FINAL
Site Inspection Report
Fort William Henry Harrison
Helena, Montana

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

August 2021

Prepared for:

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

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Acronyms and Abbreviations

6:2 FTS	6:2 Fluorotelomer sulfonate
8:2 FTS	8:2 Fluorotelomer sulfonate
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
°C	degrees Celsius
°F	degrees Fahrenheit
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
amsl	above mean sea level
AOI	Area of Interest
Argonne	Argonne National Laboratory
ARNG	Army National Guard
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
CDM	Camp Dresser, and McKee
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chain-of-custody
CSM	conceptual site model
DA	Department of the Army
DASA ESOH	Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health
DO	dissolved oxygen
DoD	Department of Defense
DPW	Department of Public Works
DRFS	Dominion Restoration's Foaming Surfactant
DQI	data quality indicator
DQO	Data Quality Objective
DRFS	Dominion Restoration's Foaming Surfactant
DUA	data usability assessment
EIS	extracted internal standard
ELAP	Environmental Laboratory Approval Program
FRB	Field Reagent Blank
FTA	firefighting training area
FTWHH	Fort William Henry Harrison
GCAL	Gulf Coast Analytical Laboratories, LLC
HA	Health Advisory
HDPE	high-density polyethylene
HSA	hollow stem auger
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
LCS	laboratory control spike
LCSD	laboratory control spike duplicate

LOD	level of detection
LOQ	level of quantitation
MBMG	Montana Bureau of Mines and Geology
MDL	method detection limit
mph	miles per hour
MS	matrix spike
MSD	matrix spike duplicate
MTARNG	Montana Army National Guard
MTDEQ	Montana Department of Environmental Quality
NELAP	National Environmental Laboratory Accreditation Program
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
ng/L	nanograms per liter
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
ORP	oxidation reduction potential
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutyrate
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUdA	perfluoroundecanoic acid
PID	photoionization detector
PPE	personal protective equipment
PQAPP	Programmatic UFP-QAPP
PRC	PRC Environmental Management, Inc.
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
RPD	relative percent differences
SI	Site Inspection
SL	screening level
TOC	total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy

US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency
VA	Veterans Administration

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Executive Summary

The Army National Guard (ARNG) is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at per- and polyfluoroalkyl substances (PFAS)-impacted sites at ARNG facilities nationwide. The objective of the SI at each facility is to identify whether there has been a release to the environment from the Areas of Interest (AOIs) identified in the PA and determine the presence or absence of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutanesulfonic acid (PFBS) at or above screening levels (SLs), as well as the presence or absence of an additional 15 PFAS. An SI was completed at Fort William Henry Harrison (FTWHH) in Helena, Montana. FTWHH will be referred to as the 'facility' throughout this document.

FTWHH is in Lewis and Clark County, approximately 4 miles west of the state capitol of Helena, Montana. The facility is bounded by the Scratchgravel Hills to the north, the Spokane Bench to the east, the Elkhorn Mountains to the south, and the General Eisenhower Mountains to the west. During the PA, ten potential PFAS release areas were grouped into three AOIs (AOI 1 through 3). Results from the first mobilization performed in 2019 identified three additional release areas that potentially exist at the facility and one directly off-site across Williams Street. SI field activities were conducted in two mobilizations. The first mobilization included permanent groundwater monitoring well installation, development, and sampling; surface and subsurface soil sampling; and groundwater sampling from existing wells from 10 to 20 February 2019 and from 19 to 31 May 2019. The second mobilization included permanent groundwater monitoring well installation, development, and sampling; surface and subsurface soil sampling; and groundwater sampling from existing wells from 5 to 15 October 2020.

To fulfill the project Data Quality Objectives (DQOs) set forth in the approved SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2019), samples were collected and analyzed for a subset of 18 PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.1 Table B-15. The 18 PFAS analyzed as part of the ARNG SI program are specific in **Section 5.8** of this Report.

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

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

- PFOS was detected in groundwater at 62.2 nanograms per liters (ng/L) at AOI1-MW3 in excess of the SL. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.
- PFOS was detected in groundwater at 118 ng/L at AOI2-MW1 in excess of the SL. Based on the results of the SI, further evaluation of AOI 2 is warranted in the RI.
- Additional offsite residential drinking water sampling is recommended due to the SL groundwater exceedance of PFOS at AOI 1 and AOI 2.

- The detected concentrations of PFOA, PFOS, and PFBS in soil samples from all AOIs were below the SLs.

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

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

Table ES-1 Screening Levels (Soil and Groundwater)

Analyte	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	130	1,600	40
PFOS	130	1,600	40
PFBS	130,000	1,600,000	40,000

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

Table ES-2 Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Mt. Defensa Avenue Drainage Ditch	◐	◐	●
1	1049th Engineer Detachment Building 1010	◐	◐	NA
1	Prairie Dog Relocation (three locations)	◐	NA	NA
1	1049th Firefighting Training Area 1	◐	◐	NA
1	1049th Firefighting Training Area 3	◐	NA	NA
1	MacDonald Property	◐	◐	NA
2	Former Weasel Barn	◐	◐	◐
2	Excavated Soil from Mt. Defensa Ave Drainage Ditch	◐	◐	●
2	1049th Engineer Detachment Building M1	◐	◐	◐
2	1049th Firefighting Training Area 4	◐	◐	NA
3	Planned Structure Fire	◐	◐	NA
3	Burial Trench	NA	◐	NA
3	1049th Firefighting Training Area 2	◐	◐	NA

Legend:
NA = Not applicable (samples not at facility boundary)
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

Table ES-3 Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Mt. Defensa Avenue Drainage Ditch, 1049th Engineer Detachment Building 1010, 1049th Firefighting Training Area 1, 1049th Firefighting Training Area 3	No exceedances of SL in groundwater at the source area; however, exceedances of SLs in groundwater at the facility boundary. No exceedances of SLs in soil.	Proceed to RI
1	Prairie Dog Relocation (Three Release Areas)	No exceedances of SLs in soil.	No further action
2	Former Weasel Barn, Excavated Soil from Mt. Defensa Ave Drainage Ditch, 1049th Firefighting Training Area 4	No exceedances of SL in groundwater at the source area; however, exceedances of SLs in groundwater at the facility boundary. No exceedances of SLs in soil.	Proceed to RI
2	1049th Engineer Detachment Building M1	No exceedances of SLs in groundwater or soil.	No further action
3	Planned Structure Fire, Burial Trench, and 1049th Firefighting Training Area 2	No exceedances of SLs in groundwater or soil.	No further action

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) for perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) at Impacted Sites, ARNG Installations, Nationwide. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor, AECOM Technical Services, Inc. (AECOM), under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017. The ARNG performed this SI at Fort William Henry Harrison (FTWHH) in Helena, Montana. FTWHH will be 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 [CFR] Part 300; USEPA, 1994), and in compliance with US Department of the Army (DA) requirements and guidance for field investigations including specific requirements for sampling for PFOA, PFOS, and perfluorobutanesulfonic acid (PFBS), and the group of related compounds known in the industry as per- and polyfluoroalkyl substances (PFAS). The term PFAS will be used throughout this report to encompass all PFAS chemicals being evaluated, including PFOA, PFOS, and PFBS, which are the key components of the suspected releases being evaluated, and the other 15 related compounds listed in the task order.

1.2 SI Purpose

A PA was performed at FTWHH (AECOM, 2018c) that identified ten potential PFAS release areas which were grouped into three Areas of Interest (AOIs). Results from the first mobilization performed in 2019 identified three additional release areas potentially existed at the facility and one directly off-site across Williams Street. The objective of the SI is to identify whether there has been a release to the environment from the AOIs and determine the presence or absence of PFOA, PFOS, and PFBS at or above screening levels (SLs).

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

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

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

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2. Site Background

2.1 Facility Location and Description

FTWHH is in Lewis and Clark County, approximately 4 miles west of the state capitol of Helena, Montana (**Figure 2-1**). The facility houses the headquarters of the Montana ARNG (MTARNG) and occupies 6,717 acres.

FTWHH was authorized by an act of Congress in 1892 and was constructed between 1894 and 1896 (Argonne National Laboratory [Argonne], 1993). In 1903, the War Department changed the installation's name from Fort Benjamin Harrison to Fort William Henry Harrison. The MTARNG began using FTWHH for training in 1911; however, FTWHH remained an active US Army post until 1913 (MTARNG, 2001; Argonne, 1993). In 1913, FTWHH was placed in caretaker status by the US Army and was periodically occupied by the MTARNG until 1919 (MTARNG, 2001). In 1919, the US Public Health Service took possession of the facility and began to operate a hospital, which is currently under the jurisdiction of the Federal Government and is operated by the Veterans Administration (VA). From 1924 to 1928, the State of Montana expanded the facility area by leasing surrounding land. The MTARNG was absent from the facility from 1940 to 1946. During that time, the US Army assumed control and used FTWHH as a training base and further expanded the facilities. FTWHH has been used for training by the MTARNG since 1947 (Argonne, 1993). FTWHH was under the jurisdiction of the Federal Government until 1966, when it was converted to a training site for ARNG, transferring management to the Montana Department of Military Affairs. The current lease, which began in 1986, extended the lease for an indefinite term.

2.2 Facility Environmental Setting

FTWHH is within the Northern Rocky Mountain physiographic province on the western edge of Helena Valley (PRC Environmental Management, Inc. [PRC] 1996). Helena Valley is a northwest-trending, oval shaped basin that is approximately 875 square miles and is surrounded by mountains (MTARNG 2001). The facility is bounded by the Scratchgravel Hills to the north, the Spokane Bench to the east, the Elkhorn Mountains to the south, and the General Eisenhower Mountains to the west (MTARNG 2001; PRC 1996). Elevations at FTWHH range from 5,318 feet above mean sea level (amsl) at the western boundary to approximately 4,060 feet amsl in the northeast corner (Camp Dresser, and McKee [CDM], 2006). The Continental Divide is approximately 5 miles west of the facility (MTARNG, 2001).

2.2.1 Geology

Helena Valley is bounded by folded and fractured sedimentary, metamorphic, and igneous bedrock of Precambrian to Cretaceous age (US Geological Survey [USGS], 1992). The valley fill has been mapped with thicknesses of up to 6,000 feet with source materials consisting of fine- and coarse-grained Tertiary materials. The valley fill is unconformably overlain by up to 100 feet of Quaternary alluvium (Montana Department of Environmental Quality [MTDEQ], 2006).

FTWHH is on gently sloping pediment gravels at the base of General Eisenhower Mountains between two principal streams flowing into Helena Valley: Sevenmile Creek to the north and Tenmile Creek to the south (MTARNG 2001; CDM 2006). Quaternary alluvial deposits form the uppermost unit (**Figure 2-2)**. The thickness of the alluvial deposits is highly variable and is predominantly thicker in the northern half of the facility (MTARNG, 2001). The gravel layers of the alluvium are made up of fragments of quartzite, shale, and limestone between layers of clay and silt (MTARNG, 2001).

Precambrian rocks crop out in the hills and mountains to the south, west, and north of FTWHH and underlie it at depths ranging from 80 to 100 feet. The Precambrian bedrock consists mainly

of argillite, feldspathic quartzite, limestone, and dolomite of the Empire and Helena formations and members of the Missoula Group (Argonne, 1993).

2.2.2 Hydrogeology

Stratified lenses of cobbles, gravel, and sand form the primary Helena Valley aquifer. The water bearing zones, intercalated clay, and silt compose the upper few hundred feet of the valley fill. Discontinuity of the clay and silt deposits allows for hydraulic connection of the water bearing zones to make up a single complex aquifer (USGS, 1992). The estimated transmissivity of the water bearing zones is 10,000 square feet per day (Argonne, 1993).

The principal water bearing zones at FTWHH are Quaternary alluvium and Tertiary pediments deposits. The unconfined Quaternary aquifer attains a maximum saturated thickness of about 70 feet in the southern half of the facility and is largely absent near the northeastern corner (Argonne, 1993).

The depth to groundwater at the facility is typically between 14 and 43 feet below ground surface (bgs). In 1992, the USGS estimated that 60% of the wells near the facility are drilled to 70 feet bgs or less.

Regionally, groundwater in the Helena Valley aquifer flows from the south, west, and north margins of the valley toward the northeast corner of the Helena Valley basin (USGS, 1992) and Lake Helena **(Figure 2-2)**. Locally at FTWHH, the groundwater flow direction is predominantly to the east in the southern half of the installation and to the east-southeast in the northern part of the installation (MTDEQ, 2006). Depth to water measurements from the May 2019 and October 2020 synoptic gauging event were used to calculate groundwater elevations. The groundwater contours for May 2019 and October 2020 are shown in **Figure 2-3** and **Figure 2-4**, respectively.

Recharge to the Helena Valley aquifer is through infiltration of streamflow and precipitation, leakage from irrigation canals, infiltration of excess irrigation water, and inflow from underlying bedrock fractures (USGS, 1992). Lake Helena is the primary point for surface water and groundwater discharge from the basin. Discharge also occurs to stream and irrigation canals and withdrawals from wells (USGS, 1992).

Although it is outside Helena city limits, FTWHH draws from the City of Helena water supply. The city uses a combination of groundwater and surface water (the Missouri River and Tenmile Creek) as sources for its residents (Helena Water Utilities Public Water System, 2004; Department of Public Works [DPW], 2012). The Eureka Well is the source of potable water for FTWHH and is approximately 3 miles southeast of the facility, in the downtown Helena area (DPW, 2012). According to the 2018 Consumer Confidence Report (DPW, 2012), the Eureka Well is a pure groundwater source that requires no further treatment. In addition, the City of Helena was selected to participate in the Third Unregulated Contaminant Monitoring Rule assessment monitoring, and no PFAS were detected for Helena, Montana. A search of the Montana Bureau of Mines and Geology (MBMG) Groundwater Information System confirmed the presence of domestic water supply wells adjacent to FTWHH (MBMG, 2018). Residential lots east of Williams Street were identified as having private wells.

2.2.3 Hydrology

FTWHH is within the Sevenmile Creek watershed (CDM, 2006) (**Figure 2-5**). Three perennial streams and a number of intermittent streams that originate in the foothills west of the facility flow through the facility (Argonne, 1993; CDM, 2006). Cherry Creek is a perennial stream that flows east through training and maneuver areas at FTWHH (MTARNG, 2001). Granite Creek is a perennial tributary of Sevenmile Creek that flows northeast through the northern third of the facility (MTARNG, 2001). Blue Cloud Creek, a perennial tributary of Tenmile Creek, crosses the extreme southwestern corner of the facility, and drains an area of undeveloped land on the western and

southwestern side (MTARNG, 2001; CDM, 2006). Blue Cloud Creek and Granite Creek do not drain the Cantonment Area. The rest of the streams on FTWHH are intermittent and occur during heavy rainfall or rapid snowmelt.

Sevenmile Creek and Tenmile Creek are the largest perennial streams near the facility (CDM, 2006). Sevenmile Creek joins Tenmile Creek about 1 mile east of the downstream property boundary (Argonne, 1993; CDM, 2006). The water diverted upgradient of FTWHH from the upper Tenmile Creek watershed provides about 70% of the municipal supply for Helena from June through September, and 100% of the city supply from October through May (USGS, 2000). Streamflow in the lower Tenmile Creek, which runs south of FTWHH, is partly controlled by two small municipal-supply reservoirs (Scott and Chessman) in the upper Tenmile Creek watershed and by diversions for municipal water supply and irrigation (USGS, 2001). In addition, a 30-acre spring-fed man-made lake exists approximately 1 mile southeast of the facility within Spring Meadow State Park. The lake is a popular swimming, fishing, and recreational area for Helena residents.

A large, unnamed drainage ditch runs from west to east through the VA property adjacent to FTWHH, along Mt. Defensa Avenue, and offsite by the Main Gate. For the purposes of this report, this drainage ditch will be referred to as the Mt. Defensa Avenue Drainage Ditch. Precipitation, snow melt, and other surface runoff on the VA property and much of the Cantonment Area is captured in the Mt. Defensa Avenue Drainage Ditch, which flows to the Main Gate on Williams Street and offsite. During rapid snow melt or high intensity rain events, runoff is channelized and flows rapidly through the ditch and Cantonment Area discharging just outside the Main Gate of the facility. As a result of the high velocity flow, limited runoff infiltrates into the subsurface of Mt. Defensa Avenue Drainage Ditch itself. Surface water runoff that reaches the Main Gate dissipates and infiltrates the subsurface and may reach groundwater.

2.2.4 Climate

The climate at FTWHH is semiarid (USGS, 1992). In December, the average temperature is 32 degrees Fahrenheit (°F). July and August have the highest average temperatures, at 86°F and 85°F, respectively. The greatest mean monthly precipitation occurs in June, and the greatest mean monthly snowfall occurs in January (World Climate, 2019). The average annual precipitation is 12.12 inches at the Helena Regional Airport weather station, approximately 6 miles southeast of the facility.

