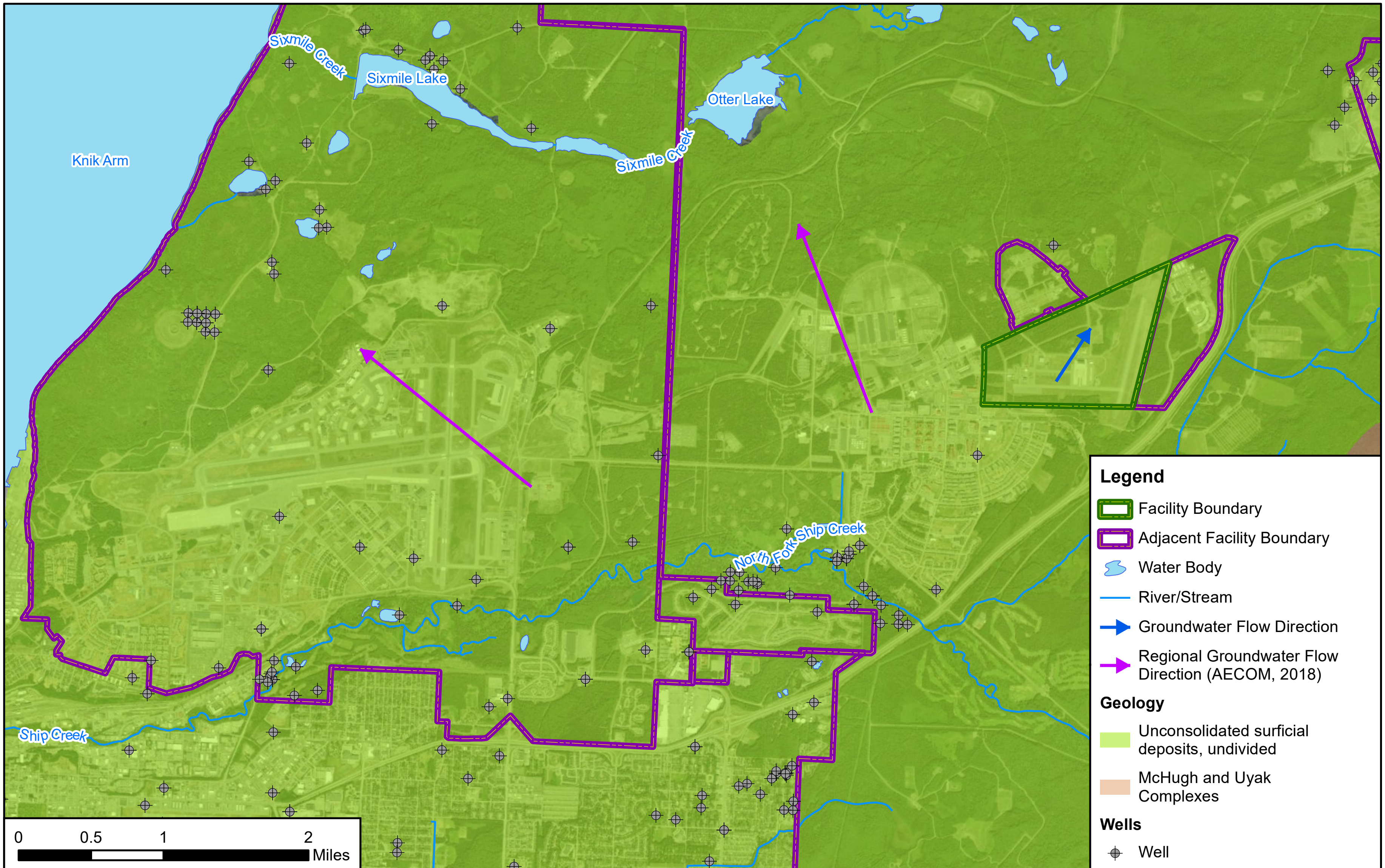
SCALE	1:18,000	CHK BY	MC	11/17/2022
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset,		PM	CM	11/17/2022

Facility Topography

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



CLIENT	ARNG			
PROJECT	Site Inspection at BAAF, AK			
REVISED	3/6/2023	GIS BY	MS	3/6/2023
SCALE	1:63,360	CHK BY	MC	3/6/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/6/2023

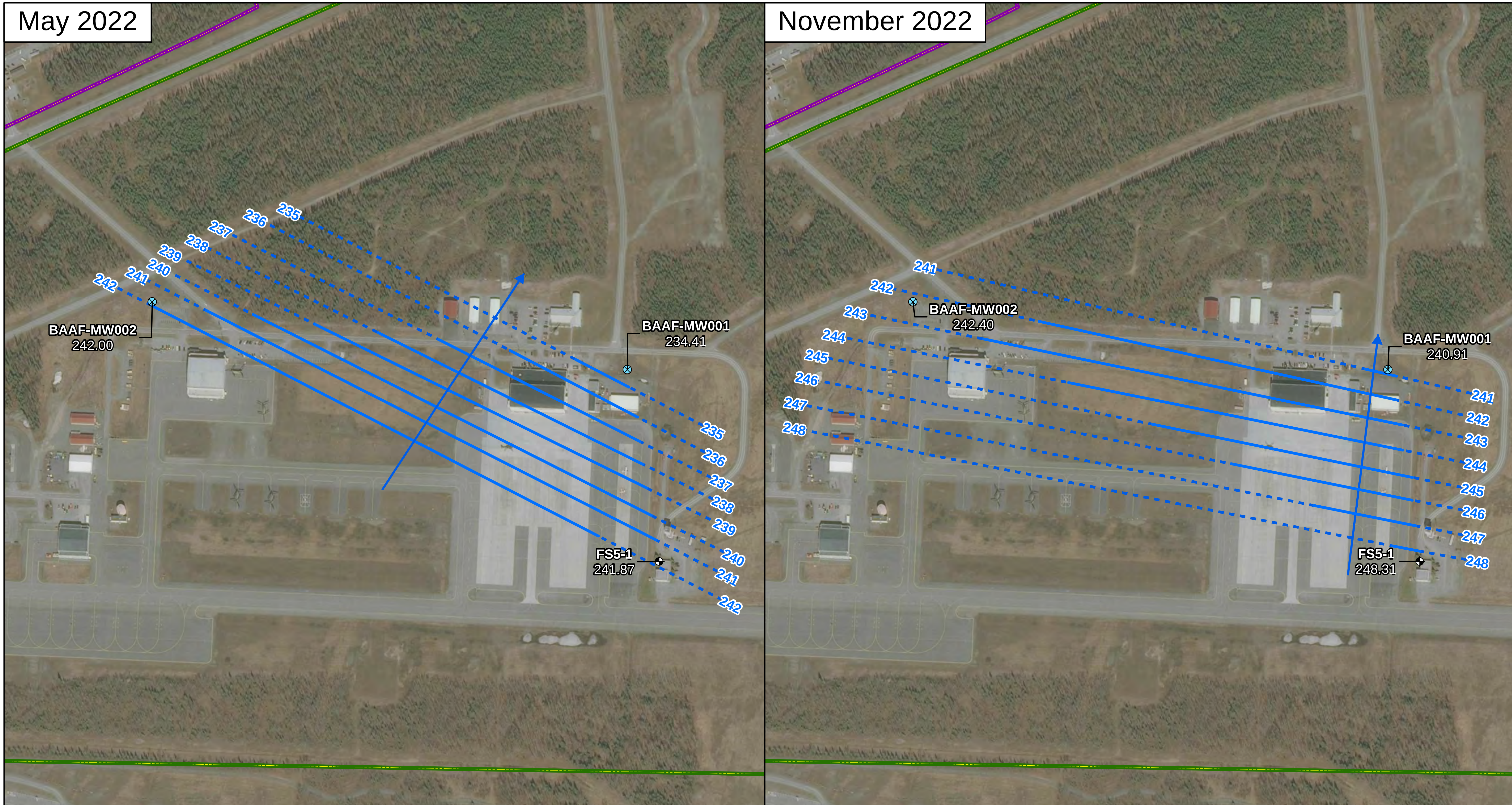
N

Groundwater Features

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3



CLIENT	ARNG			
PROJECT	Site Investigation at BAAF, AK			
REVISED	2/22/2023	GIS BY	MS	2/22/2023
SCALE	1:5,160	CHK BY	MC	2/22/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/22/2023

- Existing Monitoring Well
- Monitoring Well
- Facility Boundary
- Adjacent Facility Boundary
- Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- Groundwater Flow Direction

Groundwater elevations in ft NAVD88.

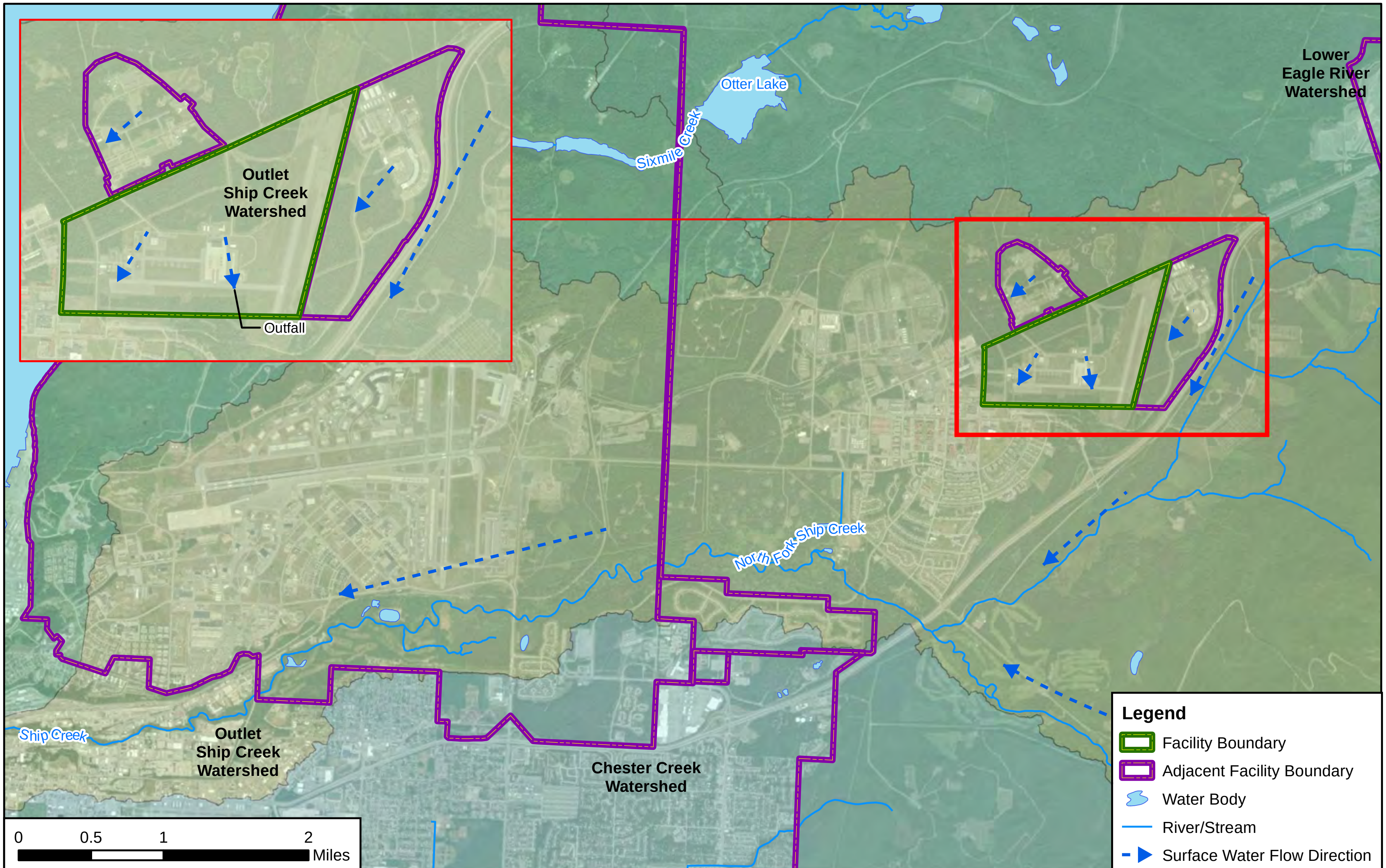
0 215 430 860 Feet

N

Groundwater Elevations, May and November 2022

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 2-4



CLIENT	ARNG			
PROJECT	Site Inspection at BAAF, AK			
REVISED	2/22/2023	GIS BY	MS	2/22/2023
SCALE	1:63,360	CHK BY	MC	2/22/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/22/2023

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 original PA findings, only two potential release areas were identified and combined into one AOI. However, based on preliminary data, current and historical aerial photographs, and subsequently received information, two additional potential release area were later identified at BAAF, and each area was made into an additional AOI (AECOM, 2022a). The potential release areas are shown on **Figure 3-1**.

3.1 AOI 1

AOI 1 consists of two potential release areas. The release areas are described below.

3.1.1 BAAF Hangar 6

BAAF Hangar 6 was built in 1975 (NHG Alaska, LLC, 2012) and has remained in use by the AKARNG since. A water deluge fire suppression system is located within BAAF Hangar 6. This system is not suspected to use foam, and it uses water sourced from a tank on BAAF that also supplies water to other structures. During the PA, three AFFF equipped Tri-Max™ units were observed at BAAF Hangar 6.

According to a former AKARNG guardsman, annual fire training occurred for 3 years sometime between 2004 and 2008. The training consisted of each technician spraying the side of a HEMTT fueling truck with a Tri-Max™ unit for about 3 seconds before passing the mobile extinguisher to the next technician. This training occurred outside at the southeast corner of BAAF Hangar 6, presumably on the paved surface. It was reported that dish soap was used in the Tri-Max™ units during the training events, and that the AFFF was temporarily transferred to drums. BAAF relies on Fire Station 5, which is operated by USAF and located near the south end of the runway, for emergency response. Fire Station 5 was investigated by USAF in 2018 (**Section 3.4.2**) and was not further evaluated in this SI.

3.1.2 BAAF Fuel Truck Shed

The BAAF Fuel Truck Shed (Building 74729) is operated by the AKARNG and is located east of BAAF Hangar 6. The BAAF Fuel Truck Shed was built in 2003 on a concrete pad contiguous with the surrounding asphalt, and it is an open-air, covered storage area. The BAAF Fuel Truck Shed is used to store fueling equipment and AFFF containers (NHG Alaska, LLC, 2012). From the 1990s to 2018, AFFF was stored outside on the asphalt to the north of its current location. At the time of the PA, one partially filled intermediate bulk container tank, two 3% AFFF Chemguard 5-gallon buckets, and one drum of AFFF were stored in the BAAF Fuel Truck Shed. AFFF from the BAAF Hangar 6 Tri-Max™ units was reportedly transferred between Tri-Max™ units and other containers when the extinguishers were sent out for servicing. AFFF was also transferred when AFFF was removed from the Tri-Max™ units and replaced with training foam. These transfers took place at or near the Fuel Truck Shed. No leaks or spills have been reported at this location, but transfers were completed out in the open without the use of secondary containment; therefore, it is possible that small spills occurred.

In Spring 2021, after the PA visit, facility personnel reported that all Tri-Max™ units located at BAAF had been consolidated and relocated to the east side of the storage yard at the Fuel Truck Shed. The exact date the units were relocated was not known, but all were noted to still be filled with AFFF.

3.2 AOI 2 BAAF Hangar 4

BAAF Hangar 4 (Building 47431) is operated by the AKARNG. Located west of Hangar 6, BAAF Hangar 4 was built in 1968 on a concrete pad contiguous with the surrounding asphalt and is a larger version of BAAF Hangar 1 (NHG Alaska, LLC, 2012). The fire suppression system in the hangar is a water deluge system. At the time of the PA, eleven Tri-Max™ units were stored inside on the south side of BAAF Hangar 4. No leaks or use of the Tri-Max™ units were reported; however, due to a gap in facility knowledge, it is possible that a spill or release could have occurred. The BAAF Hangar 4 Tri-Max™ units were relocated to the Fuel Truck Shed storage yard in AOI 1 after the PA visit.

3.3 AOI 3 BAAF Hangar 1

BAAF Hangar 1 (Building 47430) is operated by the AKARNG and near the western end of Taxiway 5, southwest of Hangars 6 and 4. BAAF Hangar 1 was built in 1958 on a concrete pad contiguous with the surrounding asphalt and is a 21,000-foot hangar with shops (NHG Alaska, LLC, 2012). The fire suppression system in the hangar is a water deluge system. At the time of the PA, one Tri-Max™ unit was staged outside on the southeast side of the hangar in the summer and brought into a partially enclosed arctic entry in the winter. No leaks or use of the Tri-Max™ unit were reported; however, due to a gap in facility knowledge, it is possible that a spill or release could have occurred. The BAAF Hangar 1 Tri-Max™ unit was relocated to the Fuel Truck Shed storage yard in AOI 1 since the time of the PA visit.

3.4 Adjacent Sources

Three adjacent areas with reported releases were identified during the PA: one area adjacent to BAAF, within the boundary of Camp Denali; one area adjacent to BAAF, outside of AKARNG property; and one area within the BAAF boundary (Fire Station 5, operated by the Air Force). Two of the three adjacent potential sources were evaluated by the Air Force in a 2018 SI (USAF, 2018), discussed below. These potential adjacent sources are also shown on **Figure 3-1**; however, it should be noted that this SI did not further evaluate these sources, and these locations are shown for informational purposes only.

3.4.1 AT029 Ruff Road Fire Training Area

The AT029 Ruff Road Fire Training Area (FTA), located east of the BAAF facility boundary and within the boundary of Camp Denali, was used for fire training exercises from the 1940s to the 1980s, although never by AKARNG. The AKARNG does not staff firefighters at this facility. The FTA contains a staging area, a grassy area, and an approximately 50-foot diameter FTA. AT029 Ruff Road FTA is addressed under the USAF investigation and is not considered a separate AOI for the ARNG SI. According to the 2018 USAF SI Report, the following compounds were detected in soil and groundwater at the FTA (USAF, 2018):

- In soil, PFOA, PFOS, and PFHxS were detected. The report indicated that the detected PFOA concentrations were below the 2016 USEPA calculated risk-based screening levels (RBSLs) and ADEC cleanup levels. PFOS concentrations were below the 2016 USEPA RBSL and the 2016 ADEC human health cleanup level, but above the 2016 ADEC Migration to Groundwater criteria (MTGW) cleanup level. The detected relevant compounds in soil were below the 2022 OSD SLs.

- In groundwater, PFOA and PFHxS were detected. Detected PFOA concentrations were reported above the 2016 USEPA Lifetime Health Advisory but below the 2016 ADEC cleanup level. The detected PFOA and PFHxS concentrations exceed the 2022 OSD SLs, at concentrations of 110 nanograms per liter (ng/L) and 53 ng/L, respectively.

The shallow aquifer ground flow direction flows west towards BAAF from AT029 (USAF, 2018).

3.4.2 Fire Station 5

Fire Station 5 (also referred to as Building 48010) was built in 1981 on BAAF, near the south end of the runway off Taxiway 5, and it is operated by the Air Force. Fire Station 5 is located within the facility boundary, southeast of AOI 1. According to the 2018 USAF SI Report, the following was identified in soil and groundwater at Fire Station 5 (USAF, 2018):

- In soil, PFOA, PFOS, PFBS, PFHxS, and PFNA were detected. The maximum detected concentration was PFHxS, at 0.0009 mg/kg (0.9 µg/kg). The report indicated that PFOA and PFOS were detected below the 2016 USEPA RBSL and 2016 ADEC human health cleanup levels, but PFOS exceeded the 2016 ADEC MTGW criteria cleanup level. The detected relevant compounds in soil were below the 2022 OSD SLs.
- In groundwater, PFOA, PFBS, and PFHxS were detected. The report indicated that PFOA was detected below the 2016 USEPA RBSL and 2016 ADEC human health cleanup levels and PFBS was detected at a concentration below the 2016 USEPA Regional Screening Level. The detected PFOA and PFHxS concentrations exceed the 2022 OSD SLs, at concentrations of 23 ng/L and 350 ng/L, respectively.

The USAF investigation indicated groundwater flow is to the north from Fire Station 5 (USAF, 2018). Due to the previous USAF investigation of Fire Station 5, Fire Station 5 is not considered a separate AOI for the ARNG SI.

3.4.3 Old Fire Station 4

On historical as-builts, Fire Station 4 is recorded as being north of BAAF runway 17-35 and the Davis Highway (Department of Military and Veterans Affairs, 2013). Based on these records, Fire Station 4 was located to the northeast of the BAAF facility boundary. Fire Station 4 would have been operated by the Army during the World War II era through the late 1970s. It is assumed that Fire Station 5 became the emergency response center for BAAF after it was constructed in 1981. During the PA, interviewees indicated that the old Fire Station 4 was used as storage and classrooms before it was demolished in the mid-1990s. Although the AKARNG did not use AFFF until the 1990s, active-duty Air Force and Army used AFFF as early as the 1960s. Therefore, the years of operation of the Old Fire Station 4 could have overlapped with AFFF use, although no interviews confirmed the use of AFFF.

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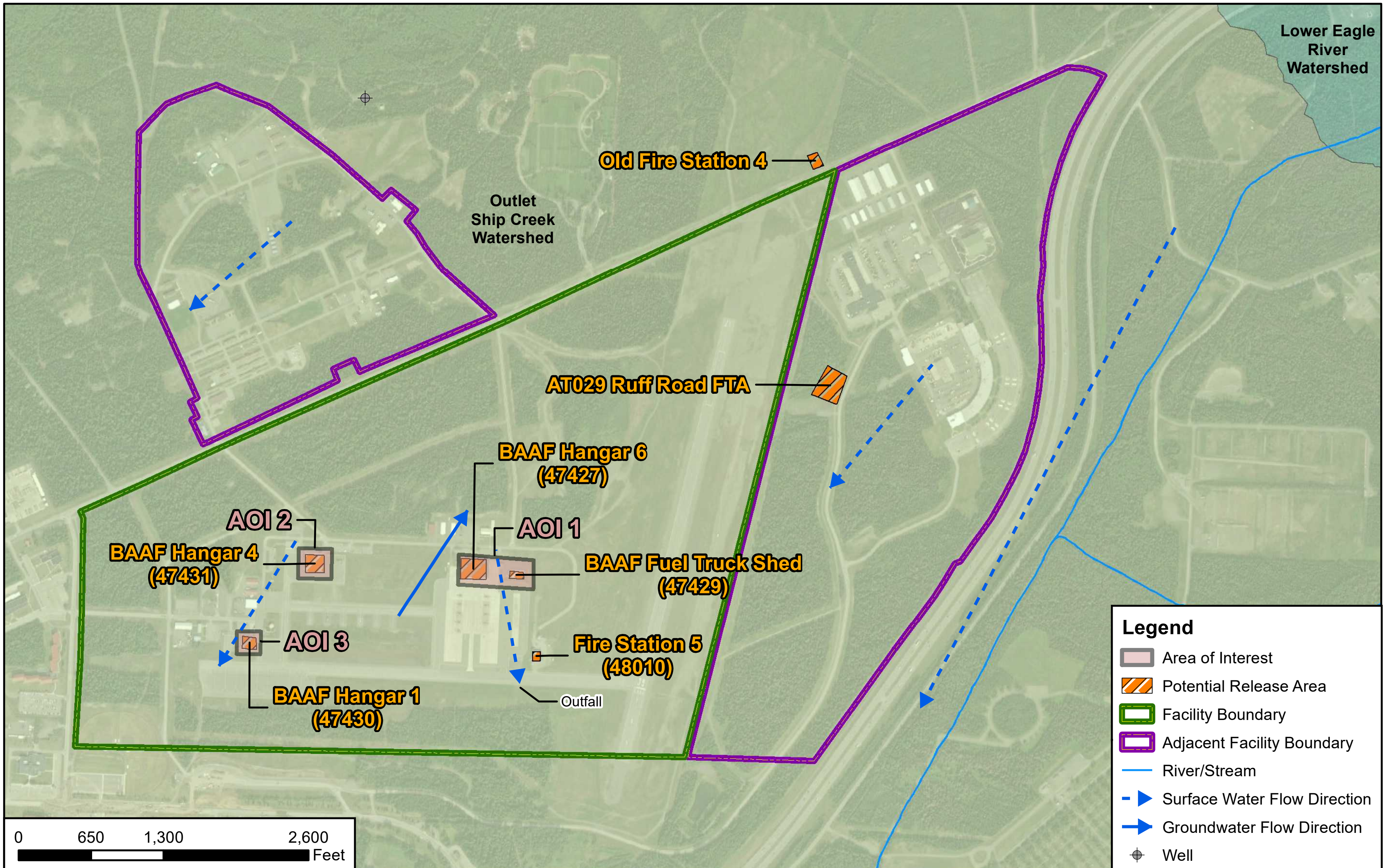

CLIENT	ARNG			
PROJECT	Site Inspection for at BAAF, AK			
REVISED	2/22/2023	GIS BY	MS	2/22/2023
SCALE	1:15,600	CHK BY	MC	2/22/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/22/2023

N

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

4.2 Information Inputs

Primary information inputs included:

- The PA for BAAF (AECOM, 2019);
- Analytical data from groundwater and soil samples collected at JBER as part of a USAF PFAS SI (USAF, 2018);
- 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). The SI scope was bounded vertically by the observed depths of the surficial groundwater table. Temporal boundaries of the study were limited by seasonal conditions present during the Spring 2022 field work.

4.4 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the DoD Environmental Laboratory Accreditation Program (ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs 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, 2018b);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018c);
- *Final Preliminary Assessment Report, Joint Base Elmendorf-Richardson, Alaska,* dated October 2019 (AECOM, 2019);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Bryant Army Airfield, Anchorage, Alaska* dated April 2022 (AECOM, 2022a); and
- *Final Site Safety and Health Plan, Bryant Army Airfield, Anchorage, Alaska* dated May 2022 (AECOM, 2022b).

The SI field activities were conducted from 16 to 30 May 2022, with additional day site visits on 3 November 2021, 14 April 2022, and 2 November 2022, and consisted of source water sampling, utility clearance, sonic boring drilling, soil sample collection, permanent monitoring well installation and development, 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:

- Twenty-three (23) soil samples from eighteen (18) locations;
- Three (3) low-flow groundwater samples from two (2) newly installed permanent monitoring wells and one (1) previously existing permanent well;
- Twenty-four (24) 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**, Field Change Request Forms are provided in **Appendix B3**, Nonconformance and Corrective Action Reports are 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 AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 10 August 2021, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, AKARNG, USACE, ADEC, Air Force Civil Engineer Center (AFCEC), and USEPA. 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 was held after the field event to discuss the results of the SI. Meeting minutes for TPP 3 are included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM placed a ticket with the 811 Alaska Digline utility clearance provider to notify them of intrusive work. 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 16 May 2022 with input from the AECOM field team and BAAF facility staff. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared using a hand auger to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and Sampling Equipment Acceptability

Two potable water sources at BAAF were sampled on 3 November 2021 and again on 14 April 2022 to assess usability for decontamination of drilling equipment. Specifically, the samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15. Results of the samples collected at both locations were confirmed to be acceptable for use in this investigation; therefore, the water source at the northeast exterior corner of Building 47427 (BAAF-DECON-01-041422) was used throughout the field activities. The results of the decontamination water samples 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

Soil samples were collected via rotary sonic (rotosonic) drilling technology, in accordance with the SI QAPP Addendum (AECOM, 2021). A GeoProbe® 8150LS Sonic drill rig and sampling system were used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top 5 feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1**, and sample depths are provided **Table 5-1**.

While drilling near the bottom of the original BAAF-MW001 location borehole at 120 feet bgs, the drill casing became stuck, and a section of drill rod broke at approximately 80 feet bgs. The stuck tooling was attributed to the difficult subsurface conditions (i.e., cobbles, gravel, and sand) binding the equipment. The drill rod was able to be recovered; however, while attempting to clear out cuttings from the bottom of the borehole from 110 to 120 feet bgs, further complications with tooling were encountered, and all casing was required to be removed from the ground. A new drill rig (Geoprobe 7822DT) with an air rotary system, considered better to handle the difficult conditions, was delivered to the site. While re-advancing the casing down to the terminal depth of the borehole, the last 15 feet of drill rod became unthreaded and were lost down hole. The driller was unable to recover the drill rod, and the determination was made to abandon this no longer viable location, identified as BAAF-MW001A, using bentonite chips hydrated in lifts. The borehole location was offset approximately 6 feet to advance the new BAAF-MW001 boring using the original GeoProbe® 8150LS Sonic drill rig system.