The area is subject to hailstorms. Flash flooding can occur in the Helena Valley during heavy rainstorms and rapid snowmelt (Argonne, 1993). The frost-free period is usually from May to September. Winds generally blow westerly at about 7 to 8 miles per hour (mph), and stronger gusts can reach 55 to 65 mph (MTARNG, 2001). Brisk westerly and northwesterly winds are common, particularly in the late winter and early spring. Chinook winds, which produce warmer temperatures in the winter months, are also common (Argonne, 1993).

2.2.5 Current and Future Land Use

FTWHH contains a cantonment area with dining and support facilities and five training range areas for the ARNG, the US Armed Forces, and other government and civilian organizations to practice combat skills and operations; access to the facility is controlled. The VA controls property immediately adjacent to the south and west of the Cantonment Area. Land use to the east, west, and north of the facility is primarily agricultural with scattered farms and residences, grazing land, and hilly to mountainous terrain. Land use to the south is a mixture of residential and agricultural.

The nearest urban area is Helena. According to the 2016 US Census, the estimated population of Helena is 31,169 (US Census Bureau, 2016). Helena has experienced significant population growth over the last decade, and several agricultural lands have been converted to residential subdivisions and single-resident lots to accommodate the growth (MTARNG, 2001). Lands to the

east and north of FTWHH are designated as urban growth areas for Lewis and Clark County. Land use to the south and west is not expected to change.

The influx of people and need for new housing in the vicinity of FTWHH has created the possibility of encroachment or intrusion on the land or property owned by the MTARNG (Nakata Planning Group, LLC, 2000). In 2015, the Prickly Pear Land Trust acquired 558 acres in the area east of Williams Street in partnership with FTWHH with funding from the Army Compatible Use Buffer Program to address the encroachment concerns. This land is designated for open space and habitat (Westech Environmental Services, Inc., 2017).

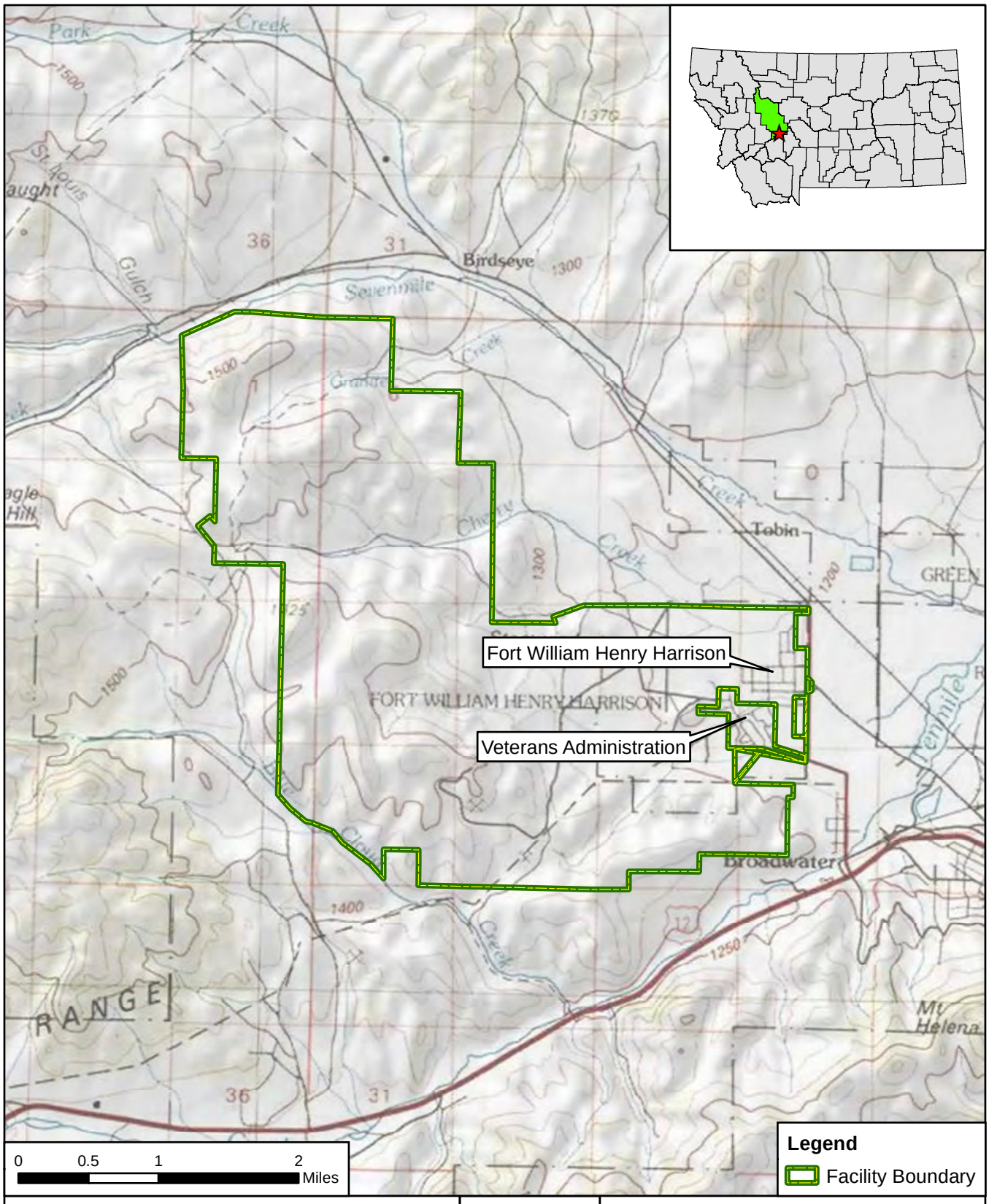
2.3 History of AFFF Use

Ten potential PFAS release areas, where aqueous film forming foam (AFFF) may have been used or released historically, were identified at FTWHH during the PA (AECOM, 2018c). The potential PFAS release areas were grouped into three AOIs based on proximity to one another and presumed groundwater flow. A description of each AOI is presented in **Section 3**. Findings from the PA indicated AFFF use at the facility primarily ranged from the late-1980s to the early-2000s. AFFF was historically used by the MTARNG during fire training activities (planned structural fires and training exercises) and pest removal activities (prairie dog relocation). AFFF was stored in several buildings at the facility during this time, but no releases were documented in these areas.

2.4 Drinking Water Sampling

Due to historical fire training activities completed with AFFF, the potential exists for exposure to offsite residential drinking water receptors immediately east of the FTWHH boundary. Prior to sampling, approval was obtained from the Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health (DASA ESOH). Drinking water samples were collected from five potable wells located in closest proximity to the facility boundary (downgradient of AOI 1). No drinking water samples were collected downgradient of AOI 2 and AOI 3 because no residential properties exist at the facility boundary. Sample results are provided below and in **Table 2-1**:

- PFOA – Detections ranged from 3.75 nanogram per liter (ng/L) (Potable-02) to 16.6 ng/L (Potable-05).
- PFOS – Detections ranged from 3.11 ng/L (Potable-02) to 22.1 ng/L (Potable-05).
- PFBS – Detections ranged from 2.48 ng/L (Potable-04) to 21.2 ng/L (Potable-05).



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SCALE	1:63,360	CHK BY	JH	5/20/2021
Base Map: Copyright:© 2013 National Geographic Society, i-cubed		PM	CM	5/20/2021

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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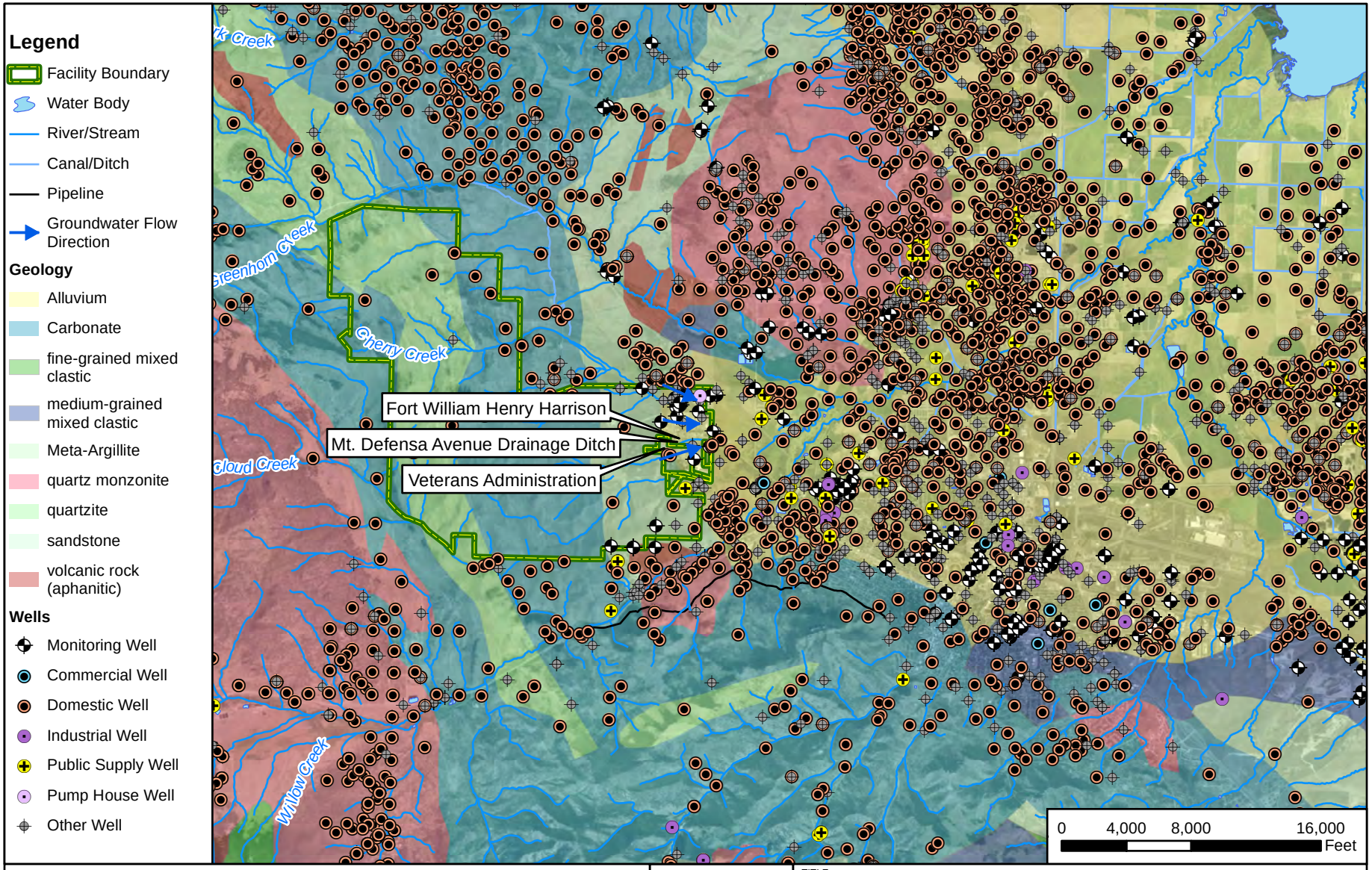

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	6/7/2021

N

TITLE

Groundwater Features

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2

Q:\Projects\ENV\GEARS\GEO\MAES 2012 Unrestricted\Fort Meade\E. Data Management\GIS\MXDs\Chisholm_6th\March2017\ Fig_2-2_FTWHH_Groundwater_Features.mxd

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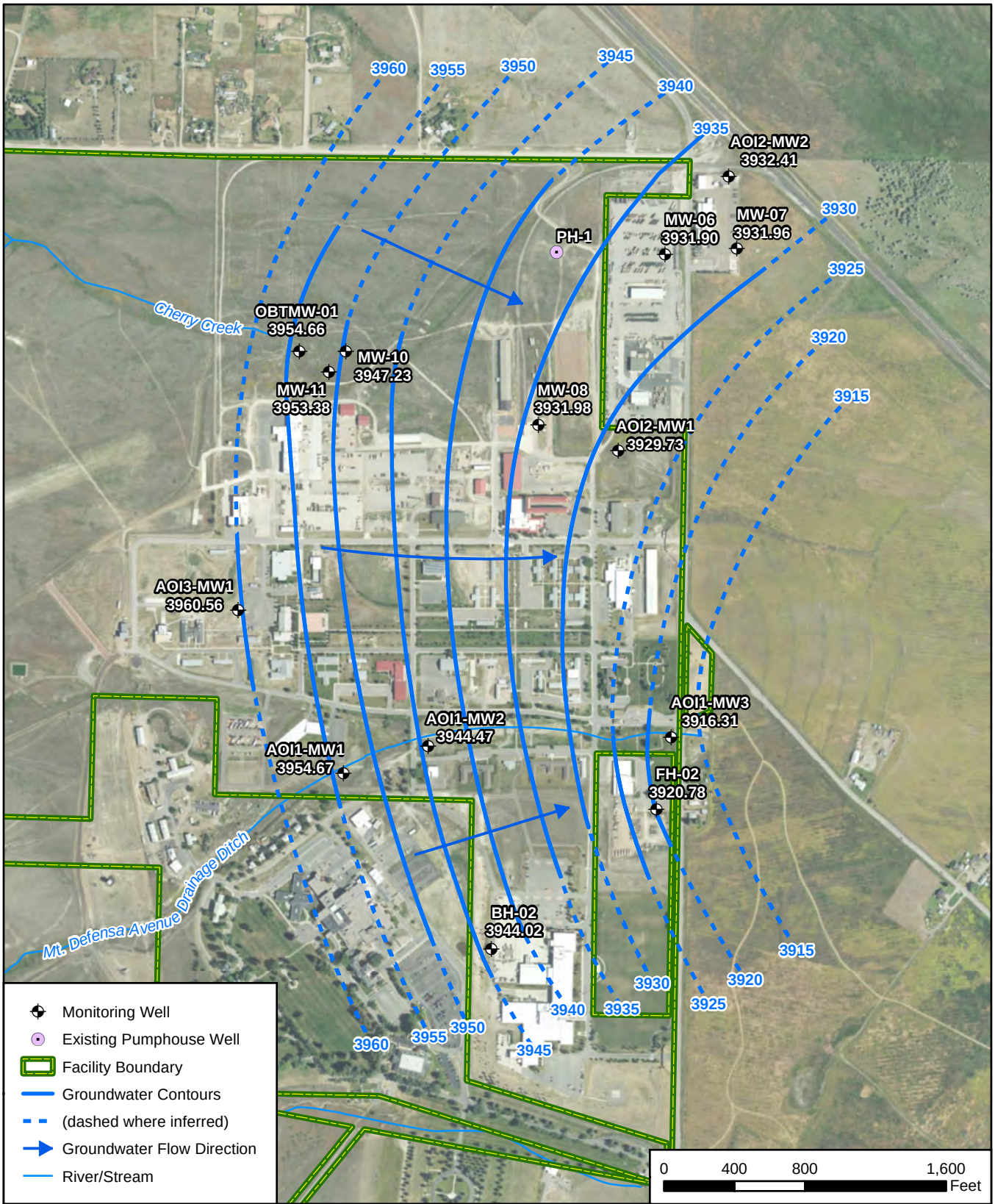

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Groundwater Elevation Contours, May 2019