At BAAF-MW001 and BAAF-MW002, three discrete soil samples were collected from each boring from the vadose zone for chemical analysis: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample at the bottom of the shallow subsurface interval (13 to 15 feet bgs), and one subsurface soil sample approximately 2 feet above the groundwater table (110 to 122 feet bgs). Two additional discrete samples were collected from the originally attempted borehole BAAF-MW001A: at the surface soil (0 to 2 feet bgs) and the shallow subsurface (13 to 15 feet bgs) intervals.

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 sampling forms (**Appendix B2**) and in a non-treated field logbook (i.e., composition notebook). Depth interval, recovery thickness, PID concentrations, moisture, relative density, color (using a Munsell soil color chart), and texture (using the USCS) were recorded. The boring logs are provided in **Appendix E**.

During the SI, borings BAAF-MW001 and BAAF-MW002 were completed to depths 132 feet bgs and 120.7 feet bgs, respectively. BAAF-MW001A was advanced to approximately 120 feet bgs; the lithology was noted to match that of BAAF-MW001. The dominant lithology encountered below BAAF consisted of well graded sand and gravel with high amounts of fines (>15%). The relative percentage of sand to gravel varied throughout the borings, alternating between sequences of predominantly sand to mostly gravel, with thin, infrequent layers of interbedded fines and poorly graded sand. These findings are likely indicative of the rapid deposition of poorly sorted alluvial material, or similarly, can represent the broad till deposits that cover the area. These observations are consistent with the known depositional history of the area and suggest that nearly the entire section of both boring logs represent the alluvial material of the Mountain View Fan and underlying glacial drift. A higher concentration of fines and absence of gravel was observed in the bottom of boring BAAF-MW002. This section may be the uppermost part of the of the diamicton that is observed in the Dishno Pond, or simply a finer-grained interval within the drift. The absence of a similar interval in boring BAAF-MW001 can be attributed to spatial differences that occur in a dynamic glacial depositional environment. Bedrock was not encountered in at either of the borings. Boring logs are presented in **Appendix E**.

Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15, total organic carbon (TOC) (USEPA Method 9060A) and pH (USEPA Method 9045D), in accordance with the SI QAPP Addendum (AECOM, 2022a). Grain size samples were not collected for laboratory analysis because extensive horizontal and vertical clay units were not observed in the borings.

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. For PFAS samples, a minimum of one field duplicate was collected per field sampling day. Matrix spike (MS)/MS duplicates (MSDs) were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples, except as noted in **Section 5.8**. 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, except as noted in **Section 5.8**.

Borings BAAF-MW001 and BAAF-MW002 were converted to permanent wells. Abandoned borehole BAAF-MW001A was plugged with bentonite chips hydrated in lifts. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 Permanent Well Installation and Groundwater Sampling

During the SI, two permanent monitoring wells, BAAF-MW001 and BAAF-MW002, were installed within or downgradient of potential source areas. The depths of the wells were installed to 130 feet and 120 feet bgs, respectively. The locations of the wells are shown on **Figure 5-2**. Additionally, existing permanent monitoring well FS5-1 was sampled.

A GeoProbe® 8150LS Sonic drill rig was used to install two 2-inch diameter monitoring wells. The monitoring wells were constructed with Schedule 40 PVC, flush-threaded 10-foot sections of riser, 0.010-inch slotted well screen, and a threaded bottom cap. The location and depth of the permanent wells were determined based on the findings of the PA and first encountered groundwater during the SI. A filter pack of 10/20 silica sand was installed in the annulus around the well screen to a minimum of 2 feet above the well screen. A 6-foot-thick bentonite seal was placed above the filter sand and hydrated in lifts. Bentonite-cement 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). The monitoring wells were completed as stick-ups with a protective steel casing set within a concrete pad and protective bollards. The screen interval of each of the groundwater monitoring wells is provided in **Table 5-3**.

Development and sampling of wells were 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. As described in **Section 5.8**, limited groundwater recharge in the wells resulted in variability in total development purge volume between BAAF-MW001 and BAAF-MW002. 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 were any foaming. No foaming was noted in any of the groundwater samples.

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

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. For PFAS samples, a minimum of one field duplicate was collected per field sampling day. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. Because non-dedicated sampling equipment was required due to the use of a bladder pump, equipment rinsate blanks were collected at a rate of 5% and analyzed for the same parameters as the groundwater samples. One field reagent blank was collected in accordance with the PQAPP (AECOM, 2018b). 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

Synoptic groundwater gauging events were performed on 30 May 2022 and 2 November 2022. Groundwater elevation measurements were collected from the two new permanent monitoring wells and one existing permanent well. Water level measurements were taken from the northern side of the well casing. During the May gauging, groundwater depths ranged between 111.49 feet bgs in well BAAF-MW002 to 123.72 feet bgs in BAAF-MW001. Groundwater depths were slightly shallower in November, with depths ranging from 111.09 feet bgs in BAAF-MW002 to 117.21 feet bgs in BAAF-MW001. Groundwater elevations and groundwater flow contour maps for both events are provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-3**.

5.5 Surveying

The northern side of each well casing was surveyed by Alaska-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 2 November 2022 in the applicable Universal Transverse Mercator zone projection with World Geodetic System 84 datum (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B5**.

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 and left onsite in within Hangar 2. Soil IDW drums containing saturated soil were minimal and filled no more than 3/4 full to account for freeze/thaw cycles in case the drums ware moved outside. The soil IDW was not sampled and assumes the characteristics of the associated soil samples collected from that source location. ARNG will land-spread, at the location at which it was generated, all soil with PFOS and PFOA concentrations below the relevant ADEC Human Health Cleanup Levels for the Under 40 Inch Zone (1.6 mg/kg for both PFOS and PFOA) established in 18 Alaska Administrative Code (AAC) 75 Table B-1 (ADEC, 2021). If results show PFOS or PFOA concentrations in soil samples at or above these cleanup levels, ARNG will manage disposal of the solid IDW in accordance with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) was contained in labeled, 55-gallon DOT-approved steel drums, and left onsite next to the soil IDW drums. The liquid IDW drums were only filled 2/3 full to account for freeze/thaw cycles in case the drums are moved outside. The liquid IDW was not sampled and assumes the characteristics of the associated groundwater samples collected from that source location. ARNG will discharge, at the location at which it was generated, groundwater with PFOS and PFOA concentrations below the relevant ADEC Groundwater Cleanup Levels (0.40 µg/L for both PFOS and PFOA) established in 18 AAC 75 Table C (ADEC, 2021). If results show PFOS or

PFOA concentrations at or above these cleanup levels, ARNG will manage and dispose of the liquid IDW either by offsite or onsite disposal or treatment, as appropriate, under a separate contract in accordance with SOP No. 042A for Treating Liquid Investigation-Derived Material (Purge water, drilling water, and decontamination fluids) (EA Engineering, Science, and Technology, Inc., 2021). ARNG will further manage the liquid IDW in accordance with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

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

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

- At the start of SI field activities, stormwater control information was provided by AKARNG personnel that indicated the stormwater inlets around AOI 1 and the flight ramp to the south were conveyed to an outfall that discharges near the southeast corner of the facility. The SI QAPP proposed multiple sample locations around AOI 1 at locations where runoff was likely to encounter the ground surface. However, the stormwater system configuration, specifically the conveyance of drainage in this area to the southeastern outfall, was not previously known. An additional surface soil sample, AOI01-07 was collected within the grass-lined channel just down-grade from the southeastern outfall. The soil sample was collected from the surface to a depth of 4 inches, the maximum depth allowed by the facility without requiring a dig permit and its typical 2-plus week approval period. These actions were documented in a field change request dated May 2022 and are provided in **Appendix B3**.

- The SOP for well development states that in cases where water is added to a borehole during drilling or well installation, three times the volume of added water will be removed during development. The use of potable water was required to flush out the interstitial space between the two sonic casings while drilling the wells installed for the BAAF SI. However, most of the water added to the borehole was considered to have either evaporated as a result of the heat generated during sonic drilling or lost by soaking into the permeable native materials within the unsaturated interval. Removing three volumes of the water added was determined unnecessary and not feasible given the relatively short interval (6 to 9 feet) of saturated well screen below the greater than 110-foot interval of unsaturated soil. Over one volume of the maximum calculated volume of water lost to the subsurface during drilling removed from both BAAF-MW001 and BAAF-MW002. During development, approximately 365 gallons of groundwater were removed from BAAF-MW001, and 165 gallons were removed from BAAF-MW002, equating to approximately 360 times and 116 times the volume of the water column within each well's casing and surrounding filter pack pore space, respectively. Removal of these volumes required development over a period of two days. As an additional measure of confidence that drilling water was removed, in situ water quality parameters were collected from the added potable water tote and were compared to the purged development groundwater parameters. The volume, duration, and monitoring of well development completed in the wells were considered adequate to ensure a representative groundwater sample could be collected. The actions were approved by ARNG during the SI. These actions were documented in a field change request dated July 2022 and are provided in **Appendix B3**.

- The sample coolers for two sample delivery groups (SDGs) were logged in at the laboratory at temperatures that exceeded the 6°C preservation requirement identified in the UFP-QAPP. SDG 221111120 arrived at the laboratory at a temperature of 8.9°C; and included the two decontamination source water samples collected in November 2021. SDG 222052406 arrived at 15.6°C; and included the surface soil samples from AOI 3 and AOI 2 (except AOI 02-02) and shallow subsurface soil sample from BAAF-MW002. Both instances were caused by issues with in-transit shipping logistics from Alaska that resulted in the samples being delivered 1 and 3 days late, respectively. This was despite following the best practices of shipping Priority Overnight, not shipping samples later than Thursday to avoid weekend delivery, packing the sample coolers with plenty of ice, and flagging the cooler for cold storage. Tracking information showed the coolers were delayed in-transit in Tennessee and Louisiana and were not kept in cold storage. The laboratory notified AECOM of the over-temperature samples shortly after they were received. For the November 2021 decontamination source water samples, the team was able to resample the same on-facility sources and had already proposed collecting an additional round of samples in Spring 2022 to support the water use determination prior to the full SI field mobilization. For the May 2022 soil samples; project chemists recommended that the samples be analyzed rather than resampled. Resampling of over-temperature samples has been performed for aqueous samples, but not soil. Soil samples are considered usable if received above temperature, and are qualified with a J/UJ flag if ≤ 20°C; or a J/X flag if > 20°C. All results for the over temperature samples are considered usable as stated in the DUA in **Appendix A**. These actions were documented in a nonconformance and corrective action report dated November 2022 and are provided in **Appendix B4**.

- Field staff requested pH and TOC analysis on the laboratory chain of custody for surface soil samples AOI02-04-SB-0.0-2.0-MS and AOI02-04-SB-0.0-2.0-MSD. Upon receipt and review of the laboratory data, it was found that the MS and MSD volumes were not analyzed for the requested pH and TOC, but instead were analyzed for PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15. As a result, the QC requirement for MS and MSD was not met for pH and TOC in soil samples for this project. The data validation determined that no flag was necessary and that the pH and TOC results from the primary sample volumes are usable. Further, pH and TOC results from the SI are used in later phases to evaluate the transport through the soil medium, but do not have an effect on the SI determinations. These actions were documented in a nonconformance and corrective action report dated November 2022 and are provided in **Appendix B4**.

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Bryant AAF, Anchorage, Alaska

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)	Comments
Soil Samples						
AOI01-01-SB-0.0-2.0	5/20/2022 14:50	0.0-2.0	x	x	x	
AOI01-01-SB-0.0-2.0-D	5/20/2022 14:50	0.0-2.0		x	x	Duplicate
AOI01-02-SB-0.0-2.0	5/20/2022 14:25	0.0-2.0	x			
AOI01-02-SB-0.0-2.0-MS	5/20/2022 14:25	0.0-2.0	x			MS/MSD
AOI01-02-SB-0.0-2.0-MSD	5/20/2022 14:25	0.0-2.0	x			MS/MSD
AOI01-03-SB-0.0-2.0	5/20/2022 13:55	0.0-2.0	x			
AOI01-03-SB-0.0-2.0-D	5/20/2022 13:55	0.0-2.0	x			Duplicate
AOI01-04-SB-0.0-2.0	5/19/2022 16:40	0.0-2.0	x			
AOI01-05-SB-0.0-2.0	5/19/2022 17:07	0.0-2.0	x			
AOI01-06-SB-0.0-2.0	5/20/2022 13:28	0.0-2.0	x			
AOI01-07-SB-0.0-0.33	5/20/2022 15:40	0.0-0.33	x			
AOI01-07-SB-0.0-0.33-MS	5/20/2022 15:40	0.0-0.33	x			MS/MSD
AOI01-07-SB-0.0-0.33-MSD	5/20/2022 15:40	0.0-0.33	x			MS/MSD
AOI02-01-SB-0.0-2.0	5/19/2022 9:55	0.0-2.0	x			
AOI02-02-SB-0.0-2.0	5/20/2022 9:47	0.0-2.0	x			
AOI02-03-SB-0.0-2.0	5/19/2022 11:20	0.0-2.0	x			
AOI02-03-SB-0.0-2.0-D	5/19/2022 11:20	0.0-2.0	x			Duplicate
AOI02-04-SB-0.0-2.0	5/19/2022 10:35	0.0-2.0	x	x	x	
AOI02-04-SB-0.0-2.0-MS	5/19/2022 10:35	0.0-2.0	x			MS/MSD
AOI02-04-SB-0.0-2.0-MSD	5/19/2022 10:35	0.0-2.0	x			MS/MSD
AOI03-01-SB-0.0-2.0	5/18/2022 14:08	0.0-2.0	x			
AOI03-02-SB-0.0-2.0	5/18/2022 15:54	0.0-2.0	x			
AOI03-03-SB-0.0-2.0	5/18/2022 15:22	0.0-2.0	x			
AOI03-03-SB-0.0-2.0-D	5/18/2022 15:22	0.0-2.0	x			Duplicate
AOI03-04-SB-0.0-2.0	5/18/2022 14:44	0.0-2.0	x	x	x	
BAAF-MW001A-SB-0.0-2.0	5/20/2022 12:27	0.0-2.0	x			
BAAF-MW001A-SB-13.0-15.0	5/20/2022 16:50	13.0-15.0	x			
BAAF-MW001-SB-0.0-2.0	5/25/2022 16:48	0.0-2.0	x			
BAAF-MW001-SB-13.0-15.0	5/25/2022 17:09	13.0-15.0	x			
BAAF-MW001-SB-13.0-15.0-D	5/25/2022 17:09	13.0-15.0	x			Duplicate
BAAF-MW001-SB-121.0-122.0	5/26/2022 17:15	121.0-122.0	x			
BAAF-MW001-SB-121.0-122.0-D	5/26/2022 17:15	121.0-122.0	x			Duplicate
BAAF-MW002-SB-0.0-2.0	5/16/2022 14:51	0.0-2.0	x			
BAAF-MW002-SB-0.0-2.0-D	5/16/2022 14:51	0.0-2.0	x			Duplicate
BAAF-MW002-SB-13.0-15.0	5/17/2022 11:30	13.0-15.0	x			
BAAF-MW002-SB-13.0-15.0-D	5/17/2022 11:30	13.0-15.0	x			Duplicate
BAAF-MW002-SB-110.0-110.8	5/19/2022 15:30	110.0-110.8	x			