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

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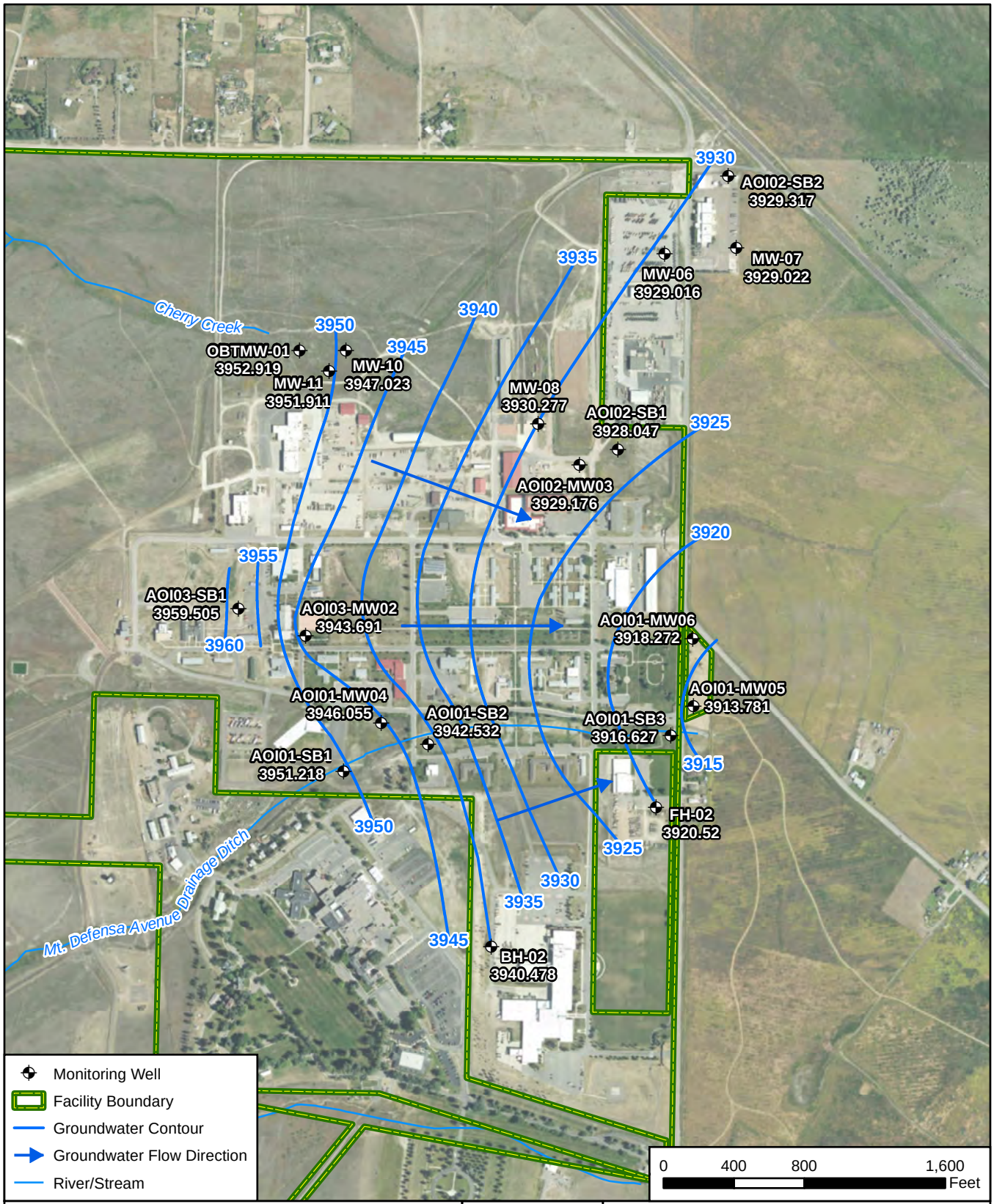

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Fort William Henry Harrison, MT			
REVISED	6/7/2021	GIS BY	MS	6/7/2021
SCALE	1:9,600	CHK BY	AB	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	6/7/2021

Groundwater Elevation Contours, October 2020

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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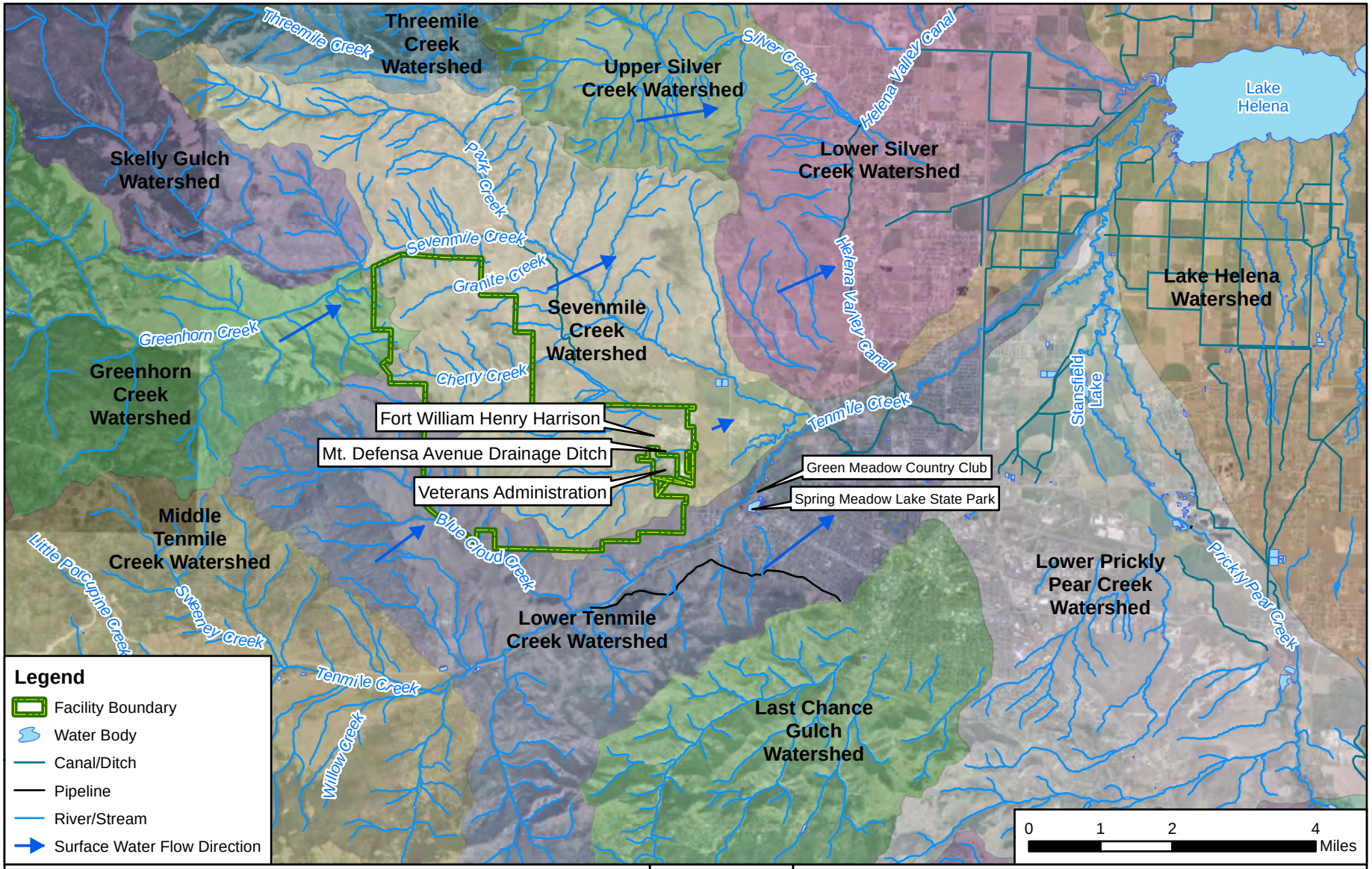

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT			
REVISED	6/7/2021	GIS BY	MS	6/7/2021
SCALE	1:126,720	CHK BY	JH	6/7/2021
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	6/7/2021

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TITLE

Surface Water Features

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Figure 2-5

Q:\Projects\ENV\GEARS\GEO\MAES 2012 Unrestricted\Fort Meade\E. Data Management\GIS\MXDs\Chisholm_6th\March2017\ Fig_2-5_FTWHH_Surfacewater_Features.mxd

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Table 2-1
PFAS Detections in Residential Drinking Water
Site Inspection Report, Fort William Henry Harrison

Area of Interest		POTABLE													
Sample ID		POTABLE-01		POTABLE-02		POTABLE-02-DUP		POTABLE-03		POTABLE-04		POTABLE-05		POTABLE-05-DUP	
Sample Date		12/03/2019		12/03/2019		12/03/2019		12/03/2019		12/03/2019		03/16/2020		03/16/2020	
Analyte	EPA HA [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS via EPA 537.1 (ng/L)															
PFBS	-	7.31	J	4.23	J	4.31	J	2.55	J	2.48	J	21.2		20.6	
PFHpA	-	10.2		3.82	J	4.05	J	5.77	J	3.81	J	20.9		19.1	
PFHxA	-	30.2		13.4		14.2		14.4		10.0		54.1		53.2	
PFHxS	-	59.8		24.3		24.6		19.1		14.6		182		186	
PFOA	70	6.46	J	3.75	J	4.41	J	6.87	J	7.76	J	16.6		16.5	
PFOS	70	17.0		3.11	J	3.15	J	15.4		13.3		19.5		22.1	
Total PFOA+PFOS	70	23.5		6.86		7.56		22.3		21.1		36.1		38.6	

Grey Fill — Detected concentration exceeded EPA HA

References

a. United States Environmental Protection Agency. 2016. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA). Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-005. May 2016. / EPA. 2016. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS). Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. EPA Document Number: 822-R-16-004. May 2016.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

DUP	Duplicate
EPA	United States Environmental Protection Agency
HA	Health Advisory
Qual	Interpreted Qualifier
ng/L	nanogram per liter
-	Not applicable

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3. Summary of Areas of Interest

This section presents a summary of each potential PFAS release area by AOI. The FTWHH PA identified ten potential PFAS release areas which were grouped into three AOIs based on proximity and inferred direction of groundwater flow (**Figure 3-1**). Results from the first mobilization performed in 2019 suggested four additional release areas potentially existed at the facility and directly off-site. Additional PA-level interviews were conducted with site workers, and as a result, four additional potential PFAS releases areas were identified (MTARNG 1049th Firefighting Training Area 1, 2, 3, and 4) within the three existing AOI boundaries. A summary of each AOI is presented below.

3.1 AOI 1

AOI 1 consists of seven potential PFAS release areas as described below, the Black-Tailed Prairie Dog Relocation (three relocation areas), MTARNG 1049th Engineer Detachment (Building 1010), Mt. Defensa Avenue Drainage Ditch, MTARNG 1049th Firefighting Training Area 1, and MTARNG 1049th Firefighting Training Area 3.

3.1.1 Black-Tailed Prairie Dog Relocation

In 1997, the MTARNG began renovations in the southeast section of the Cantonment Area, near the Mt. Defensa Avenue Drainage Ditch. At the time, a colony of black-tailed prairie dogs inhabited the renovation zone. The MTARNG live-trapped and moved the prairie dogs to a previously unoccupied area approximately 0.5 miles north of the Cantonment Area to the Charles M. Russell National Wildlife Refuge (FaunaWest, 1998).

During the last week of trapping in February 1998, an attempt was made to flush remaining prairie dogs from their burrows at multiple locations using a mixture of water and firefighting training foam. The MTARNG 1049th Engineer Detachment recalled using firefighting training foam, not AFFF, to flush the prairie dogs from their burrows. The *Relocation of the Fort Harrison Prairie Dog Colony* (FaunaWest, 1998) contains materials information from Defense Supply Center, Columbus, for Dominion Restoration's Foaming Surfactant (DRFS) in a 3% solution. According to this pamphlet, DRFS is "a solvent free, environmentally acceptable surrogate that was developed to simulate AFFF" and "a non-hazardous, water-based, neutral pH product that is 100 percent completely biodegradable" with the same appearance as AFFF.

The foam mixture was delivered through a 2-inch diameter fire hose from a FTWHH firetruck to approximately 20 prairie dog burrows (combined into three areas). Two prairie dogs were flushed from their burrows, captured, and placed into a live-trap for later release. Approximately 750 gallons of the firefighting training foam mixture were used to flush the prairie dog burrows (FaunaWest, 1998).

Additionally, the MTARNG relocated a black-tailed prairie dog colony that was on the VA property. The colony location was not sampled during the SI because it was outside the boundary of FTWHH.

3.1.2 MTARNG 1049th Engineer Detachment (Building 1010)

The MTARNG 1049th Engineer Detachment currently operates out of Building 1010, which was constructed in 1995 and is located at the southeast corner of Rome Avenue and Middle Road.

AFFF was stored at the MTARNG 1049th Engineer Detachment buildings and was only added to the firetrucks when it was intended for imminent use due to its corrosive action on the storage tanks. No information was available on the concentration or amount of AFFF stored; however, the MTARNG 1049th Engineer Detachment operated two types of trucks: small trucks capable of

holding approximately 40 gallons of solution and large trucks capable of holding approximately 100 gallons of solution. Annual AFFF fire training exercises were conducted by the MTARNG 1049th Fire Department offsite at the Helena Regional Airport and/or at Malmstrom Air Force Base in Great Falls, Montana. No regularly scheduled fire training exercises were conducted at FTWHH.

During fire training exercises, the majority of AFFF added to the trucks was expended. The trucks were washed, and residual AFFF was discharged with the wash water and allowed to dissipate on the ground. Washing and emptying of the trucks occurred at Building 1010 from 1995 to the early 2000s. The discharge was washed into the Mt. Defensa Avenue Drainage Ditch. The last known occurrence of washing and emptying of the trucks was in the early-2000s.

3.1.3 Mt. Defensa Avenue Drainage Ditch

As described in **Section 2.2.3** , the Mt. Defensa Avenue Drainage Ditch flows west to east through the VA property, into FTWHH along Mt. Defensa Avenue, and offsite by the Main Gate on Williams Street. Prior to 2016, little to no infiltration occurred within the Mt. Defensa Avenue Drainage Ditch due to the high velocity flow during snow melt and high intensity rain events. The ditch was reconfigured with large retention areas in 2016, slowing stormwater flow through the ditch. Information obtained during the PA indicated potential PFAS releases to soil have occurred along the Mt. Defensa Avenue Drainage Ditch from MTARNG activities onsite, as well as VA fire department activities upgradient of the facility. In February 2012, a rapid snowmelt event caused water to run vigorously through the drainage ditch. The vigorous movement of the water caused foaming in the drainage ditch that ran offsite to the retention pond just outside the main gate of the facility. The cause of the foaming is unknown; however, potential PFAS releases in and around the drainage ditch were noted by interviewees. Therefore, it is possible that the cause of the foaming is residual PFAS from training activities.

The Mt. Defensa Avenue Drainage Ditch runs from west to east through the VA property adjacent to FTWHH, along Mt. Defensa Avenue, and offsite by the Main Gate. Precipitation, snow melt, and other surface runoff on the VA property and much of the Cantonment Area is captured in the Mt. Defensa Avenue Drainage Ditch, which flows to the Main Gate on Williams Street. Just outside the main gate there is a culvert that discharges stormwater across Williams Street between the MTARNG property and residential properties. During rapid snow melt or high intensity rain events, runoff is channelized and flows through the ditch and Cantonment Area discharging just outside the main gate between the MacDonald Property and the residential properties. Surface water runoff that reaches the area between the MacDonald Property and residential properties dissipates and infiltrates the subsurface and may reach groundwater.

3.1.4 MTARNG 1049th Firefighting Training Area 1 and 3

After the first SI mobilization was completed, two firefighting training areas (FTAs) were identified in AOI 1. The 1049th trained with foam in the Navy Parking Lot north of AOI1-MW1 (MTARNG 1049th Firefighting Training Area 1) and in the channel area east of AOI1-MW2 before the channel was excavated (MTARNG 1049th Firefighting Training Area 3). Specific details regarding the frequency, volume, chemical composition, and concentration of any potential AFFF used at either FTA are not known.

3.2 AOI 2

AOI 2 consists of four potential PFAS release areas as described below, the Excavated Soil from Mt. Defensa Avenue Drainage Ditch. Former Weasel Barn, MTARNG 1049th Engineer Detachment (Building M1), and MTARNG 1049th Firefighting Training Area 4.

3.2.1 Excavated Soil from Mt. Defensa Avenue Drainage Ditch

Due to flooding of the Mt. Defensa Avenue Drainage Ditch during rapid snowmelt and large rainfall events, the central portion of the ditch within the FTWHH boundary was widened in 2016 by excavating soil from the ditch. Based on the potential PFAS releases to this ditch, this soil is potentially contaminated with PFAS and was used to create a military vehicle staging area onsite near a retention pond in the northeast section of the Cantonment Area.

3.2.2 Former Weasel Barn

The Former Weasel Barn located in the northeast section of the Cantonment Area, north of Sanananda Drive, was demolished in the winter of 2002 as part of a live-burn fire training exercise. The Former Weasel Barn housed the Weasel, a tracked vehicle designed for operations in Arctic environments. The MTARNG 1049th burned the structure, and the MTARNG 1049th Team Chief recalled using AFFF to extinguish the fire. No information was available on the volume, chemical composition, or concentration of AFFF used during the event.

3.2.3 MTARNG 1049th Engineer Detachment (Building M1)

Prior to 1995, the MTARNG 1049th Engineer Detachment operated out of the former Post Engineers Maintenance Shop (Building M1), near the Field Maintenance Shop #3, at the southeast corner of Williams Street and Barrett Road in the 1980s. Although Building M1 is located outside the boundary of FTWHH, the property is controlled by MTARNG. AFFF storage and truck operations are described in **Section 3.1.2**. During fire training exercises, the majority of AFFF added to the trucks was expended. The trucks were washed, and residual AFFF was discharged with the wash water and allowed to dissipate on the ground at Building M1 in the late-1980s.

3.2.4 MTARNG 1049th Firefighting Training Area 4

After the first SI mobilization was completed, one additional FTA was identified in AOI 2. The 1049th trained with foam in the parking lot south of MW-08. Specific details regarding the frequency, volume, chemical composition, and concentration of any potential AFFF used at the FTA are not known.

3.3 AOI 3

AOI 3 consists of three potential PFAS release areas as described below, the Planned Fire Structure, Burial Trench, and MTARNG 1049th Firefighting Training Area 2.

3.3.1 Planned Fire Structure

A structure was burned and used as a live-fire training exercise in the northwest portion of the Cantonment Area near the current Dining Facility (Building 410). The MTARNG 1049th Team Chief recalled using AFFF to extinguish this structure fire. Based on aerial photography, the structure was burned sometime between 1995 and 2002. Specific details regarding the frequency, volume, chemical composition, and concentration of the AFFF used during the exercise is not known.