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Bryant AAF, Anchorage, Alaska

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)	Comments
Groundwater Samples						
FS5-1-052722	5/27/2022 9:33	128	x			
FS5-1-052722-D	5/27/2022 9:33	128	x			Duplicate
BAAF-MW001-053022	5/30/2022 10:30	127	x			
BAAF-MW001-053022-D	5/30/2022 10:30	127	x			Duplicate
BAAF-MW001-053022-MS	5/30/2022 10:30	127	x			MS
BAAF-MW001-053022-MSD	5/30/2022 10:30	127	x			MSD
BAAF-MW002-052722	5/27/2022 17:20	116	x			
Blank Samples						
BAAF-ERB-01	5/20/2022 12:05	NA	x			hand auger
BAAF-ERB-02	5/20/2022 15:10	NA	x			drilling shoe
BAAF-ERB-03	5/28/2022 10:30	NA	x			bladder pump
BAAF-FRB-01	5/20/2022 12:15	NA	x			
BAAF-DECON-01-041422	4/14/2022 15:25	NA	x			source water
BAAF-DECON-02-041422	4/14/2022 15:00	NA	x			source water
BAAF-DECON-03	5/25/2022 15:45	NA	x			decon system

Notes:
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

Table 5-2
Soil Boring Depths and Permanent Well Screen Intervals
Site Inspection Report, Bryant AAF, Anchorage, Alaska

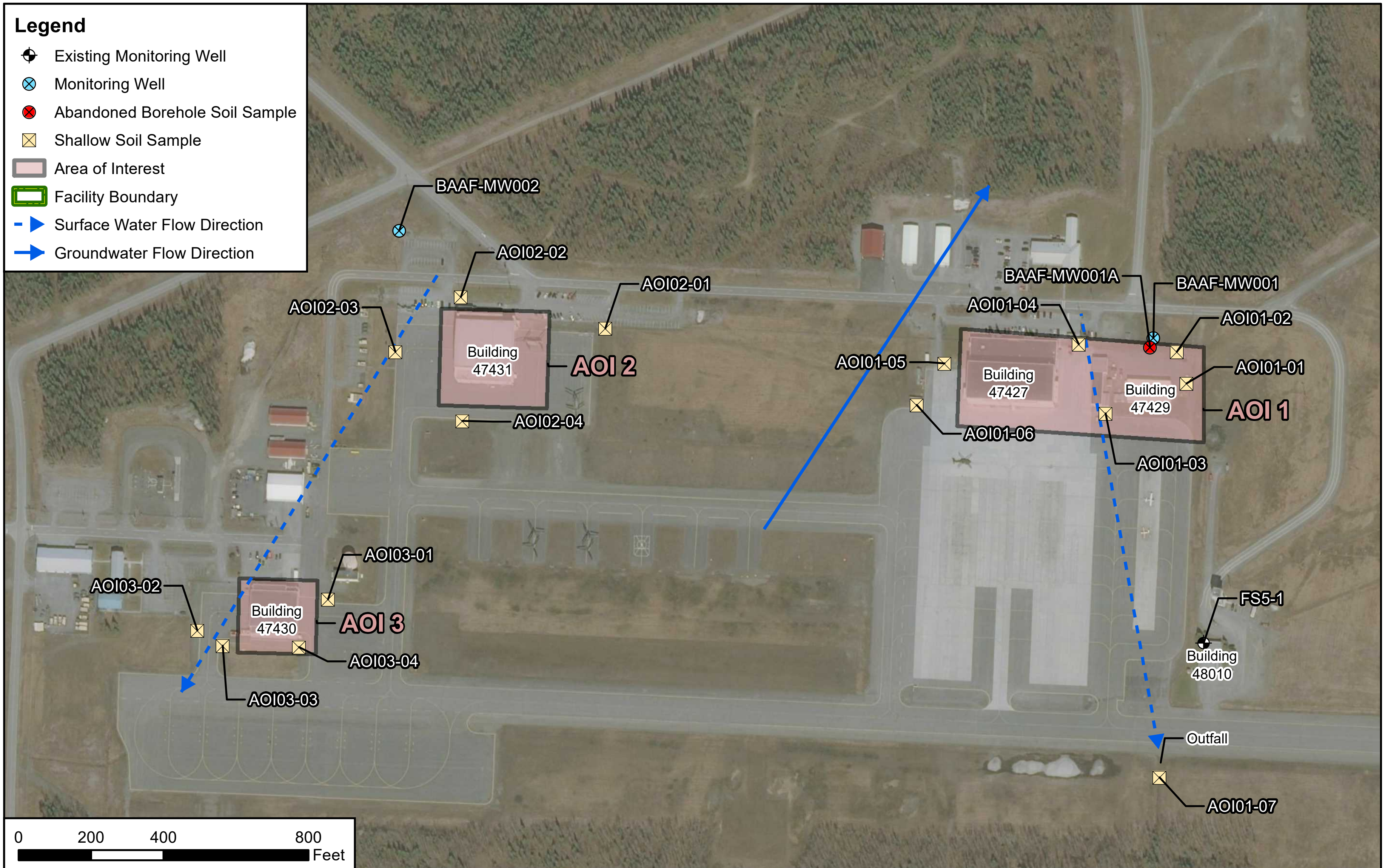
Area of Interest	Boring Location	Monitoring Well ID	Soil Boring Depth (feet bgs)	Permanent Well Screen Interval (feet bgs)
1	BAAF-MW001	BAAF-MW001	132	120-130
2	BAAF-MW002	BAAF-MW002	120.7	110-120
Fire Station 5	FS5-1	FS5-1	134	122.75-132.75

Notes:
bgs = below ground surface
BAAF = Bryant Army Airfield
ID = identification

Table 5-3
Depths to Groundwater and Groundwater Elevations in Permanent Monitoring Wells
Site Inspection Report, Bryant AAF, Anchorage Alaska

Location ID	Permanent Well Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Gauge Date	Depth to Water (feet btoc)	Depth to Water feet bgs)	Groundwater Elevation (feet NAVD88)
BAAF-MW001	120-130	361.53	358.12	5/30/2022	127.12	123.71	234.41
				11/2/2022	120.62	117.21	240.91
BAAF-MW002	110-120	356.75	353.49	5/30/2022	114.75	111.49	242.00
				11/2/2022	114.35	111.09	242.40
FS5-1	122.75-132.75	362.15	359.60	5/30/2022	120.28	117.73	241.87
				11/2/2022	113.84	111.29	248.31

Notes:
bgs - below ground surface
btoc = below top of casing
ID = identification
NA = not available
NAVD88 = North American Vertical Datum 1988



CLIENT	ARNG			
PROJECT	Site Investigation at BAAF, AK			
REVISED	2/22/2023	GIS BY	MS	2/22/2023
SCALE	1:4,800	CHK BY	MC	2/22/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/22/2023

Site Investigation Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Site Inspection Results

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

6.1 Screening Levels

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

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

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

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

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

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

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

6.2 Soil Physicochemical Analyses

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

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport. 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: BAAF Hangar 6 and BAAF Fuel Truck Shed. The soil and groundwater results are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI01-01 through AOI01-06 and at boring locations BAAF-MW001 and BAAF-MW001A. A surface soil sample was also collected from 0 to 4 inches bgs at location AOI01-07, in the grass swale down-grade from the southeastern outfall. Soil was sampled from shallow subsurface soil (13 to 15 feet bgs) at BAAF-MW001 and BAAF-MW001A, and deep subsurface soil (121 to 122 feet bgs) at BAAF-MW001. **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.

In summary, PFOS was detected in surface soil at a concentration above the SL. PFOA, PFBS, PFHxS, and PFNA were detected in surface and subsurface soil below the SLs. PFOS was also detected in shallow subsurface soil below the SLs. Details are highlighted below.

In surface soil, PFOS was detected above the SL of 13 micrograms per kilogram (µg/kg), at a concentration of 48.7 µg/kg at BAAF-MW001A. PFOS was also detected in surface soil at the remaining AOI 1 locations, at concentrations ranging from 0.148 J µg/kg to 9.17 µg/kg. PFOA, PFBS, PFHxS, and PFNA were detected at least one order of magnitude below their SLs. The maximum concentration of these four detected compounds was PFHxS at 1.93 µg/kg at BAAF-MW001A.

In shallow subsurface soil, PFOS and PFHxS were detected, with concentrations at least one order of magnitude below their SLs. The maximum concentration of the two detected compounds was PFOS at 2.39 µg/kg at BAAF-MW001. PFOA, PFBS, and PFNA were not detected in the shallow subsurface soil.

PFOS and PFHxS were detected in deep subsurface soil, at a maximum concentration of 0.109 J µg/kg at BAAF-MW001 (PFHxS). PFOA, PFBS, and PFNA were not detected.

6.3.2 AOI 1 Groundwater Analytical Results

Groundwater was sampled from the newly installed permanent monitoring well BAAF-MW001 and existing permanent monitoring well FS5-1. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

In summary, PFOS, PFOA, and PFHxS were detected in groundwater above their SLs. PFBS was detected below the SL. PFNA was not detected in groundwater. Details are highlighted below.

- PFOA was detected above the 6 ng/L groundwater SL, at concentrations of 19.9 ng/L at BAAF-MW001 and 53.8 ng/L at FS5-1.
- PFOS was detected above the 4 ng/L SL, at a concentration of 123 ng/L at FS5-1.
- PFHxS was detected above the 39 ng/L SL, at concentrations of 230 J- ng/L at BAAF-MW001 and 611 ng/L at FS5-1.
- PFBS was detected below the SL at both locations, with a maximum concentration of 61.5 ng/L at FS5-1.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOS was detected in the surface soil with concentrations above the SL. PFOA, PFOS, and PFHxS were detected in groundwater with concentrations above the SLs. Based on the exceedances of the SLs in surface soil and 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: BAAF Hangar 4. The results in soil and groundwater are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.4.1 AOI 2 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI02-01 through AOI02-04 and BAAF-MW002. Soil was sampled from the shallow subsurface soil (13 to 15 feet bgs) and deep subsurface soil (110 to 110.8 feet bgs) at BAAF-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.

In summary, PFOS was detected in surface soil, at concentrations above the SL. PFOA, PFBS, PFHxS, and PFNA were detected in surface soil below their SLs. PFOA, PFOS, PFBS, PFHxS, and PFNA were not detected in any subsurface soil sample. Details are highlighted below.

In surface soil, PFOS was detected above the 13 µg/kg SL, at a concentration of 29.4 µg/kg at AOI02-03. PFOS was detected at the remaining AOI 2 sample locations, at concentrations between 0.233 J µg/kg and 3.03 µg/kg. PFOA, PFBS, PFHxS, and PFNA were detected below their SLs in surface soil. The maximum concentration of these compounds was PFHxS, at 5.20 µg/kg at AOI02-03.

6.4.2 AOI 2 Groundwater Analytical Results

Groundwater was sampled from the newly installed permanent monitoring well BAAF-MW002. This well is not located within AOI 2, but as stated in the SI QAPP Addendum (AECOM, 2022a), was installed and sampled to evaluate groundwater downgradient of both AOI 2 and AOI 3. **Figure**

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

PFOA, PFBS, and PFHxS were detected in groundwater, below their SLs, at concentrations of 2.09 J ng/L, 3.86 ng/L, and 28.6 ng/L, respectively. PFOS and PFNA were not detected in groundwater.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOS was detected in the surface soil, at concentrations above the SL. PFOS, PFBS, and PFHxS were detected in groundwater, at concentrations below their SLs. Based on the exceedances of the SLs in surface soil, further evaluation at AOI 2 is warranted.

6.5 AOI 3

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

6.5.1 AOI 3 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI03-01 through AOI03-04. Subsurface soil samples were not collected. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** summarizes the soil results.

PFOS, PFHxS, and PFNA were detected in surface soil, at concentrations below their SLs. The maximum concentration of the three detected compounds was PFOS, at 1.36 J µg/kg at AOI03-01. PFOA and PFBS were not detected in soil at AOI 3.

6.5.2 AOI 3 Groundwater Analytical Results

Groundwater was sampled from the newly installed permanent monitoring well BAAF-MW002. This well is not located within AOI 3, but as stated in the SI QAPP Addendum (AECOM, 2022a), was installed and sampled to evaluate groundwater downgradient of both AOI 2 and AOI 3. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

PFOA, PFBS, and PFHxS were detected in groundwater at BAAF-MW002, below their SLs, at concentrations of 2.09 J ng/L, 3.86 ng/L, and 28.6 ng/L, respectively. PFOS and PFNA were not detected in groundwater.