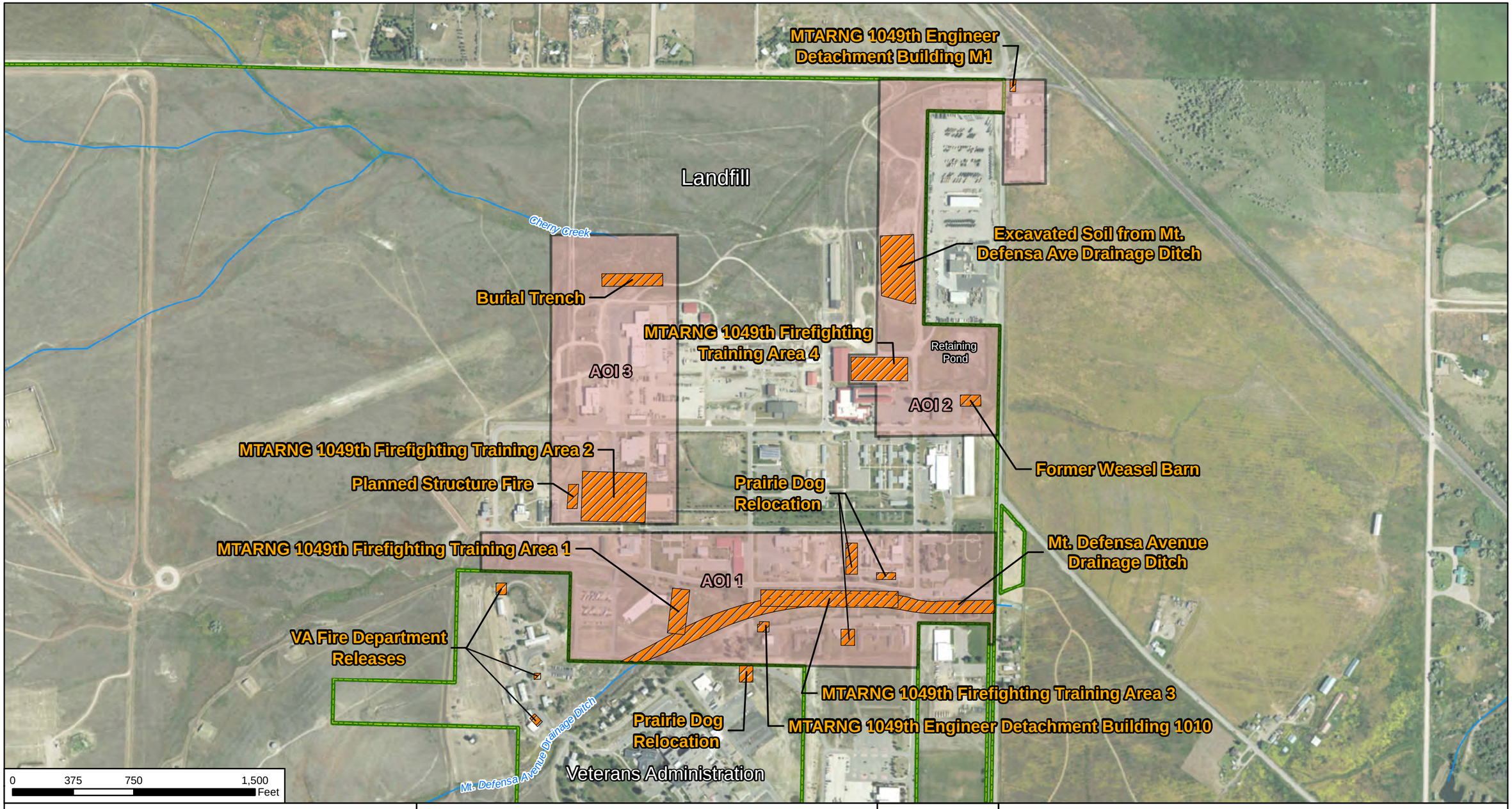
3.3.2 Burial Trench

Prior to 1987, an area approximately 200 feet north of Colle Ferro Avenue in the northwest section of the Cantonment Area was used to dig a burial trench and dispose of debris and ordnance. One MTARNG retiree indicated that vehicles were placed in the burial trench, burned, and

extinguished with AFFF by MTARNG Firefighters. This use of AFFF could not be confirmed by any other interviewees during the PA, and no information was available on the volume, chemical composition, and concentration of the potential AFFF released. The Combined Support Maintenance Shop was constructed due south of the burial trench in 1987.

3.3.3 MTARNG 1049th Firefighting Training Area 2

After the first SI mobilization was completed, one additional FTA was identified in AOI 3. The 1049th trained with foam near the former location of Building 410 (Planned Fire Structure). Specific details regarding the frequency, volume, chemical composition, and concentration of any potential AFFF used at the FTA are not known.



CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT			
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SCALE	1:7,200	CHK BY	JH	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	6/7/2021

- Area of Interest
- Potential PFAS Release
- Facility Boundary
- River/Stream

N

Areas of Interest

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

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

4.1 Problem Statement

The following problem statement was developed during project planning:

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

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

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

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

4.2 Goals of the Study

The following goals were established for this SI:

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

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

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

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

4.3 Information Inputs

Primary information inputs included:

- PA for FTWHH, Montana (AECOM, 2018c)
- Groundwater and soil samples collected in accordance with the Site Specific Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2019)
- Field data collected during the two SI mobilizations, including groundwater elevation and water quality parameters measured at the time of sampling.

4.4 Study Boundaries

The scope of the SI sampling approach was bounded by the property limits of the facility (**Figure 2-1**). Offsite sampling was not included in the scope of this SI; however, residential drinking water sampling was performed downgradient of FTWHH to determine if a complete drinking water pathways exists.

4.5 Analytical Approach

Samples were analyzed by Gulf Coast Analytical Laboratories, LLC (GCAL) during the first SI mobilization and Pace Analytical Gulf Coast during the second SI mobilization (GCAL acquired by Pace). The lab is accredited under the DoD Environmental Laboratory Accreditation Program (DoD ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs and decision rules as defined in the SI QAPP Addendum (AECOM, 2019). These rules governed response actions based on the results of the SI sampling effort.

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

Groundwater:

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

Soil:

- What is the concentration of PFOA, PFOS, and PFBS in shallow surface soil (0 to 2 feet bgs)?
- What is the concentration of PFOA, PFOS, and PFBS constituents in deep soil (15 to 42 feet bgs) (i.e., capillary fringe)?
- What does the CSM suggest in terms of source, pathway, and receptor?

Soil and groundwater samples were collected from each of the potential release areas. Groundwater was encountered at approximately 14 to 49 feet bgs.

4.6 Data Usability Assessment

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

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

4.6.1 Precision

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

Injection internal standards were added by the laboratory during sample injection to measure relative responses of target analytes and used to correct for bias associated with interference or losses during injection. Field sample AOI2-HA2-0-2 displayed injection internal standard area counts less than the lower quality control (QC) limit of 50% for M2PFDA, M2PFHxA, M2PFOA, and M4PFOS. The associated field sample results were positive and were qualified “J+”. These anomalies are considered minor, and the results are usable as qualified but should be considered as estimated values with a positive bias.

Extraction internal standards were added by the laboratory during sample extraction to measure relative responses of target analytes and used to correct for bias associated with matrix interferences and sample preparation efficiencies, injection volume variances, mass spectrometry ionization efficiencies, and other associated preparation and analytical anomalies. Several field samples displayed extraction internal standard percent recoveries associated with multiple analytes that were outside the QC limits. The positive field sample results associated with low extracted internal standard (EIS) percent recoveries were qualified “J+”, while those associated with high EIS percent recoveries were qualified “J-”. The non-detect field sample results associated with EIS percent recoveries outside the QC limits were qualified “UJ”. These

anomalies are considered minor, and the results are usable as qualified but should be considered as an estimated value.

Calibration verifications were performed routinely to ensure that instrument responses for all calibrated analytes were within established QC criteria. All calibration verifications were within the project established precision limits presented in the SI QAPP Addendum (AECOM, 2019).

LCS/LCS duplicate (LCSD) pairs were prepared by addition of known concentrations of each analyte in a matrix-free media known to be free of target analytes. LCS/LCSD pairs were analyzed for every analytical batch to demonstrate the ability of the laboratory to detect similar concentrations of a known quantity in matrix-free media. The LCS/LCSD pairs were within the project established precision limits presented in the SI QAPP Addendum (AECOM, 2019).

MS/MS duplicate (MSD) samples were prepared, analyzed, and reported for all preparation batches. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. The MS/MSD pairs were within the project established precision limits presented in the SI QAPP Addendum (AECOM, 2019).

Field duplicate samples were collected at a rate of 10% to assess the overall sampling and measurement precision for this sampling effort. The field duplicate samples were analyzed for PFAS and general chemistry parameters. The field duplicate samples were within the project established precision limits presented in the SI QAPP Addendum (AECOM, 2019).

4.6.2 Accuracy

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

LCS/LCSD samples were prepared by addition of known concentrations of each analyte in a matrix free media known to be free of target analytes. LCS/LCSD samples were analyzed for every analytical batch and demonstrated that the analytical system was in control during sample preparation and analysis, with one exception. The LCS/LCSD prepared in QC batch 661091 displayed a percent recovery for perfluorotridecanoic acid (PFTrDA) greater than the upper QC limit of 130% at 149% in the LCS and 154% in the LCSD. The associated field sample results were non-detect; no data qualifying action was required.

MS/MSD samples were prepared, analyzed, and reported at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested, with one exception. The MS/MSD performed on parent sample AOI2-SS4-0-2 displayed a percent recovery for PFOS greater than the upper QC limit of 130% at 187% in the MS. The parent sample result was positive and was qualified “J+”. This anomaly is considered minor, and the result is usable as qualified but should be considered as an estimated value with a positive bias. The MS/MSD performed on parent sample AOI2-MW1 displayed MSD percent recoveries less than the lower QC limit of 70% for perfluorohexanesulfonic acid (PFHxS) and perfluorohexanoic acid (PFHxA) at 61% and 68%, respectively. The parent sample results were positive and were flagged “J-“. These anomalies are considered minor, and the results are usable as qualified but should be considered as estimated values with a positive bias. The MS/MSD performed on parent sample AOI1-MW3-GW displayed percent recoveries greater than the upper QC limit for PFHxS at 133% in the MS and 140% in the MSD. The associated parent sample and field duplicate results were positive and were qualified “J+”.

4.6.3 Representativeness

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

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

Field QC samples were collected to assess the representativeness of the data collected. Field duplicates were collected at a rate of 10% for all field samples, while MS/MSD samples were collected at a rate of 5%. Field sample FH-02-101120 was re-extracted and reanalyzed outside of holding time due to an EIS anomaly. The re-extracted results were qualified “J” and are recommended to be retained within the data set. Several soil samples were submitted for pH analysis. The technical holding time for pH analysis is “immediate”; the associated results were qualified “J”. All preservation techniques were followed by the field staff, and all technical and analytical holding times were met by the laboratory. The laboratory used approved standard methods in accordance with the SI QAPP Addendum (AECOM, 2019) for all analyses.

Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control. Several PFAS instrument blanks and method blanks displayed detections greater than the detection limit for multiple target analytes. In total, 110 field sample results were qualified “U” during data validation due to associated detections in instrument and/or method blanks. The reported field sample result values were adjusted to be equal to the level of detection (LOD); the LOD was elevated to the concentration of the blank detection in instances where the blank concentration was greater than the LOD. The results are usable as qualified but should be considered false positives and treated as non-detect.

Equipment blanks and field blanks were also collected for groundwater and soil samples. Equipment blank AOI-MW3-EB displayed a detection greater than the detection limit for perfluorobutanoic acid (PFBA) at 16.5 ng/L. The positive associated field sample results were greater than five times the concentration in the equipment blank; therefore, no data qualifying action was required. The field blank sample FIELD BLANK displayed a detection greater than the detection limit for PFOS at 1.62 ng/L. The field blank result was associated with an instrument blank detection within five times the blank concentration and was qualified “U”. The qualified field blank result should be considered as false positive and treated as non-detect; no data qualifying action was taken based on the qualified field blank result. Equipment blank FTWHH-ERB-03 in QC batch 695178 displayed concentrations greater than the detection limit for 6:2 fluorotelomer sulfonate (6:2 FTS). The field sample results associated with the equipment blank were either non-detect, or previously qualified due to a method blank contamination; no further data qualifying action was required. The field blank FTWHH-FRB in QC batch 695178, displayed concentrations greater than the detection limit for 6:2 FTS. The associated field sample results were greater than five times the concentration found in the blank detection; no data qualifying action was required.

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

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

4.6.4 Comparability

Comparability is the extent to which data from one study can be compared directly to either past data from the current project or data from another study. Using standardized sampling and analytical methods, units of reporting, and site selection procedures help ensure comparability. Standard field sampling and typical laboratory protocols were used during the SI and are considered comparable to ongoing investigations.

4.6.5 Completeness

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

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

4.6.6 Sensitivity

Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory fortified blanks, a method detection limit (MDL) study, and calibration standards at the level of quantitation (LOQ). In order to meet the needs of the data users, project data must meet the measurement performance criteria for sensitivity and project LOQs specified in the SI QAPP Addendum (AECOM, 2019). The laboratory provided the requested MDL studies and provided applicable calibration standards at the LOQ. In order to achieve the DQOs for sensitivity outlined in the SI QAPP Addendum (AECOM, 2019), the laboratory reported all field sample results at the lowest possible dilution. Additionally, any analytes detected below the LOQ and above the MDL were reported and qualified “J” as estimated values by the laboratory.

5. Site Inspection Activities

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

- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan* dated March 2018 (AECOM, 2018a)
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b)
- *Final Preliminary Assessment Report, Fort William Henry Harrison, Montana* dated August 2018 (AECOM, 2018c)
- *Final Site Safety and Health Plan, Fort William Henry Harrison, Montana* dated October 2018 (AECOM, 2018d)
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Fort William Henry Harrison, Montana* dated January 2019 (AECOM, 2019)
- *Final Supplemental Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Fort William Henry Harrison, Montana* dated October 2020 (AECOM, 2020)

SI field activities were conducted in two mobilizations. The first mobilization included permanent groundwater monitoring well installation, development, and sampling; surface and subsurface soil sampling; and groundwater sampling from existing wells from 10 to 20 February 2019 and from 19 to 31 May 2019. The second mobilization included permanent groundwater monitoring well installation, development, and sampling; surface and subsurface soil sampling; and groundwater sampling from existing wells from 5 to 15 October 2020. Field activities were conducted in accordance with the SI QAPP Addendum and Supplemental SI QAPP Addendum (AECOM, 2019; AECOM, 2020), except as noted in **Section 5.9**.

To fulfill the project DQOs set forth in the approved the SI QAPP Addendum and Supplemental SI QAPP Addendum (AECOM, 2019; AECOM, 2020), samples were collected and analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15 to fulfill the project DQOs:

Mobilization 1 –

- 47 soil grab samples from 27 boring locations; and
- 15 groundwater samples, six from new monitoring well locations, eight from existing monitoring well locations, and one from an irrigation well location.

Mobilization 2 –

- 30 soil grab samples from 27 boring locations; and
- 15 groundwater samples, five from new monitoring well locations and ten from existing monitoring well locations.

Figures 5-1 and **5-2** provide the sample locations for all media across the facility for Mobilization 1 and 2, respectively. **Table 5-1** presents all samples collected for each media during Mobilization 1 and 2, respectively. Daily reports were completed throughout both SI activities, which are provided in **Appendix B1**. 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 a Technical Project Planning (TPP) meeting, performed utility clearance, and sampled decontamination source water, each of which is discussed in more detail below.

5.1.1 Technical Project Planning

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

TPP Meeting 1 and 2 for Mobilization 1 were held on 8 November 2018, prior to SI field activities. Meeting minutes are provided in **Appendix D**. TPP meetings 1 and 2 were conducted in general accordance with EM 200-1-2 (USACE, 2016).

The stakeholders for this SI include the ARNG, MTARNG, USACE, MTDEQ, and the VA, and they were provided the opportunity to make comments on the technical sampling approach and methods in the TPP 2 meeting. The outcome of TPP meetings 1 and 2 were memorialized in the SI QAPP Addendum (AECOM, 2019). Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

No formal TPP Meeting 1 and 2 was held for Mobilization 2 given the scope followed many of the same procedures outlined in the SI QAPP Addendum. However, a call was held on 22 September 2020 with the stakeholders (ARNG, MTARNG, USACE, and MTDEQ) to discuss the proposed sampling locations and MTDEQ comments on the Supplemental SI QAPP, which were provided before the call.