6.5.3 AOI 3 Conclusions

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

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Bryant Army Airfield

	Area of Interest	AOI01																			
	Sample ID	AOI01-01-SB-0.0-2.0		AOI01-02-SB-0.0-2.0		AOI01-03-SB-0.0-2.0		AOI01-03-SB-0.0-2.0-D		AOI01-04-SB-0.0-2.0		AOI01-05-SB-0.0-2.0		AOI01-06-SB-0.0-2.0		AOI01-07-SB-0.0-0.33		BAAF-MW001-SB-0.0-2.0		BAAF-MW001A-SB-0.0-2.0	
	Sample Date	05/20/2022		05/20/2022		05/20/2022		05/20/2022		05/19/2022		05/19/2022		05/20/2022		05/20/2022		05/25/2022		05/20/2022	
	Depth	0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-0.33 ft		0-2 ft		0-2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	0.022	J	ND	U	ND	U	ND	U	ND	U	ND	U	0.023	J	0.021	J	0.051	J
PFHxS	130	ND	U	0.173	J	0.043	J	ND	UJ	0.208	J	0.035	J	0.045	J	0.597	J	0.526	J	1.93	
PFNA	19	ND	U	ND	U	0.027	J	ND	UJ	0.920	J	ND	U	0.021	J	0.051	J	ND	U	0.048	J
PFOA	19	ND	U	ND	U	ND	U	ND	U	0.551	J	ND	U	ND	U	0.116	J	ND	U	0.127	J
PFOS	13	0.148	J	1.74	J-	0.458	J	0.195	J	9.16		1.01	J	0.297	J	7.14	J	9.17		48.7	

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
J- = Estimated concentration, biased low
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
BAAF	Bryant Army Airfield
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Bryant Army Airfield

	Area of Interest	AOI02														AOI03					
	Sample ID	AOI02-01-SB-0.0-2.0		AOI02-02-SB-0.0-2.0		AOI02-03-SB-0.0-2.0		AOI02-03-SB-0.0-2.0-D		AOI02-04-SB-0.0-2.0		BAAF-MW002-SB-0.0-2.0		BAAF-MW002-SB-0.0-2.0-D		AOI03-01-SB-0.0-2.0		AOI03-02-SB-0.0-2.0		AOI03-03-SB-0.0-2.0	
	Sample Date	05/19/2022		05/20/2022		05/19/2022		05/19/2022		05/19/2022		05/16/2022		05/16/2022		05/18/2022		05/18/2022		05/18/2022	
	Depth	0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	UJ	ND	U	0.049	J	0.042	J	ND	UJ	ND	UJ	ND	UJ	ND	UJ	ND	UJ	ND	UJ
PFHxS	130	0.231	J	0.428	J	5.20	J	5.10	J	0.087	J	0.310	J	0.557	J	0.144	J	0.036	J	ND	UJ
PFNA	19	0.038	J	0.032	J	0.447	J	0.438	J	0.080	J	ND	UJ	ND	UJ	0.024	J	ND	UJ	ND	UJ
PFOA	19	ND	UJ	0.120	J	2.95	J	2.56	J	0.118	J	0.108	J	0.158	J	ND	UJ	ND	UJ	ND	UJ
PFOS	13	1.57	J	3.03		29.4	J	29.2	J	0.715	J	0.233	J	0.497	J	1.36	J	0.074	J	ND	UJ

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
J- = Estimated concentration, biased low
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
BAAF	Bryant Army Airfield
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Bryant Army Airfield

	Area of Interest	AOI03			
	Sample ID	AOI03-03-SB-0.0-2.0-D		AOI03-04-SB-0.0-2.0	
	Sample Date	05/18/2022		05/18/2022	
	Depth	0-2 ft		0-2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)					
PFBS	1900	ND	UJ	ND	UJ
PFHxS	130	ND	UJ	0.133	J
PFNA	19	ND	UJ	ND	UJ
PFOA	19	ND	UJ	ND	UJ
PFOS	13	ND	UJ	0.700	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
J- = Estimated concentration, biased low
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
BAAF	Bryant Army Airfield
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Bryant Army Airfield

	Area of Interest	AOI01						AOI02			
	Sample ID	BAAF-MW001-SB-13.0-15.0		BAAF-MW001-SB-13.0-15.0-D		BAAF-MW001A-SB-13.0-15.0		BAAF-MW002-SB-13.0-15.0		BAAF-MW002-SB-13.0-15.0-D	
	Sample Date	05/25/2022		05/25/2022		05/20/2022		05/17/2022		05/17/2022	
	Depth	13-15 ft		13-15 ft		13-15 ft		13-15 ft		13-15 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)											
PFBS	25000	ND	U	ND	U	ND	U	ND	UJ	ND	UJ
PFHxS	1600	0.138	J	0.146	J	0.091	J	ND	UJ	ND	UJ
PFNA	250	ND	U	ND	U	ND	U	ND	UJ	ND	UJ
PFOA	250	ND	U	ND	U	ND	U	ND	UJ	ND	UJ
PFOS	160	2.39		2.03		1.16		ND	UJ	ND	UJ

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

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

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Bryant Army Airfield

Area of Interest	AOI01				AOI02	
Sample ID	BAAF-MW001-SB-121.0-122.0		BAAF-MW001-SB-121.0-122.0-D		BAAF-MW002-SB-110.0-110.8	
Sample Date	05/26/2022		05/26/2022		05/19/2022	
Depth	121-122 ft		121-122 ft		110-110.8 ft	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)						
PFBS	ND	U	ND	U	ND	U
PFHxS	0.096	J	0.109	J	ND	U
PFNA	ND	U	ND	U	ND	U
PFOA	ND	U	ND	U	ND	U
PFOS	0.075	J	0.074	J	ND	U

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

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

Table 6-5
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Bryant Army Airfield

	Area of Interest	AOI01								AOI02 & AOI03	
	Sample ID	BAAF-MW001-053022		BAAF-MW001-053022-D		FS5-1-052722		FS5-1-052722-D		BAAF-MW002-052722	
	Sample Date	05/30/2022		05/30/2022		05/27/2022		05/27/2022		05/27/2022	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)											
PFBS	601	38.8	J-	37.6	J-	52.7		61.5		3.86	
PFHxS	39	230	J-	222	J-	529		611		28.6	
PFNA	6	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	6	19.9		19.1		46.6		53.8		2.09	J
PFOS	4	2.80	J	2.93	J	105		123		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 Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers
J = Estimated concentration
J- = Estimated concentration, biased low
U = The analyte was not detected at a level greater than or equal to the adjusted DL

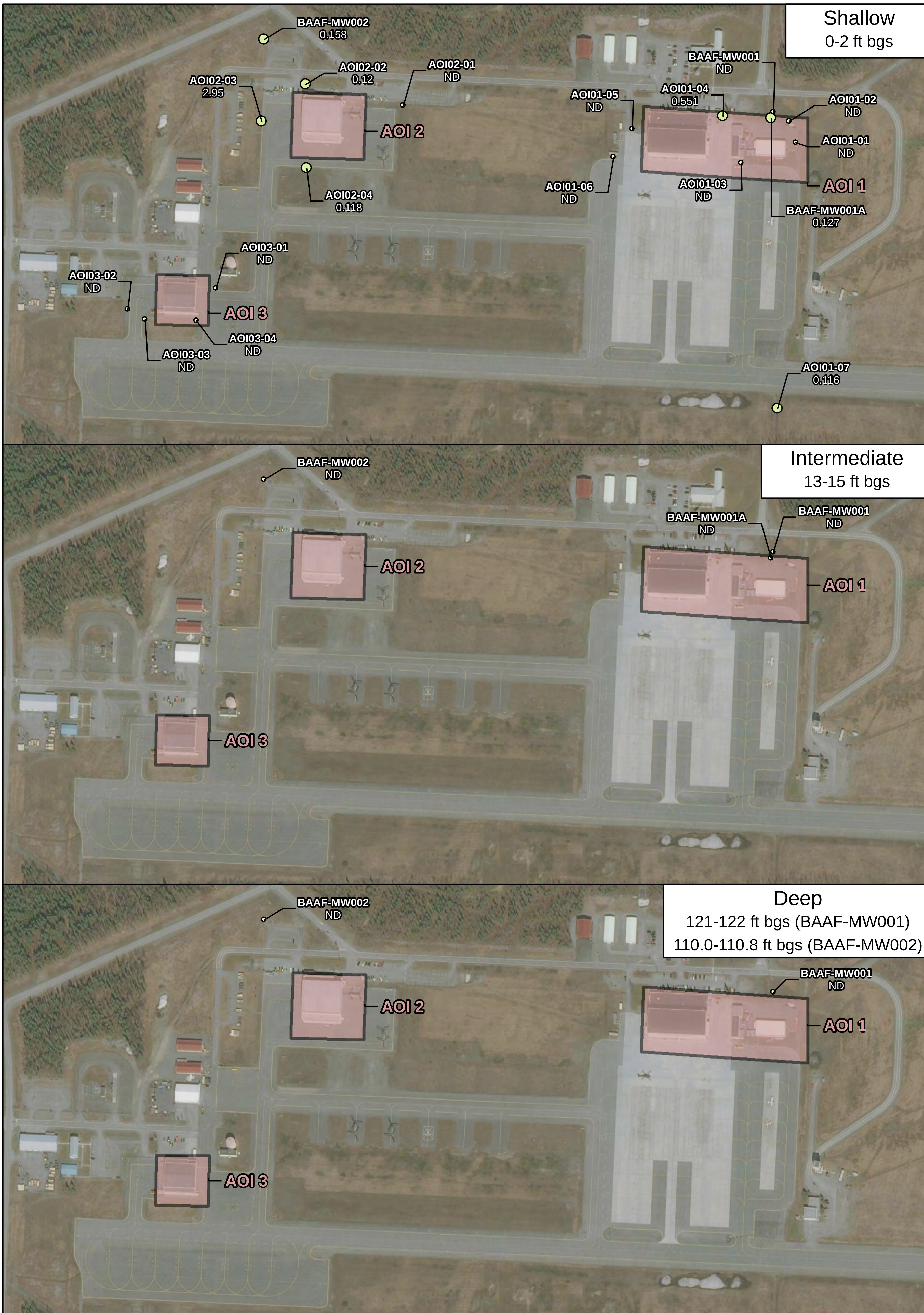
Notes
ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

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

Acronyms and Abbreviations

AOI	Area of Interest
BAAF	Bryant Army Airfield
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



Legend

Area of Interest

PFOA Results (µg/kg)

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

N

0 200 400 800 Feet

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

PFOA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Investigation at BAAF, AK			
REVISED	6/8/2023	GIS BY	MS	6/8/2023
SCALE	1:4,800	CHK BY	MC	6/8/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	6/8/2023

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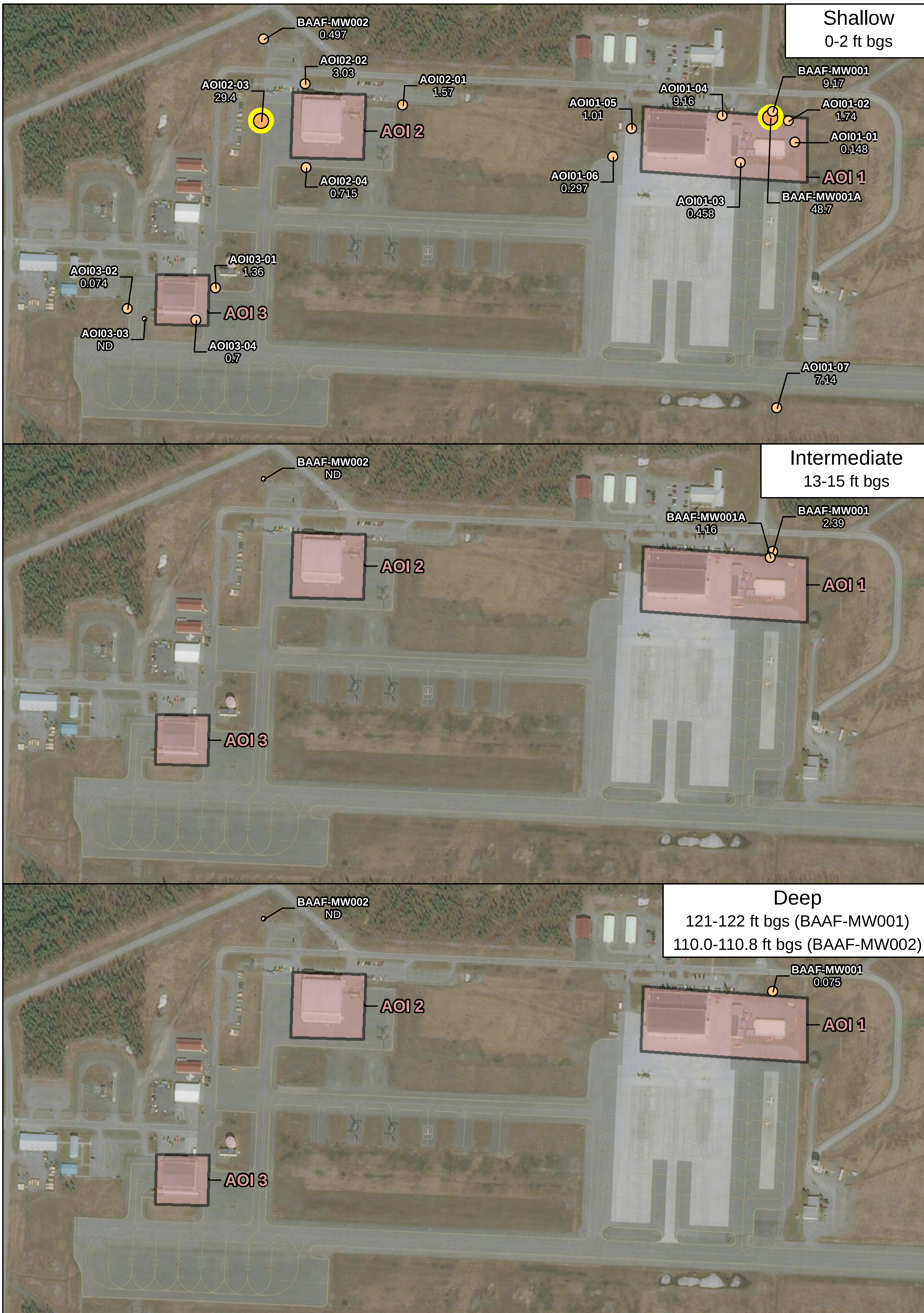
Figure 6-1



Legend

Area of Interest

PFOS Results (µg/Kg)

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

N

0 200 400 800 Feet

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

PFOS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Investigation at BAAF, AK			
REVISED	6/8/2023	GIS BY	MS	6/8/2023
SCALE	1:4,800	CHK BY	MC	6/8/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	6/8/2023

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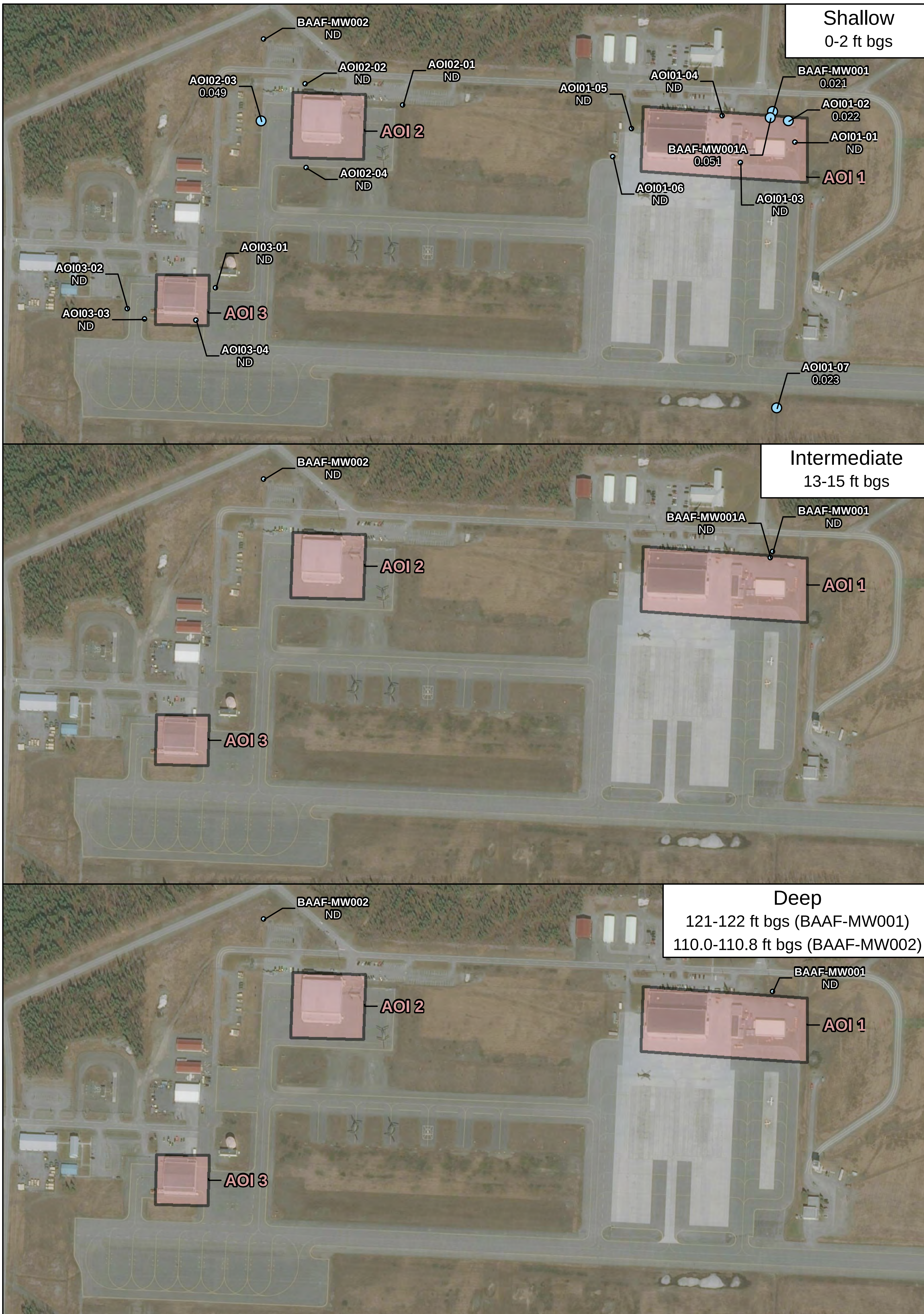
Figure 6-2



Legend

Area of Interest

PFBS Results (μg/Kg)

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

N

0 200 400 800 Feet

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

PFBS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Investigation at BAAF, AK			
REVISED	6/8/2023	GIS BY	MS	6/8/2023
SCALE	1:4,800	CHK BY	MC	6/8/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	6/8/2023

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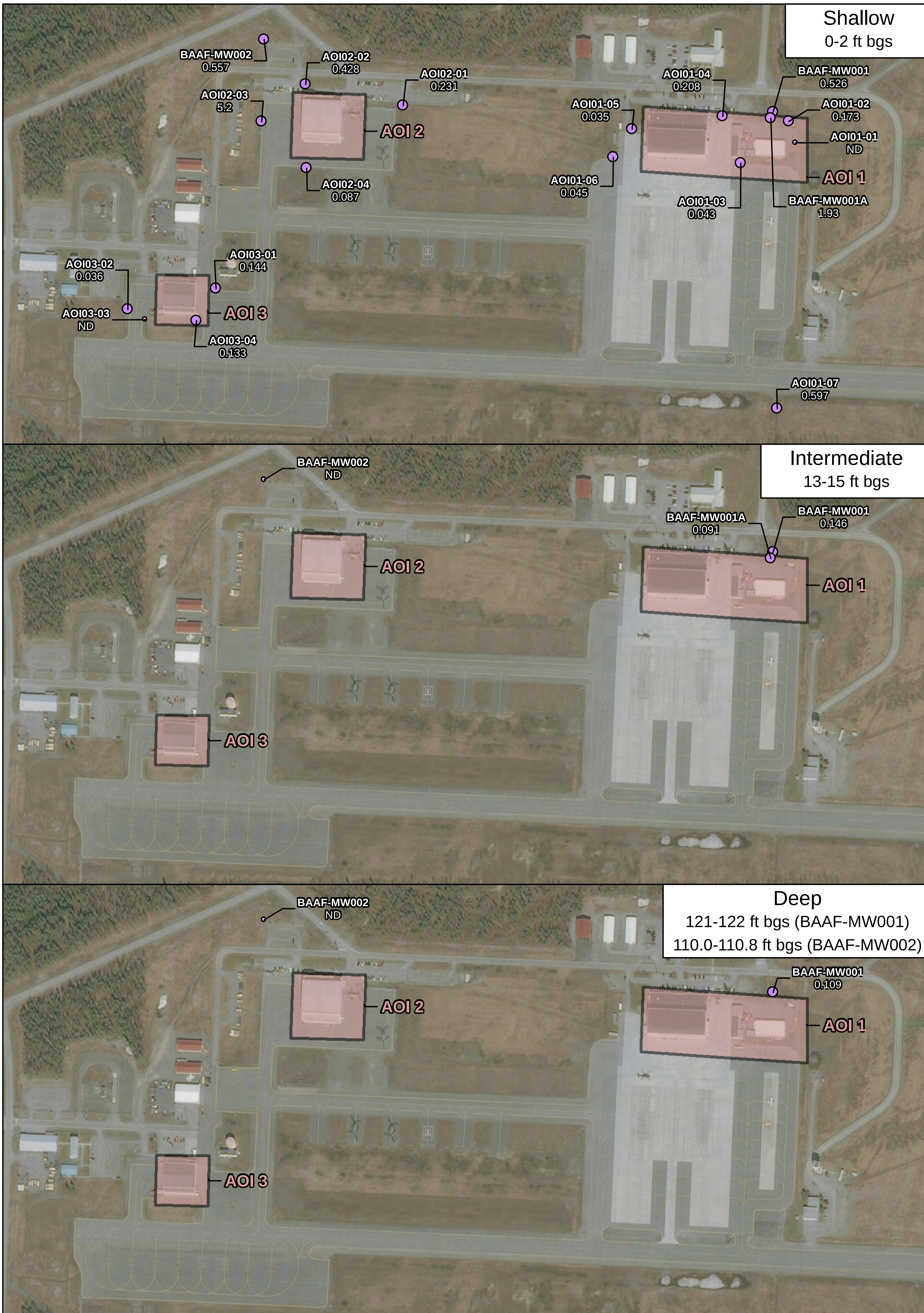
Figure 6-3



Legend

Area of Interest

PFHxS Results (µg/Kg)

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

N

0 200 400 800 Feet

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

PFHxS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Investigation at BAAF, AK			
REVISED	6/8/2023	GIS BY	MS	6/8/2023
SCALE	1:4,800	CHK BY	MC	6/8/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	6/8/2023

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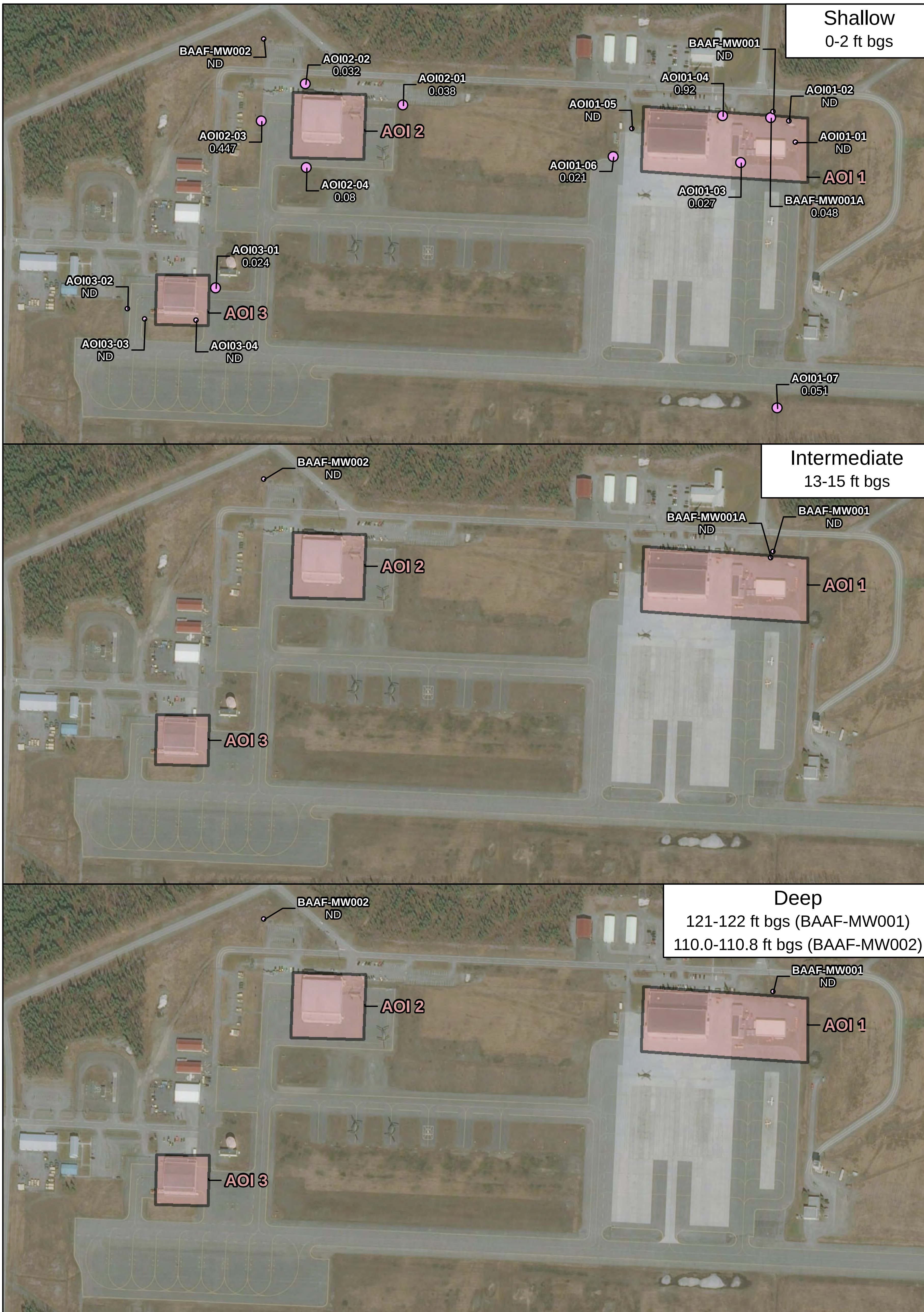
Figure 6-4



Legend

Area of Interest

PFNA Results (μg/kg)

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

N

0 200 400 800 Feet

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

PFNA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Investigation at BAAF, AK			
REVISED	6/8/2023	GIS BY	MS	6/8/2023
SCALE	1:4,800	CHK BY	MC	6/8/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	6/8/2023

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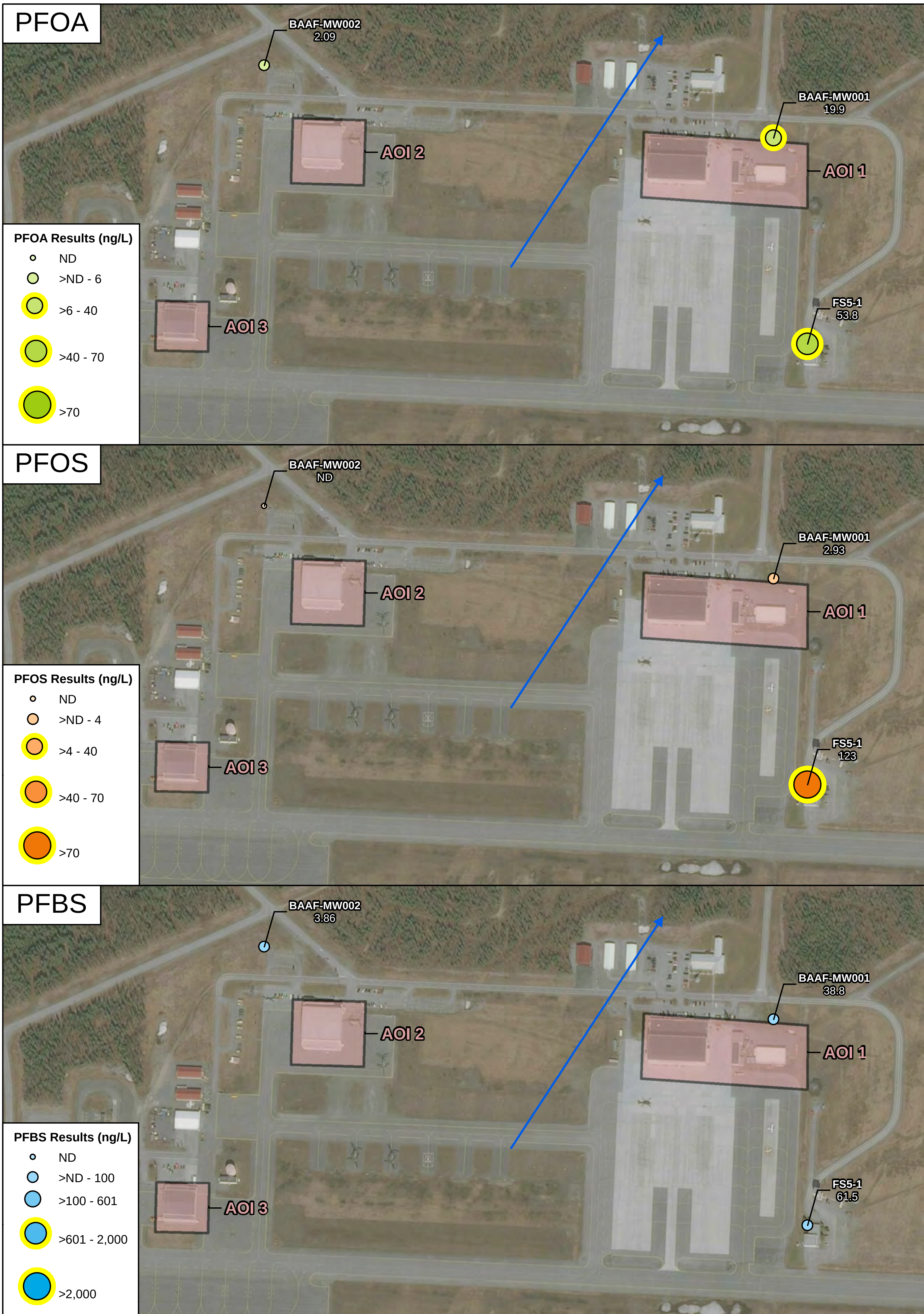
Figure 6-5