5.1.2 Utility Clearance

Utility clearance was conducted by Montana811 and facilitated by MTARNG. MTARNG contacted Montana811 one-call utility clearance contractor to notify them of intrusive work. AECOM field staff were onsite during the utility locate. Additionally, the first 5 feet of each boring were advanced using an air knife and hand augering to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

A sample from a local potable water source at FTWHH was collected on 8 September 2018, prior to Mobilization 1, and analyzed for PFAS via LC/MS/MS compliant with DoD QSM 5.1 Table B-15. The potable water source at FTWHH is supplied by the City of Helena. The results of the potable well sample are provided in **Appendix G**. A discussion of the results is presented in **Section 4.6.3**. The same water source was used during Mobilization 2.

All materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment is provided in PQAPP Appendix C, Table 1 (AECOM, 2018a). Prior to the start of field work each day, a PFAS Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Soil borings and sampling were performed during both Mobilization 1 and 2. During Mobilization 1, soil samples were collected from boreholes drilled by one of three methods: 1) air knifing, 2) hand augering, or 3) rotosonic drilling. In February 2019, when the ground was frozen, the surface soil and shallow subsurface samples were collected using an air knife, and in May 2019, during warmer weather, surface and shallow subsurface samples were collected with a hand auger. Deep subsurface soil samples collected from well borings were collected using a Boart Longyear LS250 minisonic drill rig. Three discrete soil samples were collected from the sonic well borings: the first from 0 to 2 feet bgs, the second from the mid-point between the surface and the groundwater table, and the third from approximately 1 foot above the groundwater table. The Mobilization 1 and 2 SI boring locations are shown on **Figure 5-1**, Mobilization 2 SI boring locations are shown on **Figure 5-2**, and boring depths for both mobilizations are provided **Table 5-1**. The soil boring locations were selected based on the AOI information as agreed on through TPP and SI QAPP Addendum review.

During Mobilization 2, soil samples were collected from boreholes drilled by one of three methods: 1) air knifing, 2) hand augering, or 3) hollow stem auger (HSA). Surface and shallow subsurface soil samples were collected as described during Mobilization 1. Deep subsurface soil samples were collected from well borings using a CME-75 HSA rig with 18-inch split-spoons.

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

Each 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 under standard chain-of-custody (COC) procedures to the laboratory and analyzed for PFAS via LC/MS/MS compliant with DoD QSM 5.1 Table B-15, TOC, (USEPA Method 9060A) and pH (USEPA Method 9045D) in accordance with the SI QAPP Addendum (AECOM, 2019). For cases in which non-dedicated sampling equipment was used, such as a stainless-steel scoop and mixing bowl used for the 0 to 2 feet bgs soil samples, equipment blank samples were collected and analyzed for the same parameters as the soil samples.

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 4 degrees Celsius (ºC) during shipment.

5.3 Permanent Well Installation and Groundwater Sampling

Permanent monitoring wells were installed during both Mobilization 1 and 2. Six permanent groundwater monitoring wells were installed during Mobilization 1, and five were installed during Mobilization 2. The wells were installed at locations within or downgradient of potential PFAS release areas. Additionally, the new well locations assisted with the understanding of groundwater flow direction at the facility.

Boreholes were advanced using the drilling methods described above and used to install 2-inch diameter monitoring wells. The monitoring wells were constructed with Schedule 40 polyvinyl chloride (PVC), flush threaded 10-feet sections of riser, 0.010-inch slotted well screen, and a

threaded bottom cap. A filter pack of 20/40 silica sand was installed in the annulus around the well screen to a minimum of 2-feet above the well screen. A 2-feet thick bentonite seal was placed above the filter sand and hydrated with distilled water. Bentonite grout was placed in the well annulus from the top of the bentonite seal to ground surface during Mobilization 1. Bentonite chips were used during Mobilization 2. The bentonite grout/chips were allowed to set for 24-hours prior to well completion in accordance with the SI QAPP Addendum and Supplemental SI QAPP Addendum (AECOM, 2019; AECOM, 2020). The screen interval of each of the groundwater monitoring wells installed during Mobilization 1 and 2 are provided in **Table 5-2**.

The newly installed monitoring wells were developed no sooner than 24 hours following installation by pumping and surging using a variable speed submersible pump. Development of wells was completed in accordance with the SI QAPP Addendum and Supplemental SI QAPP Addendum (AECOM, 2019; AECOM, 2020).

5.4 Groundwater Sampling from Existing Wells

Groundwater samples were collected from newly installed and existing monitoring wells during Mobilization 1 and 2. Samples from newly installed wells were collected no sooner than 24 hours following development. All samples were collected via low-flow sampling methods using a bladder pump (with a disposable polytetrafluoroethylene bladder) with disposable PFAS-free, HDPE tubing. New tubing and bladders were 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 [DO], turbidity, and oxidation-reduction potential [ORP]) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**). Water levels were measured to the nearest 0.01 inch and recorded. Additionally, a subsample of each groundwater sample was collected in a separate container and a shaker test was completed to identify if there was any foaming. No foaming was noted in any of the groundwater samples. During Mobilization 1, the Pump House system was flushed and sampled for 15 minutes prior to collecting the groundwater sample. The location of wells sampled during Mobilization 1 are provided in **Figure 5-1**, Mobilization 2 in **Figure 5-2**, and the screen interval of each of the groundwater monitoring wells is provided in **Table 5-2**.

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, transported via Federal Express under standard COC procedures to the laboratory, and analyzed for PFAS in accordance with the SI QAPP Addendum and Supplemental SI QAPP Addendum (AECOM, 2019; AECOM, 2020).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSD were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. FRBs accompanied each cooler containing samples for PFAS analysis and were analyzed for select PFAS. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 4 °C during shipment.

5.5 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 30 May 2019 and 13 October 2020. Water level measurements were taken from the northern side of the well casing. A groundwater flow contour map is provided in **Figure 2-4** and **Figure 2-5**. Depth to water readings and calculated groundwater elevation data from both synoptic rounds are provided in **Table 5-3**.

5.6 Surveying

The northern side of each well casing was surveyed by Montana-Licensed land surveyor following guidelines provided in the standard operating procedures provided in the SI QAPP Addendum

and Supplemental SI QAPP Addendum (AECOM, 2019; AECOM, 2020). Survey data from the newly installed wells were collected on 24 July 2019 and 14 October 2020 in the Montana State Plane North American Datum of 1983 and North American Vertical Datum of 1988. The surveyed well data is provided in **Appendix B3**.

5.7 Investigation Derived Waste

Soil investigation-derived waste (IDW) (i.e., soil cuttings) and liquid IDW (purge and decontamination water) generated during the SI activities were containerized in 55-gallon drums for future disposal by ARNG. The soil and liquid IDW was not sampled and assumes the PFAS characteristics of the associated soil samples collected from that source location.

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

5.8 Laboratory Analytical Methods

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

- 6:2 fluorotelomer sulfonate (6:2 FTS)
- 8:2 fluorotelomer sulfonate (8:2 FTS)
- N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
- N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
- Perfluorobutyrate (PFBA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexanoic acid (PFHxA)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS)
- Perfluoropentanoic acid (PFPeA)
- Perfluorotetradecanoic acid (PFTeDA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluoroundecanoic acid (PFUdA)

Soil samples were also analyzed for TOC using USEPA Method 9060A, and pH by USEPA Method 9045D.

5.9 Deviations from SI QAPP Addendum

Deviations from the SI QAPP Addendum and Supplemental SI QAPP Addendum occurred based on field conditions and discussion between AECOM and ARNG. Deviations from both mobilizations are noted below:

- During Mobilization 1, the SI QAPP Addendum indicated that groundwater would be sampled at nine existing wells. The USGS Well was only a PVC stickup location to measure water level and not a properly installed well location; therefore, a groundwater sample was not collected from this location.

- During Mobilization 2, two proposed sample locations within AOI 1 (AOI01-MW4 and AOI01-SS7) were within the Navy property boundary. The field team shifted these proposed locations to the east (on FTWHH property) and completed a Field Change Request for team approval before proceeding with sampling those locations. This has been included in **Appendix B4.**

Table 5-1
Samples by Medium
Fort William Henry Harrison, MT
Site Inspection Report

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS (USEPA Method 537 Modified)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D422)	Comments
SI Soil Samples AOI 1							
AOI1-SB1-0-2	2/13/2019	0-2	x	x	x		
AOI1-SB1-20-22	2/13/2019	20-22	x	x	x		MS/MSD
AOI1-SB1-38-40	2/13/2019	38-40	x	x	x		
AOI1-MW1-18-20	2/13/2019	18-20				x	
AOI1-MW1-50-55	2/13/2019	50-55				x	
AOI1-SB2-0-2	2/15/2019	0-2	x	x	x		
AOI1-SB2-15-17	2/15/2019	15-17	x	x	x		
AOI1-SB2-28-30	2/15/2019	28-30	x	x	x		
AO1-MW2-35-37	2/15/2019	35-37				x	
AOI1-SB3-0-2	2/20/2019	0-2	x	x	x		
AOI1-SB3-18-20	2/20/2019	18-20	x	x	x		
AOI1-SB3-18-20-DUP	2/20/2019	18-20	x	x	x		Field Duplicate
AOI1-SB3-38-40	2/20/2019	38-40	x	x	x		
AOI1-MW3-47-48	2/20/2019	47-48				x	
AOI1-HA1-0-2	2/12/2019	0-2	x	x	x		
AOI1-HA1-2-4	2/12/2019	2-4	x	x	x		
AOI1-HA2-0-2	2/12/2019	0-2	x	x	x		
AOI1-HA2-2-4	2/12/2019	2-4	x	x	x		
AOI1-SS1-0-2	2/14/2019	0-2	x	x	x		
AOI1-SS1-0-2R	5/20/2019	0-2	x	x	x		
AOI1-SS2-0-2	2/14/2019	0-2	x	x	x		
AOI1-SS3-0-2	2/14/2019	0-2	x	x	x		MS/MSD
AOI1-SS4-0-2	2/14/2019	0-2	x	x	x		
AOI1-SS5-0-2	2/14/2019	0-2	x	x	x		
AOI1-SS6-0-2	2/20/2019	0-2	x	x	x		
SSI Soil Samples AOI 1							
AOI01-04-SB-00-02	10/7/2020	0-2	x				
AOI01-04-SB-15-17	10/9/2020	15-17	x				
AOI01-04-SB-30-32	10/9/2020	30-32	x	x	x		
AOI01-05-SB-00-02	10/6/2020	0-2	x				
AOI01-05-SB-15-17	10/8/2020	15-17	x	x	x		
AOI01-05-SB-15-17-DUP	10/8/2020	15-17		x	x		Field Duplicate
AOI01-05-SB-15-17-MS	10/8/2020	15-17		x	x		MS
AOI01-05-SB-15-17-MSD	10/8/2020	15-17		x	x		MSD
AOI01-05-SB-30-32	10/8/2020	30-32	x				
AOI01-06-SB-00-02	10/6/2020	0-2	x				
AOI01-06-SB-15-17	10/9/2020	15-17	x				
AOI01-06-SB-30-32	10/9/2020	30-32	x				
AOI01-SS7-00-02	10/7/2020	0-2	x				
AOI01-SS8-00-02	10/6/2020	0-2	x				
AOI01-SS9-00-02	10/6/2020	0-2	x				
AOI01-SS10-00-02	10/6/2020	0-2	x				
AOI01-SS11-00-02	10/7/2020	0-2	x				
AOI01-SS12-00-02	10/7/2020	0-2	x				
AOI01-SS13-00-02	10/7/2020	0-2	x				
AOI01-SS14-00-02	10/7/2020	0-2	x				
AOI01-SS15-00-02	10/7/2020	0-2	x				
SI Soil Samples AOI 2							
AOI2-SB1-0-2	5/21/2019	0-2	x	x	x		
AOI2-SB1-9-11	5/21/2019	9-11	x	x	x		
AOI2-SB1-18-20	5/21/2019	18-20	x	x	x		
AOI2-SB2-0-2	5/23/2019	0-2	x	x	x		
AOI2-SB2-0-2-DUP	5/21/2019	0-2	x	x	x		Field Duplicate
AOI2-SB2-8-10	5/23/2019	8-10	x	x	x		
AOI2-SB2-18-20	5/23/2019	18-20	x	x	x		
AOI2-HA1-0-2	2/13/2019	0-2	x	x	x		
AOI2-HA1-2-4	2/13/2019	2-4	x	x	x		
AOI2-HA2-0-2	2/13/2019	0-2	x	x	x		MS/MSD
AOI2-HA2-2-4	2/13/2019	2-4	x	x	x		
AOI2-HA2-2-4-DUP	2/13/2019	2-4	x	x	x		Field Duplicate

Table 5-1
Samples by Medium
Fort William Henry Harrison, MT
Site Inspection Report

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS (USEPA Method 537 Modified)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D422)	Comments
AOI2-HA3-0-2	2/13/2019	0-2	x	x	x		
AOI2-HA3-2-4	2/13/2019	2-4	x	x	x		
AOI2-HA4-0-2	2/13/2019	0-2	x	x	x		
AOI2-HA4-2-4	2/13/2019	2-4	x	x	x		
AOI2-HA5-0-2	2/13/2019	0-2	x	x	x		
AOI2-HA5-2-4	2/13/2019	2-4	x	x	x		
AOI2-HA6-0-2	2/12/2019	0-2	x	x	x		
AOI2-HA6-2-4	2/12/2019	2-4	x	x	x		
AOI2-HA6-2-4-DUP	2/12/2019	2-4	x	x	x		Field Duplicate
AOI2-SS1-0-2	5/20/2019	0-2	x	x	x		
AOI2-SS2-0-2	5/20/2019	0-2	x	x	x		
AOI2-SS2-0-2-DUP	5/20/2019	0-2	x	x	x		Field Duplicate
AOI2-SS3-0-2	5/20/2019	0-2	x	x	x		
AOI2-SS4-0-2	5/20/2019	0-2	x	x	x		MS/MSD
AOI2-SS5-0-2	5/20/2019	0-2	x	x	x		
SSI Soil Samples AOI 2							
AOI02-03-SB-00-02	10/6/2020	0-2	x	x	x		
AOI02-03-SB-00-02-DUP	10/6/2020	0-2	x				Field Duplicate
AOI02-03-SB-00-02-MS	10/6/2020	0-2	x				MS
AOI02-03-SB-00-02-MSD	10/6/2020	0-2	x				MSD
AOI02-03-SB-10-12	10/10/2020	10-12	x				
AOI02-03-SB-10-12-DUP	10/10/2020	10-12	x				Field Duplicate
AOI02-03-SB-25-27	10/10/2020	25-27	x				
AOI02-SS6-00-02	10/6/2020	0-2	x				
AOI02-SS7-00-02	10/6/2020	0-2	x				
AOI02-SS8-00-02	10/6/2020	0-2	x				
SI Soil Samples AOI 3							
AOI3-SB1-0-2	5/22/2019	0-2	x	x	x		
AOI3-SB1-18-20	5/22/2019	18-20	x	x	x		
AOI3-SB1-40-42	5/22/2019	40-42	x	x	x		
AOI3-HA1-0-2	2/12/2019	0-2	x	x	x		
AOI3-HA1-0-4	2/12/2019	2-4	x	x	x		
SSI Soil Samples AOI 3							
AOI03-02-SB-00-02	10/6/2020	0-2	x				
AOI03-SS1-00-02	10/7/2020	0-2	x				
AOI03-SS2-00-02	10/7/2020	0-2	x				
AOI03-SS3-00-02	10/7/2020	0-2	x				
AOI03-SS4-00-02	10/7/2020	0-2	x				
AOI03-SS4-00-02-DUP	10/7/2020	0-2	x				Field Duplicate
AOI03-SS5-00-02	10/7/2020	0-2	x	x	x		
SI Groundwater Samples							
AOI1-MW1	5/28/2019	Mid-Screen	x				
AOI1-MW2	5/29/2019	Mid-Screen	x				
AOI1-MW2-DUP	5/29/2019	Mid-Screen	x				Field Duplicate
AOI1-MW3	5/25/2019	Mid-Screen	x				
BH-02	5/28/2019	Mid-Screen	x				
FH-02	5/28/2019	Mid-Screen	x				
AOI2-MW1	5/29/2019	Mid-Screen	x				
AOI2-MW2	5/30/2019	Mid-Screen	x				
MW-06	5/29/2019	Mid-Screen	x				
MW-06-DUP	5/29/2019	Mid-Screen	x				Field Duplicate
MW-07	5/30/2019	Mid-Screen	x				
MW-08	5/29/2019	Mid-Screen	x				
AOI3-MW1	5/29/2019	Mid-Screen	x				
MW-10	5/29/2019	Mid-Screen	x				
MW-11	5/30/2019	Mid-Screen	x				
OBTMW-01	5/30/2019	Mid-Screen	x				
PH-1	5/30/2019	NA	x				
PH-2-DUP	5/30/2019	NA	x				Field Duplicate
SSI Groundwater Samples							
AOI1-MW1-GW	10/11/2020	53.0	x				

Table 5-1
Samples by Medium
Fort William Henry Harrison, MT
Site Inspection Report

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS (USEPA Method 537 Modified)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D422)	Comments
AOI1-MW2-GW	10/12/2020	38.5	x				
AOI1-MW3-GW	10/10/2020	45.0	x				
AOI1-MW3-GW-DUP	10/10/2020	45.0	x				Field Duplicate
AOI1-MW3-GW-MS	10/10/2020	45.0	x				MS
AOI1-MW3-GW-MSD	10/10/2020	45.0	x				MSD
AOI1-MW04-GW	10/14/2020	36.0	x				
AOI1-MW05-GW	10/12/2020	40.0	x				
AOI1-MW06-GW	10/13/2020	33.5	x				
BH-02-101020	10/10/2020	31.0	x				
FH-02-101120	10/11/1010	51.0	x				
AOI2-MW1-GW	10/12/2020	35.0	x				
AOI2-MW1-GW-DUP	10/12/2020	35.0	x				Field Duplicate
AOI2-MW2-GW	10/13/2020	25.0	x				
AOI2-MW03-GW	10/14/2020	36.0	x				
MW-08-101120	10/11/2020	50.0	x				
AOI3-MW1-GW	10/9/2020	56.5	x				
AOI3-MW02-GW	10/13/2020	56.0	x				
MW-11-100920	10/9/2020	52.0	x				
Field Blank Samples							
AOI1-HA1-2-4-EB	2/13/2019		x				Equipment Blank
AOI1-SS1-0-2-EB	2/14/2019		x				Equipment Blank
AOI1-MW3-EB	2/16/2019		x				Equipment Blank
AOI2-FRB	5/20/2016		x				Field Blank
AOI3-SB1-0-2-EB	5/21/2019		x				Equipment Blank
AOI2-SB1-0-2-EB	5/23/2019		x				Equipment Blank
FTWHH-ERB-01	10/6/2020		x				Equipment Blank
FTWHH-ERB-02	10/7/2020		x				Equipment Blank
FTWHH-ERB-03	10/10/2020		x				Equipment Blank
FTWHH-ERB-04	10/14/2020		x				Equipment Blank
FTWHH-FRB-01	10/10/2020		x				Field Blank

Notes:
AOI = Area of Interest
ASTM = American Standard Test Method
EB = equipment blank
ERB = equipment blank
FRB = field reagent blank
GW = groundwater
ft = feet
HA = hand auger
MS/MSD = matrix spike/ matrix spike duplicate
MW = monitoring well
NA = not applicable
PFAS = per- and polyfluoroalkyl substances
PH = Pump House
R = recollected
SB = soil boring
SS = surface soil
TOC = Total Organic Carbon
USEPA = United States Environmental Protection Agency

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Table 5-2
Monitoring Well Screen Intervals
Fort William Henry Harrison, MT
Site Inspection Report

Monitoring Well ID	Screen Interval (ft bgs)
AOI1-MW1	45-55
AOI1-MW2	30-40
AOI1-MW3	40-50
AOI1-MW4	28-38
AOI1-MW5	35-45
AOI1-MW6	27-37
AOI2-MW1	28-38
AOI2-MW2	20-30
AOI2-MW3	30-40
AOI3-MW1	48-58
AOI3-MW2	50-60
BH-02	29-34
FH-02	34.8-54.8
MW-05	29-39.2
MW-06	20-30
MW-07	29.1-39.1
MW-08	39.2-59.2
MW-10	59-79
MW-11	25-55
MW-12	35-55
OBTMW-01	20-50

Notes:
bgs = below ground surface
ft = feet
ID = identification

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Table 5-3
Groundwater Elevation
Fort William Henry Harrison, MT
Site Inspection Report

Monitoring Well ID	Date Measured	Top of Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Groundwater Elevation (ft amsl)
AOI1-MW1	5/30/2019	3985.92	31.25	3954.67
AOI1-MW2	5/30/2019	3976.32	31.85	3944.47
AOI1-MW3	5/30/2019	3948.75	32.44	3916.31
BH-02	5/30/2019	3968.06	24.04	3944.02
FH-02	5/30/2019	3954.95	34.17	3920.78
AOI2-MW1	5/30/2019	3950.83	21.10	3929.73
AOI2-MW2	5/30/2019	3946.64	14.23	3932.41
MW-06	5/30/2019	3952.55	20.65	3931.90
MW-07	5/30/2019	3948.40	16.44	3931.96
MW-08	5/30/2019	3959.17	27.19	3931.98
AOI3-MW1	5/30/2019	4003.43	42.87	3960.56
MW-10	5/30/2019	3977.10	29.87	3947.23
MW-11	5/30/2019	3981.19	27.81	3953.38
OBTMW-01	5/30/2019	3982.56	27.90	3954.66
AOI1-MW1	10/12/2020	3985.93	34.71	3951.22
AOI1-MW2	10/12/2020	3976.33	33.80	3942.53
AOI1-MW3	10/12/2020	3948.76	32.13	3916.63
AOI1-MW4	10/12/2020	3975.46	29.40	3946.06
AOI1-MW5	10/12/2020	3947.70	33.92	3913.78
AOI1-MW6	10/12/2020	3948.09	29.82	3918.27
BH-02	10/12/2020	3968.07	27.59	3940.48
FH-02	10/12/2020	3954.95	34.43	3920.52
AOI2-MW1	10/12/2020	3950.84	22.79	3928.05
AOI2-MW2	10/12/2020	3946.65	17.33	3929.32
AOI2-MW3	10/12/2020	3953.36	24.18	3929.18
MW-05	10/12/2020	3954.99	25.54	3929.45
MW-06	10/12/2020	3952.56	23.54	3929.02
MW-07	10/12/2020	3948.41	19.39	3929.02
MW-08	10/12/2020	3959.18	28.90	3930.28
AOI3-MW1	10/12/2020	4003.44	43.93	3959.51
AOI3-MW2	10/12/2020	3993.34	49.65	3943.69
MW-10	10/12/2020	3977.13	30.11	3947.02
MW-11	10/12/2020	3981.20	29.29	3951.91
MW-12	10/12/2020	3980.48	36.56	3943.92
OBTMW-01	10/12/2020	3982.57	29.65	3952.92

Notes:

amsl = above mean sea level

btoc = below top of casing

ft = feet

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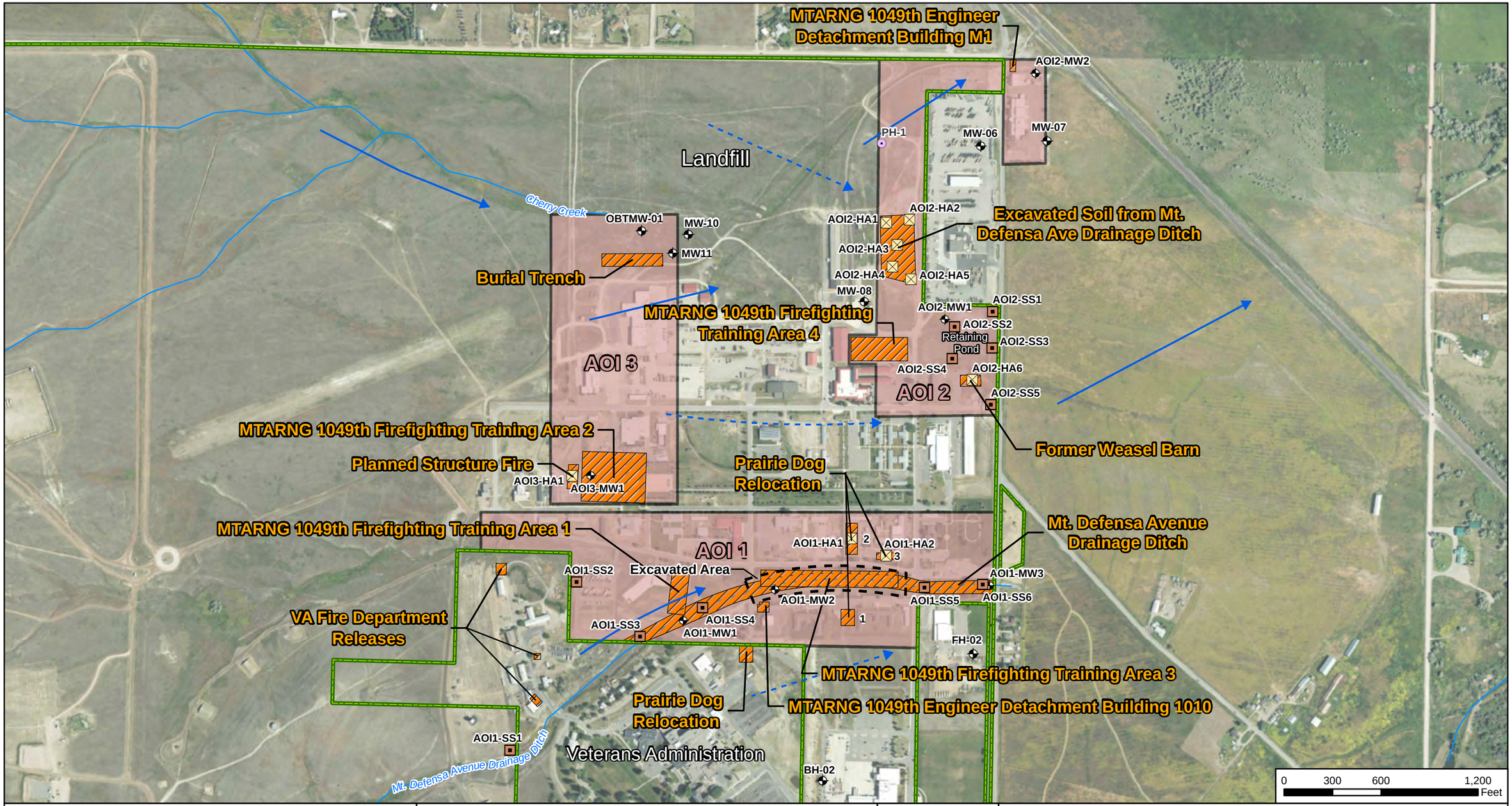

CLIENT	ARNG
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT

REVISED		6/7/2021	GIS BY	MS	6/7/2021
SCALE		1:7,200	CHK BY	JH	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community			PM	CM	6/7/2021

- Monitoring Well
- Surface/Subsurface Soil Location
- Surface Soil Location
- Existing Pumphouse Well
- Area of Interest
- Potential PFAS Release
- Facility Boundary
- River/Stream
- Surface Water Flow Direction
- Groundwater Flow Direction

N

SI Mobilization 1 Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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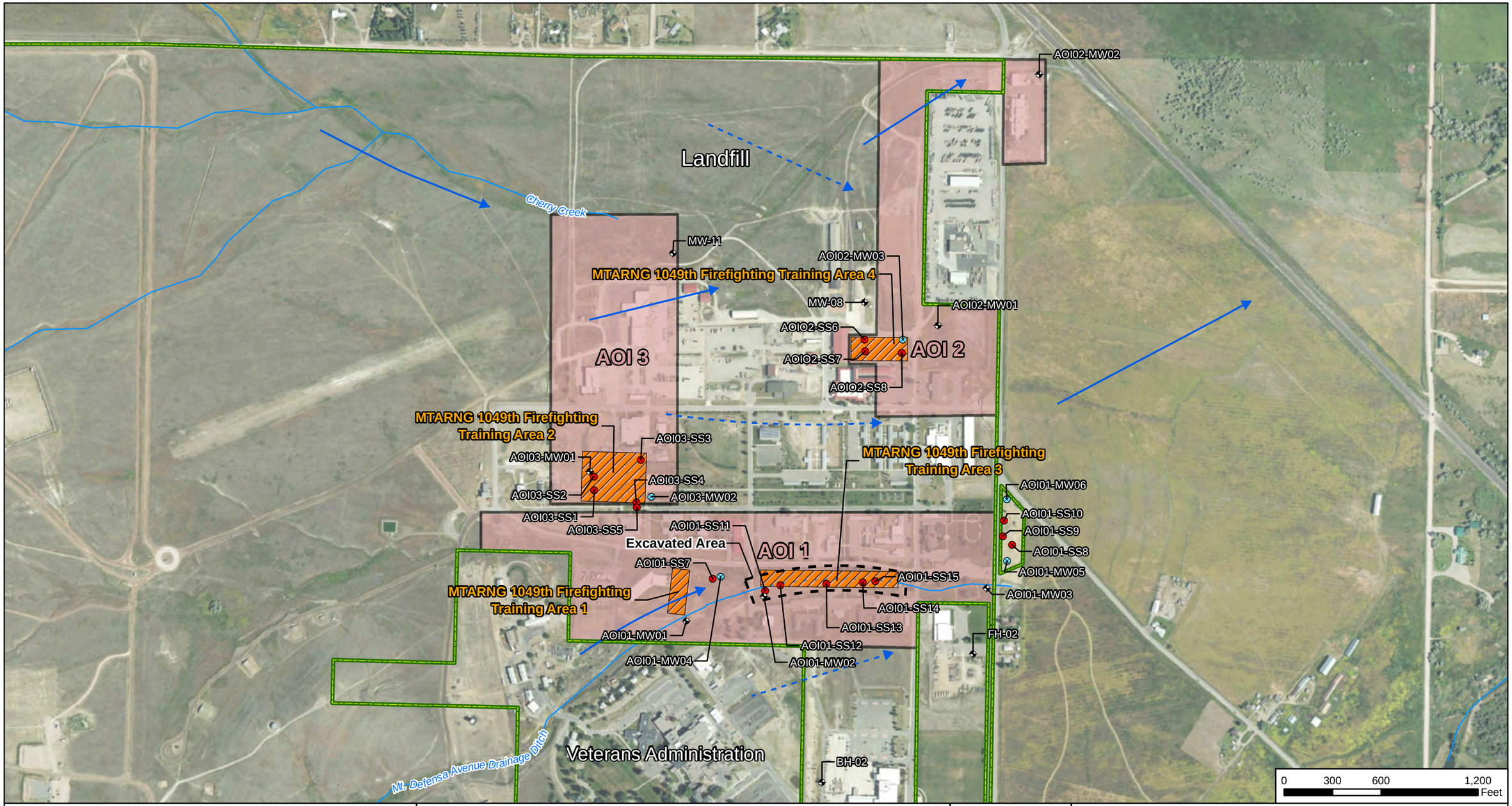

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT			
REVISED	6/7/2021	GIS BY	MS	6/7/2021
SCALE	1:7,200	CHK BY	JH	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	6/7/2021

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

2020 SSI Locations

- Monitoring Well
- Soil Sample Location

N

SI Mobilization 2 Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-2

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6. Site Inspection Results

This section presents the analytical results of the SI for each AOI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Sections 6.3** through **6.5**. **Table 6-2** through **Table 6-5** present PFAS results for samples with detections in soil and groundwater; only constituents detected in one or more samples are included. Tables that contain all results are provided in **Appendix F** and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

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

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

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

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

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

6.2 Soil Physicochemical Analyses

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

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

factors (for example, pH and presence of polyvalent cations) may also affect PFAS sorption to solid phases (ITRC, 2018).

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1, which includes seven potential PFAS release areas: Black-Tailed Prairie Dog Relocation areas (three locations), MTARNG 1049th Engineer Detachment Building 1010, Mt. Defensa Avenue Drainage Ditch, 1049th Firefighting Training Area 1, and 1049th Firefighting Training Area 3. The detected compounds in soil and groundwater are summarized in **Tables 6-2** through **6-5**. The detections of PFOA and PFOS in soil and groundwater are presented on **Figures 6-1** through **6-6**.

6.3.1 AOI 1 Soil Analytical Results

Within the Mt. Defensa Avenue Drainage Ditch, soil was sampled at three intervals from soil borings locations AOI1-SB1 and AOI1-SB3 and one interval from surface locations AOI1-SS1 through AOI1-SS6. All PFOA, PFOS, and PFBS results were below SLs. PFOA concentrations ranged from non-detect to 0.122 J micrograms per Kilogram (µg/Kg), which occurred at AOI1-SB3 in the shallow interval (0 to 2 feet bgs). PFOS concentrations ranged from non-detect to 2.23 µg/Kg, which occurred at AOI1-SS5 in the shallow interval (0 to 2 feet bgs). PFBS concentrations ranged from non-detect to 0.012 J µg/Kg, which occurred in AOI1-SB3 in the shallow interval (0 to 2 feet bgs). In the intermediate interval, PFOA concentrations were non-detect. PFOS concentrations ranged from 0.039 J µg/Kg in AOI1-SB1 (20 to 22 feet bgs) to 0.526 J µg/Kg in AOI1-SB3 (18 to 20 feet bgs). PFBS concentrations ranged from 0.00418 J µg/Kg in AOI1-SB1 (20 to 22 feet bgs) to 0.021 J µg/Kg in AOI1-SB3 (18 to 20 feet bgs). In the deep interval, PFOA and PFBS concentrations were non-detect. PFOS concentrations ranged from 0.014 J µg/Kg in AOI1-SB1 (38 to 40 feet bgs) to 0.135 J µg/Kg, in AOI1-SB3 (38 to 40 feet bgs). **Table 6-2** and **Table 6-4** summarize the detected compounds in soil. **Figure 6-1** and **Figure 6-2** present ranges of detections of PFOS and PFOA in soil.