Legend

Area of Interest

Groundwater Flow Direction

N

0 200 400 800 Feet

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

PFOA, PFOS, and PFBS Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Investigation at BAAF, AK			
REVISED	2/17/2023	GIS BY	MS	2/17/2023
SCALE	1:4,800	CHK BY	MC	2/17/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/17/2023

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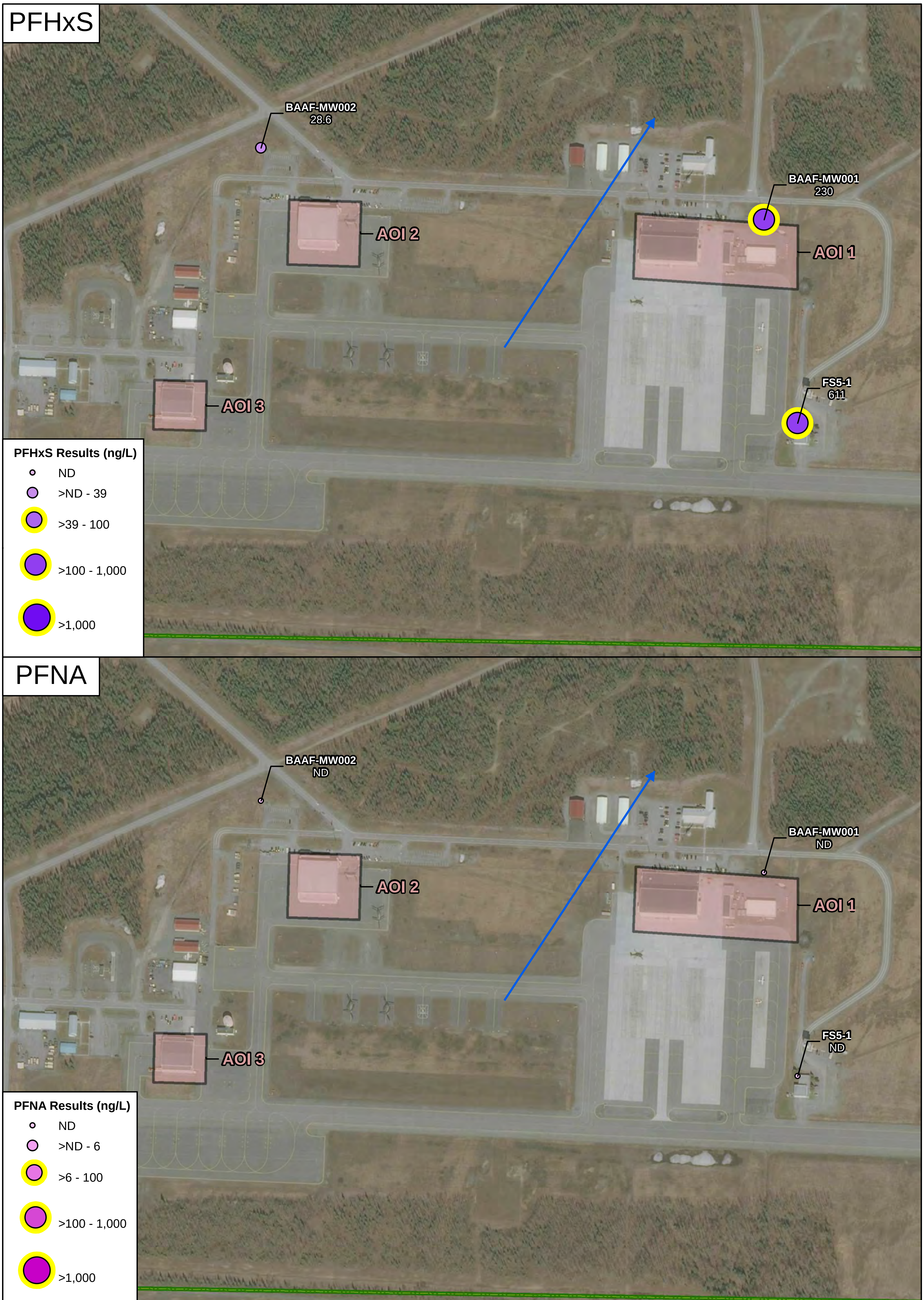
Figure 6-6



Legend

- Area of Interest
- Facility Boundary
- Groundwater Flow Direction

N

0 200 400 800 Feet

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

PFHxS and PFNA Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Investigation at BAAF, AK			
REVISED	2/20/2023	GIS BY	MS	2/20/2023
SCALE	1:4,800	CHK BY	MC	2/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/20/2023

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Figure 6-7

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7. Exposure Pathways

The conceptual site models (CSMs) for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-3**. 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 an RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

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

7.1 Soil Exposure Pathway

The SI results in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 1, AOI 2, and AOI 3 based on the aforementioned criteria.

7.1.1 AOI 1

At AOI 1, annual fire training occurred outside of BAAF Hangar 6 for between 2004 and 2008. Tri-Max™ units containing AFFF were stored inside Hangar 6, and bulk AFFF was stored outside of the BAAF Fuel Truck Shed from the 1990s to 2018. All Tri-Max™ units at BAAF were relocated to the storage yard near the Fuel Truck Shed at some point after the PA site visit. AFFF may have been spilled during transfer of the Tri-Max™ unit contents for fire training, or through incidental leaks and spills of stored AFFF. It is possible AFFF spilled in the hangar may have infiltrated into the subsurface soil via joints in the floor slab or could have traveled outside onto the flight ramp and surrounding grassy areas. AFFF spills near the Fuel Shed and storage yard could have run off to surrounding grassy areas or infiltrated directly.

PFOS was detected above the SL in surface soil at AOI 1. Site workers and construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. No ongoing construction was observed at the facility during the SI. However, future construction is planned at the facility that will impact AOI 1. Therefore, the surface soil exposure pathway for site workers and future construction workers are potentially complete. JBER is a secure facility but does allow public access for recreation. While the BAAF airfield has a secondary security fence, several sample locations at AOI 1 are located outside of the fenced area. There are no immediate nearby residential structures. Therefore, the incidental ingestion and inhalation of dust exposure pathways for the trespassers and recreational users are potentially complete but, are considered incomplete for residential receptors. PFOS and PFHxS were detected below their SLs in shallow subsurface soil at AOI 1. Construction workers could contact constituents in subsurface soil via incidental ingestion, so 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

At the time of the PA, 11 Tri-Max™ units were stored inside of BAAF Hangar 4 at AOI 2. While there were no documented releases, it is possible that incidental leaks or spills of AFFF could have occurred. AFFF spilled in the hangar may have infiltrated into the subsurface soil via joints in the floor slab or could have traveled outside onto the flight ramp and surrounding grassy areas.

PFOS was detected above the SL in surface soil at AOI 2. No ongoing construction was observed at the facility during the SI. However, future construction is planned at the facility that will impact AOI 2. Therefore, the surface soil exposure pathway for site workers and future construction workers is potentially complete. Several sample locations at AOI 1 are located outside of BAAF's secured area. There are no immediate nearby residential structures. Therefore, the incidental ingestion and inhalation of dust exposure pathways for the trespassers and recreational users are potentially complete, and they are incomplete for residential receptors. PFOA, PFOS, PFBS, PFHxS, and PFNA were not detected in subsurface soil at AOI 2; therefore, the subsurface soil exposure pathway for construction workers is considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.1.3 AOI 3

At the time of the PA, one Tri-Max™ unit was staged outside Hangar 1 in the summer and brought into a partially enclosed arctic entry in the winter. While there were no documented releases, it is possible that incidental leaks or spills of AFFF could have occurred. AFFF spilled may have infiltrated into the subsurface soil via joints in the pavement or could have run off to the surrounding grassy areas.

PFOS, PFHxS, and PFNA were detected in surface soil at AOI 3 below their SLs. No ongoing construction was observed at the facility during the SI; therefore, the surface soil exposure pathway for site workers and future construction workers are potentially complete. AOI 3 is within the secure area of BAAF and there are no nearby residential structures; therefore, the soil exposure pathway for residents, trespassers, and recreational users is considered incomplete. Subsurface soil samples were not collected at AOI 3, consistent with the SI QAPP Addendum, since there were no wells or borings at the AOI. The CSM for AOI 3 is presented on **Figure 7-3**.

7.2 Groundwater Exposure Pathway

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

7.2.1 AOI 1

PFOA, PFOS, and PFHxS were detected in groundwater above their SLs at AOI 1. The primary drinking water source for BAAF is Ship Creek, with supplemental drinking water supplied by wells located upgradient from BAAF. Downgradient wells identified within 4 miles were designated as monitoring wells. Therefore, the pathway of exposure to site workers, off-facility residents, trespassers, and recreational users via ingestion of groundwater is considered incomplete. Due to the variability of groundwater flow and potential for wells to be installed in the downgradient direction in the future, a potentially complete pathway is identified for both site workers and residents in the future scenario. Depths to water measured at AOI 1 during the SI were greater than 100 feet bgs. The construction worker exposure scenario assumes excavation occurs at depths at or above 15 feet bgs. Therefore, the ingestion exposure pathway for future construction workers is considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

PFOS, PFBS, and PFHxS were detected below their SLs in groundwater at AOI 2. Because supplemental drinking water supply wells for the facility are upgradient of the facility, and downgradient supply wells were not identified within 4 miles of the facility, the pathway of exposure to site workers, off-facility residents, trespassers, and recreational users via ingestion of groundwater is currently considered incomplete; but potentially complete for site workers and residents in the future scenario, similar to AOI 1. Depth to water measured at during the SI was greater than 100 feet bgs; therefore, the ingestion exposure pathway for future construction workers is considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.2.3 AOI 3

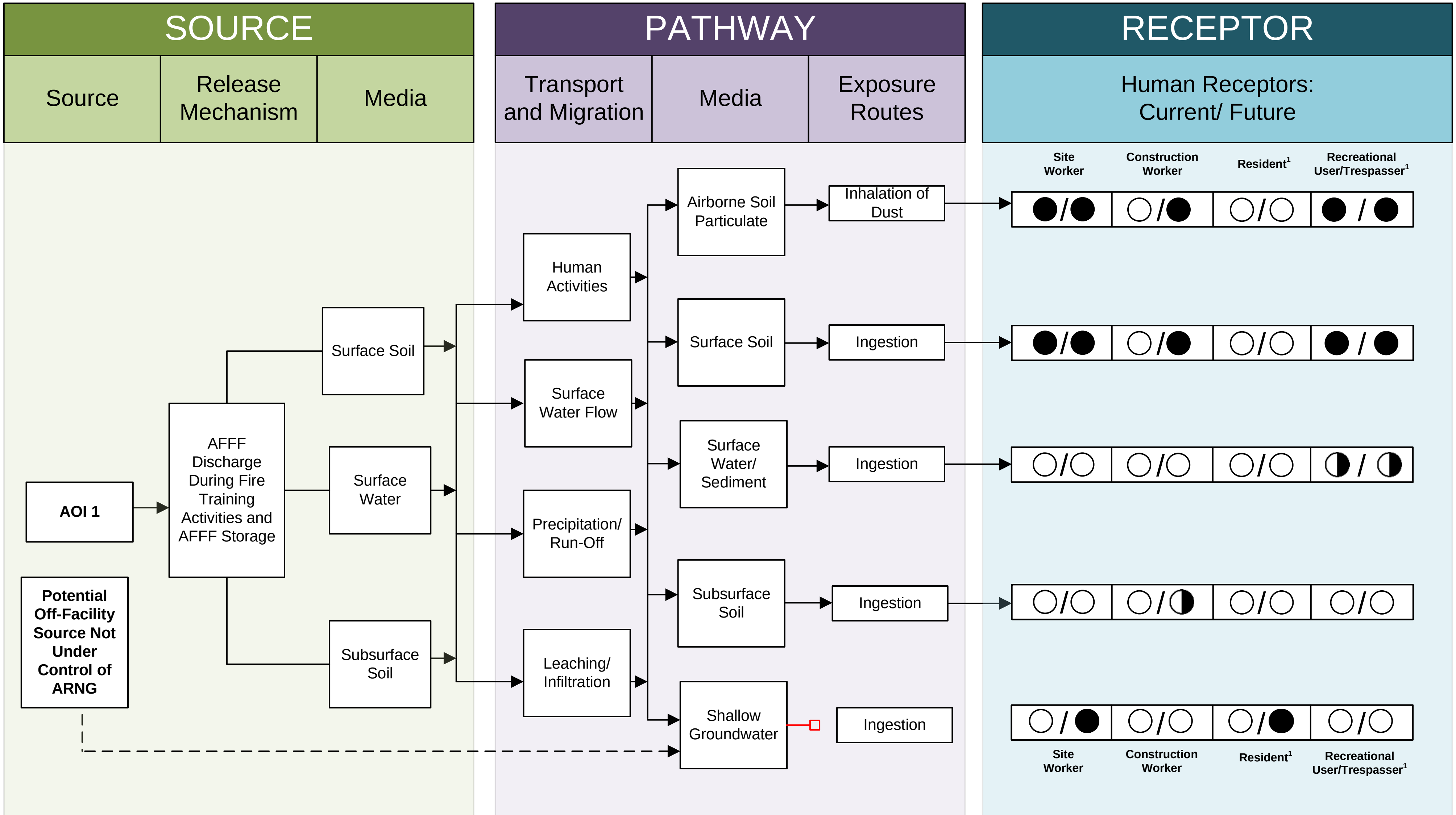
PFOS, PFBS, and PFHxS were detected below their SLs in groundwater at well BAAF-MW002, which was installed to evaluate groundwater at both AOI 3 and AOI 2, as noted in the SI QAPP Addendum. Because supplemental drinking water supply wells for the facility are upgradient of the facility, and downgradient supply wells were not identified within 4 miles of the facility, the pathway of exposure to site workers, off-facility residents, trespassers, and recreational users via ingestion of groundwater is currently considered incomplete; but potentially complete for site workers and residents in the future scenario, as it is for AOI 1. Depth to water measured at during the SI was greater than 100 feet bgs; therefore, the ingestion exposure pathway for future construction workers is considered incomplete. The CSM for AOI 3 is presented on **Figure 7-3**.