Within the 1049th Engineer Detachment Building 1010 area, soil was sampled at three intervals from soil boring location AOI1-SB2. All PFOA, PFOS, and PFBS results were below SLs. PFOA was non-detect in the shallow interval (0 to 2 feet bgs). PFOS was detected at 0.751 J µg/Kg and PFBS was detected at 0.104 J µg/Kg. In the intermediate interval (15 to 17 feet bgs), PFOA was detected at 0.055 J µg/Kg, PFOS was detected at 0.478 J µg/Kg, and PFBS was detected at 0.142 J µg/Kg. PFOA, PFOS, and PFBS were non-detect in the deep interval (28 to30 feet bgs). **Table 6-2** and **Table 6-4** summarize the detected compounds in soil. **Figure 6-1** and **Figure 6-2** present ranges of detections of PFOS and PFOA in soil.

Within in the Prairie Dog Relocation areas, soil was sampled at two intervals from hand auger locations AOI1-HA1 and AOI1-HA2. All PFOA, PFOS, and PFBS results were below SLs. PFOA and PFOS concentrations were all non-detect in the shallow interval (0 to 2 feet bgs) and intermediate interval (2 to 4 feet bgs). PFBS concentrations ranged from non-detect in AOI1-HA2 (2 to 4 feet bgs) to 0.00547 J µg/Kg in AOI1-HA2 (2 to 4 feet bgs). **Table 6-2** and **Table 6-3** summarize the detected compounds in soil. **Figure 6-1** and **Figure 6-2** present ranges of detections of PFOS and PFOA in soil.

Soil was sampled at three intervals from soil borings locations AOI01-04-SB through AOI01-06-SB and one interval from surface locations AOI1-SS8 through AOI1-SS10 at the FTWHH parcel of property located on the east side of Williams Street. PFOA, PFOS, and PFBS concentrations were non-detect.

Within in the 1049th Firefighting Training Area 1, surface soil was sampled from location AOI01-SS7. PFOA, PFOS, and PFBS results were below SLs. PFOA and PFBS concentrations were

non-detect. The PFOS concentration was 0.630 J µg/Kg, which occurred in the shallow interval (0 to 2 feet bgs). **Table 6-2** summarize the detected compounds in soil. **Figure 6-3** present the detections of PFOS in soil.

Within in the 1049th Firefighting Training Area 3, surface soil was sampled from locations AOI01-SS11 through AOI01-SS15 (0 to 2 feet bgs). All PFOA, PFOS, and PFBS results were below SLs. PFOA concentrations ranged from non-detect to 0.166 J µg/Kg, which occurred in AOI1-SS11 (0 to 2 feet bgs). PFOS concentrations ranged from non-detect to 39.9 µg/Kg, which occurred in AOI1-SS11 (0 to 2 feet bgs). PFBS concentrations ranged from non-detect to 1.08 µg/Kg, which occurred in AOI1-SS11 (0 to 2 feet bgs). **Table 6-2** summarizes the detected compounds in soil. **Figure 6-3** and **Figure 6-4** present ranges of detections of PFOS and PFOA in soil.

6.3.2 AOI 1 Groundwater Analytical Results

PFOA, PFOS, and PFBS were detected in 13 of the 13 groundwater samples collected in AOI 1. All PFOA and PFBS results were below SLs. PFOA was detected in 12 of 13 samples and ranged in concentrations from non-detect to 13.5 ng/L (14.3 ng/L duplicate), which was detected in AOI1-MW3. PFOS was detected below the SLs at all well locations with the exception of AOI1-MW3. PFOS concentrations ranged from 2.61 J ng/L at BH-02 to 62.2 ng/L (61.6 ng/L duplicate) at AOI1-MW3. PFBS was detected in 12 of 13 samples and ranged in concentrations from non-detect (BH-02) to 34.1 ng/L (AOI1-MW3). The detected compounds are summarized in **Table 6-5**. **Figure 6-5** and **Figure 6-6** present the range of detections for PFOS and PFOA at the facility.

6.3.3 AOI 1 Conclusions

Based on the results of SI, PFOA, PFOS, and PFBS were detected in soil at AOI 1; however, the detected concentrations were below soil SLs. PFOA and PFBS were detected in groundwater at AOI 1, and PFOS exceeded SLs. Therefore, further evaluation at AOI 1 is warranted as part of an RI.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2, which includes four potential PFAS release areas: Former Weasel Barn, Excavated Soil from Mt. Defensa Ave Drainage Ditch, 1049th Engineer Detachment Building M1, and 1049th Firefighting Training Area 4. The detected compounds in soil and groundwater are summarized in **Tables 6-2** through **6-5**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figures 6-1** through **6-6**.

6.4.1 AOI 2 Soil Analytical Results

Within the Former Weasel Barn area, soil was sampled at three intervals from soil boring location AOI2-SB1; two intervals from hand auger location AOI2-HA6; and one interval from surface locations AOI2-SS1 through AOI2-SS5. All PFOA, PFOS, and PFBS results were below SLs. PFOA concentrations ranged from non-detect to 0.271 J µg/Kg, which occurred at AOI2-SB1 in the shallow interval (0 to 2 feet bgs). PFOS concentrations ranged from 0.181 J µg/Kg in AOI2-SS3 (0 to 2 feet bgs) to 10.9 µg/Kg in AOI2-HA6 (0 to 2 feet bgs). PFBS concentrations ranged from non-detect to 0.07 J µg/Kg in AOI2-HA6 (0 to 2 feet bgs). In the intermediate interval, PFOA concentrations ranged from non-detect to 0.087 J µg/Kg, which occurred at AOI2-HA6 (2 to 4 feet bgs). PFOS concentrations ranged from 0.046 J µg/Kg in AOI2-SB1 (9 to 11 feet bgs) to 0.572 J µg/Kg in AOI2-HA6 (2 to 4 feet bgs). PFBS concentrations ranged from non-detect to 0.036 J µg/Kg, which was detected in AOI2-HA6 (2 to 4 feet bgs). In the deep interval, PFOS and PFBS were non-detect (AOI2-SB1). PFOS was detected at a concentration of 0.00678 J µg/Kg (18 to 20 feet bgs). **Tables 6-2** through **6-4** summarize the detected compounds in soil. **Figure 6-1** and **Figure 6-2** present ranges of detections of PFOS and PFOA in soil.

Within the Excavated Soil from Mt. Defensa Ave Drainage Ditch area, soil was sampled at two intervals from hand auger locations AOI2-HA1 through AOI2-HA5. All PFOA, PFOS, and PFBS results were below SLs. In the shallow interval (0 to 2 feet bgs), PFOA concentrations ranged from non-detect to 0.126 J µg/Kg, which occurred at AOI2-HA5. PFOS concentrations ranged from 0.086 J µg/Kg in AOI2-HA2 (0 to 2 feet bgs) to 1.73 µg/Kg in AOI2-HA5 (0 to 2 feet bgs). PFBS concentrations ranged from non-detect to 0.059 J µg/Kg, which was detected in AOI2-HA3 (0 to 2 feet bgs). In the intermediate interval (2 to 4 feet bgs), concentrations of PFOA ranged from non-detect to 0.083 J µg/Kg, which was detected in AOI2-HA4. PFOS concentrations ranged from non-detect to 1.92 µg/Kg, which occurred at AOI2-HA5 (2 to 4 feet bgs). PFBS concentrations ranged from non-detect to 0.047 J µg/Kg, which occurred in AOI2-HA5 (2 to 4 feet bgs). **Table 6-2** and **Table 6-3** summarize the detected compounds in soil. **Figure 6-1** and **Figure 6-2** present ranges of detections of PFOS and PFOA in soil.

Within the 1049th Engineer Detachment Building M1 area, soil was sampled at three intervals from soil boring location AOI2-SB2. All PFOA, PFOS, and PFBS results were below SLs. In the shallow interval (0 to 2 feet bgs), PFOA was detected at a concentration of 0.042 J µg/Kg. PFOS was detected at a concentration of 4.31 J µg/Kg (0 to 2 feet bgs). PFBS was non-detect. In the intermediate interval (2 to 11 feet bgs), PFOS and PFBS were non-detect. PFOS was detected at a concentration of 0.046 J µg/Kg. In the deep interval (18 to 20 feet bgs), PFOA, PFOS, and PFBS were non-detect. **Tables 6-2** through **6-4** summarize the detected compounds in soil. **Figure 6-1** and **Figure 6-2** present ranges of detections of PFOS and PFOA in soil.

Within the 1049th Firefighting Training Area 4, soil was sampled at three intervals from soil boring location AOI02-03-SB and one interval from surface locations AOI02-SS6 through AOI02-SS8. All PFOA, PFOS, and PFBS results were below SLs. In the shallow interval (0 to 2 feet bgs), PFOA and PFBS concentrations were non-detect. PFOS concentrations ranged from non-detect to 0.807 J µg/Kg, which occurred at AOI02-03-SB-DUP (0 to 2 feet bgs). In the intermediate and deep intervals, PFOA, PFOS, and PFBS were non-detect with the exception of a PFOS detection of 0.00678 J µg/Kg in the deep interval of AOI2-03-SB (25 to 27 feet bgs). **Tables 6-2** through **6-4** summarize the detected compounds in soil. **Figure 6-3** and **Figure 6-4** present ranges of detections of PFOS and PFOA in soil.

6.4.2 AOI 2 Groundwater Analytical Results

PFOA, PFOS, and PFBS were detected in seven of nine groundwater samples collected in AOI 2. PFOS exceeded SLs at AOI2-MW1 (118 ng/L). PFOA concentrations ranged from non-detect to 14.6 ng/L (AOI2-MW1-DUP). PFOS concentrations ranged from non-detect to 118 ng/L (AOI2-MW1). PFBS concentrations ranged from non-detect to 27.3 ng/L (AOI2-MW1). The detected compounds are summarized in **Table 6-5**. **Figure 6-5** and **Figure 6-6** present the range of detections for PFOS and PFOA at the facility.

6.4.3 AOI 2 Conclusions

Based on the results of SI, PFOA, PFOS, and PFBS were detected in soil at AOI 2; however, the detected concentrations were below soil SLs. PFOA and PFBS were detected in groundwater at AOI 2 and PFOS exceeded SLs. Therefore, further evaluation at AOI 2 is warranted as part of an RI.

6.5 AOI 3

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 3, which includes two potential PFAS release area: Planned Structure Fire and 1049th Firefighting Training Area 2. The detected compounds in soil and groundwater are summarized in **Tables 6-2** through **6-5**. The detections of PFOA and PFOS in soil and groundwater are presented on **Figures 6-1** through **6-6**.

6.5.1 AOI 3 Soil Analytical Results

Within the Planned Structure Fire area, soil was sampled at three intervals from soil boring location AOI3-SB1 and two intervals from hand auger location AOI3-HA1. All PFOA, PFOS, and PFBS results were below SLs. In the shallow interval (0 to 2 feet bgs), PFOA concentrations ranged from non-detect to 0.473 J µg/Kg, which occurred at AOI3-SB1. PFOS concentrations ranged from non-detect to 12.3 µg/Kg, which was detected in AOI3-SB1 (0 to 2 feet bgs). PFBS concentrations ranged from non-detect to 0.178 J µg/Kg, which was detected in AOI3-SB1 (0 to 2 feet bgs). In the intermediate interval (2 to 20 feet bgs), PFOA and PFBS were non-detect. PFOS was detected at a concentration of 0.056 J µg/Kg in AOI3-SB1 (18 to 20 feet bgs). In the deep interval (40 to 42 feet bgs), PFOA was non-detect. PFOS was detected at a concentration of 0.021 J µg/Kg in AOI3-SB1 (40 to 42 feet bgs). PFBS was detected at a concentration of 0.147 J µg/Kg in AOI3-SB1 (40 to 42 feet bgs.). **Tables 6-2** through **6-4** summarize the detected compounds in soil. **Figure 6-1** and **Figure 6-2** present ranges of detections of PFOS and PFOA in soil.

Within the 1049th Firefighting Training Area 2, soil was sampled at one interval from soil boring location AOI03-02-SB and from surface soil locations AOI03-SS1 through AOI03-SS5. All PFOA, PFOS, and PFBS results were below SLs. In the shallow interval (0 to 2 feet bgs), PFOA and PFBS concentrations were non-detect. PFOS concentrations ranged from non-detect to 2.91 µg/Kg, which occurred at AOI03-SS3 (0 to 2 feet bgs). **Table 6-2** summarizes the detected compounds in soil. **Figure 6-3** and **Figure 6-4** present ranges of detections of PFOS and PFOA in soil.

6.5.2 AOI 3 Groundwater Analytical Results

PFOA, PFOS, and PFBS were detected in six of nine groundwater samples collected in AOI 3. All PFOA, PFOS, and PFBS results were below SLs. PFOA concentrations ranged from non-detect to 1.71 J ng/L (MW-10). PFOS concentrations ranged from non-detect to 2.32 J ng/L (AOI03-MW02). PFBS concentrations ranged from non-detect to 59.2 ng/L (AOI3-MW1). The detected compounds are summarized in **Table 6-5**. **Figure 6-5** and **Figure 6-6** present the range of detections for PFOS and PFOA at the facility.

6.5.3 AOI 3 Conclusions

Based on the results of SI, PFOA, PFOS, and PFBS were detected in soil at AOI 3; however, the detected concentrations were below soil SLs. PFOA, PFOS, and PFBS were detected in groundwater at AOI 3, but were below groundwater SLs. Therefore, further evaluation at AOI 3 is not warranted.

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Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI01																			
Sample ID		AOI1-HA1-0-2		AOI1-HA2-0-2		AOI1-SB1-0-2		AOI1-SB2-0-2		A0I1-SB3-0-2		AOI01-04-SB-00-02		AOI01-05-SB-00-02		AOI01-06-SB-00-02		AOI1-SS1-0-2		AOI1-SS1-0-2R	
Sample Date		02/12/2019		02/12/2019		02/13/2019		02/15/2019		02/20/2019		10/07/2020		10/06/2020		10/06/2020		02/14/2019		05/20/2019	
Depth		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																					
6:2 FTS	-	0.043	J	0.043	X	ND		ND		ND		ND		ND		ND		ND		ND	
8:2 FTS	-	ND		ND	UX	ND		ND		0.015	J	ND		ND		ND		ND		ND	
NEtFOSAA	-	ND		ND	UX	ND		ND		0.011	J	ND		ND		ND		ND		ND	
NMeFOSAA	-	ND		ND	UX	ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	ND		ND	UX	ND		0.305	J	ND		ND		ND		1.42		ND		0.051	J
PFBS	130000	ND		ND	UX	ND		0.104	J	0.012	J	ND		ND		ND		ND		ND	
PFDA	-	ND		ND	UX	ND		ND		ND		ND		ND		ND		ND		0.021	J
PFDoA	-	ND		ND	UX	ND		ND		ND		ND		ND		ND		ND		0.00951	J
PFHpA	-	0.015	J	ND	UX	ND		0.163	J	0.043	J	ND		ND		ND		ND		0.018	J
PFHxA	-	0.197	J	0.068	X	0.03	J	0.618	J	ND		ND		ND		ND		ND		ND	
PFHxS	-	ND		ND	UX	ND		7.97		0.103	J	ND		ND		ND		ND		0.011	J
PFNA	-	ND		ND	UX	ND		ND		0.032	J	ND		ND		ND		ND		0.066	J
PFOA	130	ND		ND	UX	ND		ND		0.122	J	ND		ND		ND		ND		0.069	J
PFOS	130	ND		ND	UX	ND		0.751	J	0.664	J	ND		ND		ND		0.082	J	0.386	J
PFPeA	-	0.102	J	ND	UX	ND		0.364	J	0.087	J	ND		ND		ND		ND		ND	
PFTeDA	-	ND		ND	UX	ND		ND		0.015	J	ND		ND		ND		ND		ND	
PFTrDA	-	ND		ND	UX	ND		ND		0.00995	J	ND		ND		ND		ND		ND	
PFUnDA	-	ND		ND	UX	ND		ND		0.013	J	ND		ND		ND		ND		0.011	J

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

Interpreted Qualifiers

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J+ = Estimated concentration, biased high