7.3 Surface Water and Sediment Exposure Pathway

Surface water and sediment samples were not collected during the SI field mobilization at BAAF. 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 run-off. There are no surface water bodies on BAAF. Storm water runoff at the facility either infiltrates directly into the subsurface, or it is conveyed to shallow swales, where it may be redirected off-facility and join storm water runoff elsewhere on JBER, particularly during times of heavy snowmelt or precipitation.

7.3.1 AOI 1, AOI 2, and AOI 3

Because there are no surface water bodies at BAAF, the exposure pathways for site workers and future construction works are considered incomplete. Ship Creek is the nearest surface water body, located as close as 0.15 miles to the southeast of the facility. This intermittent section of Ship Creek is topographically upgradient from the facility and across Glenn Highway. Overall surface water flow from the facility is expected to be to the southwest based on topography, and it is more likely to reach Ship Creek approximately 2 miles southwest after it becomes a gaining stream and mixes with storm water runoff from JBER. Ship Creek is the primary drinking water source for JBER and BAAF; however, the intake for drinking water is noted as being on Upper Ship Creek at the Ship Creek Dam, topographically higher than BAAF and upstream from possible input from BAAF (USAF, 2018). Therefore, the surface water and sediment ingestion exposure pathway for off-facility residents is considered incomplete. Ship Creek is used recreationally; therefore, the surface water and sediment exposure pathways for recreational users are considered potentially complete. The CSMs for AOI 1, AOI 2, and AOI 3 is presented on **Figure 7-1**, **Figure 7-2**, and **Figure 7-3**, respectively.



LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

Incomplete Pathway

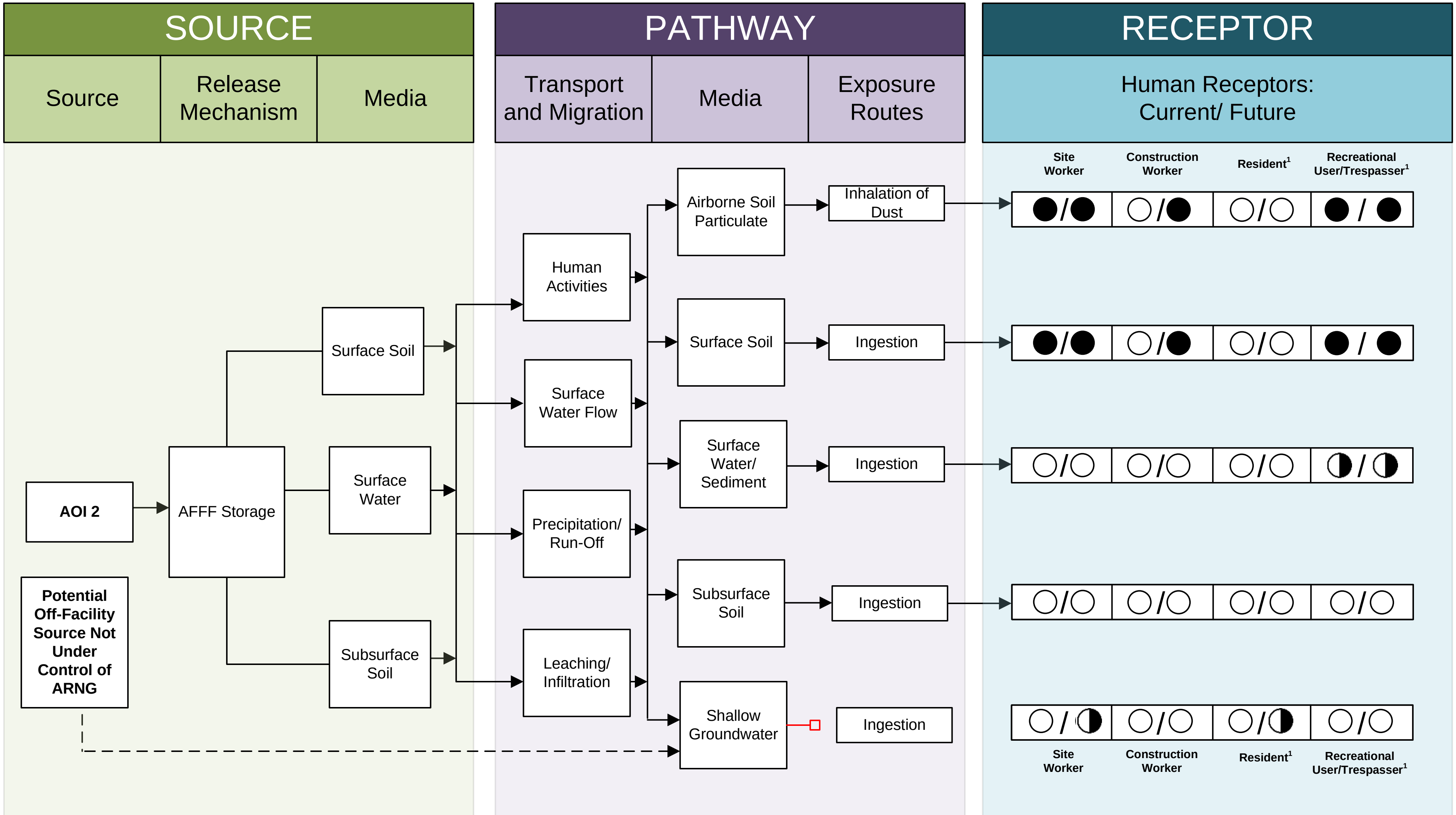
Potentially Complete Pathway

Potentially Complete Pathway with Exceedance of SL

NOTES

1. The resident and recreational users refer to off-site receptors.

Figure 7-1
Conceptual Site Model, AOI 1
BAAF, Anchorage, Alaska



LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

Incomplete Pathway

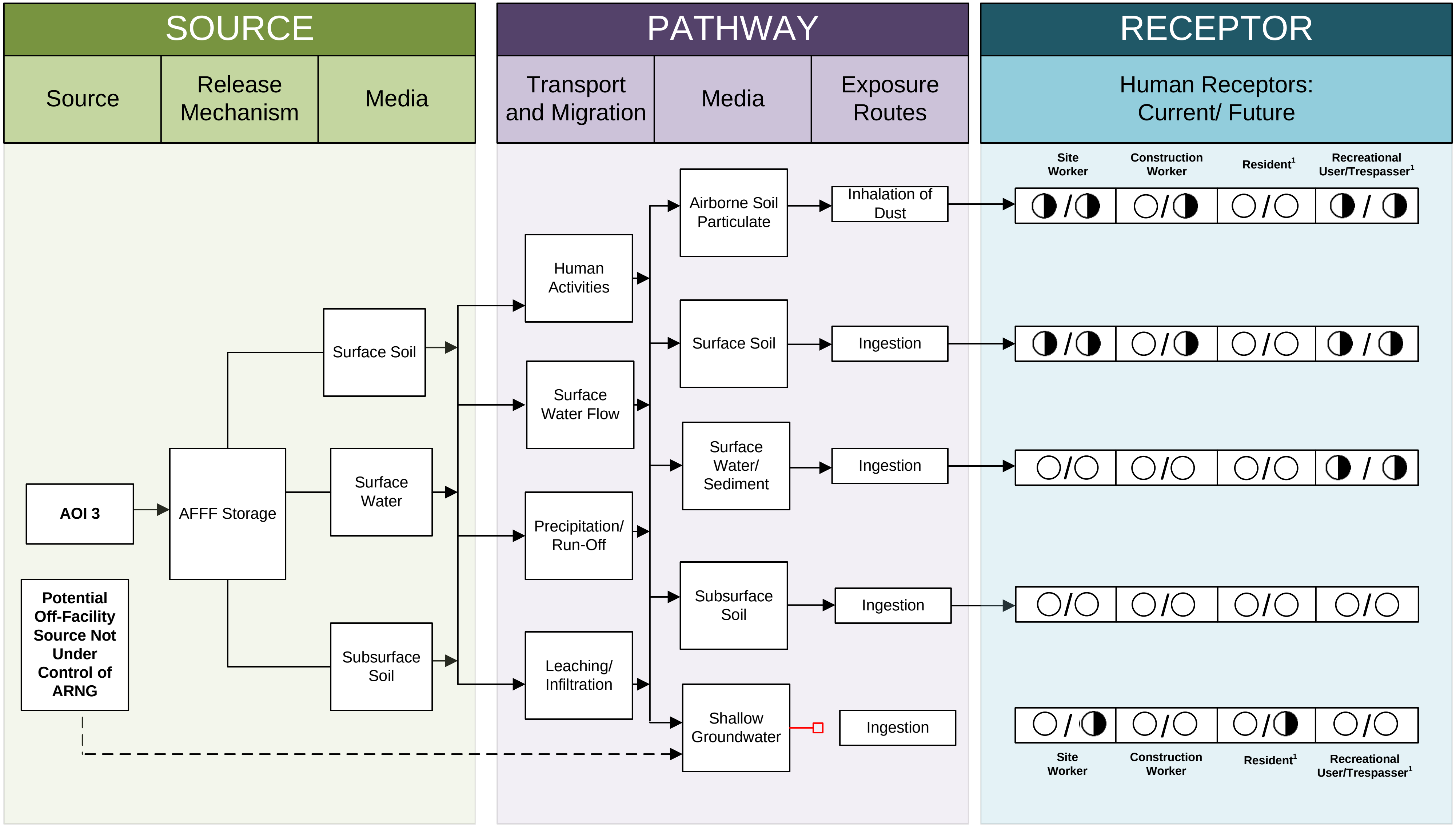
Potentially Complete Pathway

Potentially Complete Pathway with Exceedance of SL

NOTES

1. The resident and recreational users refer to off-site receptors.

Figure 7-2
Conceptual Site Model, AOI 2
BAAF, Anchorage, Alaska



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. Subsurface soil was not sampled at AOI 3.

Figure 7-3
Conceptual Site Model, AOI 3
BAAF, Anchorage, Alaska

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8. Summary and Outcome

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

8.1 SI Activities

The SI field activities were conducted from 16 to 30 May 2022, with additional day site visits on 3 November 2021, 14 April 2022, and 2 November 2022, and consisted of utility clearance, sonic boring, soil sample collection, permanent monitoring well installation and development, 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**.

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:

- Twenty-three (23) soil samples from eighteen (18) borings;
- Three (3) grab groundwater samples from two (2) newly installed and one (1) existing permanent wells;
- Twenty-four (24) QA/QC samples.

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

8.2 Outcome

Based on the results of this SI, further evaluation is warranted in an RI for AOI 1: BAAF Hangar 6 and BAAF Fuel Truck Shed and AOI 2: BAAF Hangar 4. No further evaluation is warranted for AOI 3 at this time. Based on the CSMs developed and revised in light of the SI findings, there is no potential for exposure to drinking water receptors from sources on the facility resulting from historical DoD activities. 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:
    - PFOS was detected above the 13 µg/kg SL in surface soil at location BAAF-MW001A, at a concentration of 48.7 µg/kg. All other relevant compounds in surface soil were below their SLs. All relevant compounds were below SLs or not detected in subsurface soil.
    - PFOA, PFOS, and PFHxS in groundwater exceeded their SLs. PFOA exceeded the 6 ng/L SL, with a maximum concentration of 53.8 ng/L at FS5-1; PFOS exceeded the 4 ng/L SL, with a maximum concentration of 123 ng/L at FS5-1; PFHxS exceeded

the 39 ng/L SL, with a maximum concentration of 611 ng/L at FS5-1. PFBS and PFNA were below their SLs in groundwater.

- Based on the results of the SI, further evaluation of AOI 1 is warranted.

- At AOI 2:
    - PFOS was detected above the SL in surface soil at AOI02-03, at a concentration of 29.4 µg/kg. All other relevant compounds in surface soil were below their SLs. No relevant compounds were detected in subsurface soil.
    - PFOA, PFBS, and PFHxS were detected in groundwater, at concentrations below their SLs. The maximum concentration of the three compounds was PFHxS, at 28.6 ng/L. PFOS and PFNA were not detected in groundwater. Groundwater for AOI 2 was evaluated using new well BAAF-MW002.
    - Based on the results of the SI, further evaluation of AOI 2 is warranted.

- At AOI 3:
    - PFOS, PFHxS, and PFNA were detected in surface soil, at concentrations below their SLs. PFOA and PFBS were not detected.
    - PFOA, PFBS, and PFHxS were detected in groundwater, at concentrations below their SLs. The maximum concentration of the three compounds was PFHxS, at 28.6 ng/L. PFOS and PFNA were not detected in groundwater. Groundwater for AOI 3 was evaluated using new well BAAF-MW002.
    - Based on the results of the SI, further evaluation of AOI 3 is not warranted.

The determination for no further action at AOI 3 is based on the detection of PFAS compounds below the relevant SLs for soil and groundwater in samples associated with the AOI. Monitoring well BAAF-MW002 was used to evaluate groundwater at both AOI 2 and AOI 3. The soil results at AOI 3 are not indicative of a source area; however, variations in groundwater flow direction and the relative position of AOIs 2 and 3 to BAAF-MW002 create uncertainty in the source of PFAS concentrations detected in groundwater at this well. Further evaluation of AOI 2 during the RI may address this data gap.

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

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

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	BAAF Hangar 6 and BAAF Fuel Shed	●	●	N/A	Proceed to RI
2	BAAF Hangar 4	●	N/A	◐	Proceed to RI
3	BAAF Hangar 1	◐	N/A	◐	No further action

Groundwater sampling was not performed within the source areas for AOI 2 and AOI 3. Therefore, groundwater data for the well installed downgradient of these AOIs (BAAF-MW002) is representative of facility boundary groundwater.

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

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