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

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Chemical Abbreviations

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

Acronyms and Abbreviations

AOI	Area of Interest
DL	detection limit
DUP	Duplicate
ft	feet
HA	Hand auger
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
SS	Surface Soil
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI01																			
Sample ID		AOI1-SS2-0-2		AOI1-SS3-0-2		AOI1-SS4-0-2		AOI1-SS5-0-2		A0I1-SS6-0-2		AOI01-SS7-00-02		AOI01-SS8-00-02		AOI01-SS9-00-02		AOI01-SS10-00-02		AOI01-SS11-00-02	
Sample Date		02/14/2019		02/14/2019		02/14/2019		02/14/2019		02/20/2019		10/07/2020		10/06/2020		10/06/2020		10/06/2020		10/07/2020	
Depth		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																					
6:2 FTS	-	ND		ND		ND	UJ	ND		ND		ND		ND		ND		ND		ND	
8:2 FTS	-	ND		ND		ND	UJ	ND		ND		ND		ND		ND		ND		ND	
NEtFOSAA	-	ND		ND		ND	UJ	0.014	J	ND		ND		ND		ND		ND		ND	
NMeFOSAA	-	ND		ND		ND	UJ	ND		ND		ND		ND		ND		ND		ND	
PFBA	-	ND		ND		0.029	J	ND		ND		ND		ND		ND		ND		0.205	J
PFBS	130000	ND		ND		ND	UJ	ND		0.010	J	ND		ND		ND		ND		1.08	
PFDA	-	ND		0.034	J	ND	UJ	ND		ND		ND		ND		ND		ND		ND	
PFDoA	-	ND		ND		ND	UJ	ND		0.016	J	ND		ND		ND		ND		ND	
PFHpA	-	ND		0.018	J	ND	UJ	0.023	J	0.026	J	ND		ND		ND		ND		ND	
PFHxA	-	ND		0.092	J	0.064	J	ND		ND		ND		ND		ND		ND		0.769	J
PFHxS	-	ND		0.252	J	ND	UJ	0.058	J	0.068	J	ND		ND		ND		ND		4.38	
PFNA	-	ND		0.01	J	ND	UJ	0.065	J	ND		ND		ND		ND		ND		ND	
PFOA	130	ND		0.064	J	ND	UJ	0.106	J	0.089	J	ND		ND		ND		ND		0.166	J
PFOS	130	ND		0.249	J	ND	UJ	2.23		0.822	J	0.630	J	ND		ND		ND		39.9	
PFPeA	-	ND		0.0099	J	ND	UJ	0.039	J	0.043	J	ND		ND		ND		ND		0.180	J
PFTeDA	-	ND		ND		ND	UJ	ND		0.015	J	ND		ND		ND		ND		ND	
PFTrDA	-	ND		ND		ND	UJ	ND		ND		ND		ND		ND		ND		ND	
PFUnDA	-	ND		ND		ND	UJ	ND		0.018	J	ND		ND		ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

Interpreted Qualifiers

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Chemical Abbreviations

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8:2 FTS	8:2 fluorotelomer sulfonate
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NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DL	detection limit
DUP	Duplicate
ft	feet
HA	Hand auger
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
SS	Surface Soil
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI01								AOI02											
Sample ID		AOI01-SS12-00-02		AOI01-SS13-00-02		AOI01-SS14-00-02		AOI01-SS15-00-02		AOI2-HA1-0-2		AOI2-HA2-0-2		AOI2-HA3-0-2		AOI2-HA4-0-2		AOI2-HA5-0-2		AOI2-HA6-0-2	
Sample Date		10/07/2020		10/07/2020		10/07/2020		10/07/2020		02/13/2019		02/13/2019		02/13/2019		02/13/2019		02/13/2019		02/12/2019	
Depth		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																					
6:2 FTS	-	ND		ND		ND		ND		ND		0.059	J	0.044	J	ND		ND		ND	
8:2 FTS	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
NEtFOSAA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
NMeFOSAA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBS	130000	ND		ND		ND		ND		ND		ND		0.059	J	ND		0.057	J	0.07	J
PFDA	-	ND		ND		ND		ND		0.026	J	ND		ND		ND		0.035	J	ND	
PFDoA	-	ND		ND		ND		ND		ND		ND		ND		ND		0.013	J	ND	
PFHpA	-	ND		ND		ND		ND		0.018	J	ND		0.029	J	0.02	J	0.066	J	0.124	J
PFHxA	-	ND		ND		ND		ND		0.066	J	0.029	J	0.151	J	0.053	J	0.179	J	0.351	J
PFHxS	-	ND		ND		ND		ND		0.042	J	0.025	J	0.118	J	0.05	J	0.628	J	2.27	
PFNA	-	ND		ND		ND		ND		ND		ND		ND		0.013	J	ND		0.074	J
PFOA	130	ND		ND		ND		ND		ND		ND		ND		0.042	J	0.126	J	0.265	J
PFOS	130	ND		2.11		0.872	J	1.03		0.217	J	0.086	J	0.233	J	0.407	J	1.73		10.9	
PFPeA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		0.154	J
PFTeDA	-	ND		ND		ND		ND		ND		ND		ND		ND		0.016	J	ND	
PFTrDA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFUnDA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

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8:2 FTS	8:2 fluorotelomer sulfonate
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NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DL	detection limit
DUP	Duplicate
ft	feet
HA	Hand auger
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
SS	Surface Soil
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI02																			
Sample ID		AOI2-SB1-0-2		AOI2-SB2-0-2		AOI2-SB2-0-2-DUP		AOI02-03-SB-00-02		AOI02-03-SB-00-02-DUP		AOI2-SS1-0-2		AOI2-SS2-0-2		AOI2-SS2-0-2-DUP		AOI2-SS3-0-2		AOI2-SS4-0-2	
Sample Date		05/21/2019		05/23/2019		05/23/2019		10/06/2020		10/06/2020		05/20/2019		05/20/2019		05/20/2019		05/20/2019		05/20/2019	
Depth		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																					
6:2 FTS	-	0.022	J	0.027	J	ND		ND		ND		ND		0.023	J	ND		ND		ND	
8:2 FTS	-	ND		0.014	J	ND		ND		ND		0.033	J	ND		ND		ND		ND	
NEtFOSAA	-	ND		0.013	J	ND		ND		ND		ND		ND		ND		ND		ND	
NMeFOSAA	-	ND		ND		ND		ND		ND		ND		0.029	J	ND		ND		ND	
PFBA	-	0.212	J	ND		0.051	J	ND		ND		0.215	J	ND		ND		0.071	J	ND	
PFBS	130000	0.039	J	ND		ND		ND		ND		0.03	J	ND		ND		0.00705	J	ND	
PFDA	-	0.041	J	0.08	J	ND		ND		ND		ND		ND		0.024	J	0.012	J	0.03	J
PFDoA	-	ND		0.026	J	ND		ND		ND		0.00614	J	ND		ND		ND		ND	
PFHpA	-	0.145	J	0.018	J	0.055	J	ND		ND		0.085	J	0.012	J	0.00955	J	0.013	J	ND	
PFHxA	-	0.392	J	ND		0.096	J	ND		ND		ND		ND		ND		ND		ND	
PFHxS	-	0.684	J	0.131	J	0.289	J	ND		ND		0.193	J	0.025	J	0.038	J	0.032	J	0.069	J
PFNA	-	0.084	J	0.035	J	0.141	J	ND		ND		0.074	J	0.03	J	0.025	J	ND		0.048	J
PFOA	130	0.271	J	0.042	J	0.135	J	ND		ND		0.132	J	ND		0.055	J	ND		0.098	J
PFOS	130	4.14		4.31	J	22	J	0.602	J	0.807	J	2.22		0.893	J	0.758	J	0.181	J	1.09	J+
PFPeA	-	0.228	J	ND		ND		ND		ND		0.421	J	ND		ND		0.14	J	ND	
PFTeDA	-	ND		0.014	J	ND		ND		ND		ND		ND		ND		ND		ND	
PFTrDA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFUnDA	-	0.015	J	0.022	J	ND		ND		ND		ND		0.00894	J	ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

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PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
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Acronyms and Abbreviations

AOI	Area of Interest
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µg/Kg	micrograms per Kilogram
-	Not applicable

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PFAS Detections in Surface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI02								AOI03											
Sample ID		AOI2-SS5-0-2		AOI02-SS6-00-02		AOI02-SS7-00-02		AOI02-SS8-00-02		AOI3-HA1-0-2		AOI03-02-SB-00-02		AOI3-SB1-0-2		AOI03-SS1-00-02		AOI03-SS2-00-02		AOI03-SS3-00-02	
Sample Date		05/20/2019		10/06/2020		10/06/2020		10/06/2020		02/12/2019		10/06/2020		05/22/2019		10/07/2020		10/07/2020		10/7/2020	
Depth		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																					
6:2 FTS	-	ND		ND		ND		ND		0.021	J	ND		ND		ND		ND		ND	
8:2 FTS	-	ND		ND		ND		ND		ND		ND		0.103	J	ND		ND		ND	
NEtFOSAA	-	0.00995	J	ND		ND		ND		ND		ND		ND		ND		ND		ND	
NMeFOSAA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	ND		ND		ND		ND		ND		ND		0.181	J	ND		ND		ND	
PFBS	130000	ND		ND		ND		ND		0.178	J	ND		0.103	J	ND		ND		ND	
PFDA	-	ND		ND		ND		ND		ND		ND		0.024	J	ND		ND		ND	
PFDoA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFHpA	-	0.021	J	ND		ND		ND		0.04	J	ND		0.698	J	ND		ND		ND	
PFHxA	-	ND		0.165	J	0.282	J	ND		1.05	J	ND		0.792	J	ND		ND		ND	
PFHxS	-	0.062	J	0.213	J	0.259	J	0.274	J	0.345	J	ND		5.02		ND		ND		0.278	J
PFNA	-	0.048	J	ND		ND		ND		ND		ND		0.110	J	ND		ND		ND	
PFOA	130	0.08	J	ND		ND		ND		0.043	J	ND		0.473	J	ND		ND		ND	
PFOS	130	0.679	J	0.678	J	ND		0.617	J	0.308	J	ND		12.3		ND		0.438	J	2.91	
PFPeA	-	ND		ND		ND		ND		1.3		ND		0.248	J	ND		ND		ND	
PFTeDA	-	ND		ND		ND		ND		0.012	J	ND		ND		ND		ND		ND	
PFTrDA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFUnDA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

Interpreted Qualifiers

J = Estimated concentration

J+ = Estimated concentration, biased high

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

UX/X = The presence or absence of the analyte cannot be substantiated. Acceptance or rejection of the data should be decided by the project team, but exclusion of the data is recommended.

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
NEtFOSAA	N-ethyl perfluorooctane- sulfonamidoacetic acid
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DL	detection limit
DUP	Duplicate
ft	feet
HA	Hand auger
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
SS	Surface Soil
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI03					
Sample ID		AOI03-SS4-00-02		AOI03-SS4-00-02-DUP		AOI03-SS5-00-02	
Sample Date		10/07/2020		10/07/2020		10/07/2020	
Depth		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)							
6:2 FTS	-	ND		ND		ND	
8:2 FTS	-	ND		ND		ND	
NEtFOSAA	-	ND		ND		ND	
NMeFOSAA	-	ND		ND		ND	
PFBA	-	ND		ND		ND	
PFBS	130000	ND		ND		ND	
PFDA	-	ND		ND		ND	
PFDoA	-	ND		ND		ND	
PFHpA	-	ND		ND		ND	
PFHxA	-	ND		ND		ND	
PFHxS	-	ND		ND		ND	
PFNA	-	ND		ND		ND	
PFOA	130	ND		ND		ND	
PFOS	130	0.764	J	0.936	J	0.215	J
PFPeA	-	ND		ND		ND	
PFTeDA	-	ND		ND		ND	
PFTrDA	-	ND		ND		ND	
PFUnDA	-	ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

Interpreted Qualifiers

J = Estimated concentration

J+ = Estimated concentration, biased high

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

UX/X = The presence or absence of the analyte cannot be substantiated. Acceptance or rejection of the data should be decided by the project team, but exclusion of the data is recommended.

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
NEtFOSAA	N-ethyl perfluorooctane- sulfonamidoacetic acid
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DL	detection limit
DUP	Duplicate
ft	feet
HA	Hand auger
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
SS	Surface Soil
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-3
PFAS Detections in Shallow Subsurface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI01				AOI02															
Sample ID		AOI1-HA1-2-4		AOI1-HA2-2-4		AOI2-HA1-2-4		AOI2-HA2-2-4		AOI2-HA2-2-4-DUP		AOI2-HA3-2-4		AOI2-HA4-2-4		AOI2-HA5-2-4		AOI2-HA6-2-4		AOI2-HA6-2-4-DUP	
Sample Date		02/12/2019		02/12/2019		02/13/2019		02/13/2019		2/13/2019		02/13/2019		02/13/2019		02/13/2019		02/12/2019		02/12/2019	
Depth		2 - 4 ft		2 - 4 ft		2 - 4 ft		2 - 4 ft		2 - 4 ft		2 - 4 ft		2 - 4 ft		2 - 4 ft		2 - 4 ft		2 - 4 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																					
6:2 FTS	-	0.058	J	0.041	J	ND		0.041	J	ND		0.046	J	0.026	J	ND		0.019	J	ND	
NEtFOSAA	-	0.018	J	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	ND		ND		ND		ND		0.069	J	0.168	J	ND		ND		ND		ND	
PFBS	1600000	0.00547	J	ND		0.0085	J	ND		0.00808	J	0.027	J	ND		0.047	J	0.036	J	0.031	J
PFDA	-	ND		ND		ND		ND		ND		0.015	J	ND		ND		ND		0.021	J
PFDoA	-	0.013	J	ND		ND		ND		ND		ND		ND		0.018	J	ND		ND	
PFHpA	-	0.01	J	ND		ND		ND		0.011	J	0.022	J	0.054	J	ND		0.072	J	0.054	J
PFHxA	-	0.061	J	0.035	J	ND		0.057	J	ND		0.146	J	0.141	J	0.144	J	0.263	J	0.22	J
PFHxS	-	ND		ND		0.129	J	ND		0.011	J	ND		0.091	J	0.307	J	0.285	J	0.25	J
PFNA	-	ND		ND		ND		ND		ND		ND		0.037	J	0.043	J	0.019	J	ND	
PFOA	1600	ND		ND		ND		ND		ND		ND		0.083	J	ND		0.087	J	0.081	J
PFOS	1600	ND		ND		0.135	J	ND		0.032	J	0.12	J	0.326	J	1.92		0.572	J	0.489	J
PFPeA	-	ND		ND		ND		ND		ND		0.116	J	ND		ND		0.143	J	0.093	J
PFTeDA	-	ND		ND		ND		ND		ND		ND		0.022	J	0.013	J	ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

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

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
ft	feet
HA	Hand auger
HQ	Hazard quotient
ID	identification
LOD	Limit of Detection
LCMSMS	Liquid Chromatography Mass Spectrometry
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-3
PFAS Detections in Shallow Subsurface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI02								AOI03	
Sample ID		AOI2-SB1-9-11		AOI2-SB2-8-10		AOI02-03-SB-10-12		AOI02-03-SB-10-12-DUP		AOI3-HA1-2-4	
Sample Date		05/21/2019		05/23/2019		10/10/2020		10/10/2020		02/12/2019	
Depth		9 - 11 ft		8 - 10 ft		10 - 12 ft		10 - 12 ft		2 - 4 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ug/Kg)											
6:2 FTS	-	ND		0.019	J	ND		ND		ND	
NEtFOSAA	-	ND		ND		ND		ND		ND	
PFBA	-	ND		ND		ND		ND		ND	
PFBS	1600000	ND		ND		ND		ND		0.00739	J
PFDA	-	ND		ND		ND		ND		ND	
PFDoA	-	ND		ND		ND		ND		ND	
PFHpA	-	ND		ND		ND		ND		ND	
PFHxA	-	ND		ND		ND		ND		ND	
PFHxS	-	0.012	J	0.212	J	ND		ND		0.06	J
PFNA	-	ND		0.00501	J	ND		ND		ND	
PFOA	1600	ND		ND		ND		ND		0.034	J
PFOS	1600	0.046	J	0.161	J	ND		ND		0.244	J
PFPeA	-	ND		ND		ND		ND		ND	
PFTeDA	-	ND		ND		ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

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

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
ft	feet
HA	Hand auger
HQ	Hazard quotient
ID	identification
LOD	Limit of Detection
LCMSMS	Liquid Chromatography Mass Spectrometry
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram
-	Not applicable

Table 6-4
PFAS Detections in Deep Subsurface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest	AOI01																	
Sample ID	AOI1-SB1-20-22		AOI1-SB1-38-40		AOI1-SB2-15-17		AOI1-SB2-28-30		A0I1-SB3-18-20		A0I1-SB3-18-20-DUP		A0I1-SB3-38-40		AOI01-04-SB-15-17		AOI01-04-SB-30-32	
Sample Date	02/13/2019		02/13/2019		02/15/2019		02/15/2019		02/20/2019		02/20/2019		02/20/2019		10/09/2020		10/09/2020	
Depth	20 - 22 ft		38 - 40 ft		15 - 17 ft		28 - 30 ft		18 - 20 ft		18 - 20 ft		38 - 40 ft		15 - 17 ft		30 - 32 ft	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																		
6:2 FTS	0.051	J	ND		ND		ND		ND		ND		ND		ND		ND	
8:2 FTS	ND		ND		ND		ND		0.117	J	ND		ND		ND		ND	
NEtFOSAA	ND		ND		ND		ND		0.135	J	ND		0.025	J	ND		ND	
NMeFOSAA	ND		ND		ND		ND		0.136	J	ND		0.02	J	ND		ND	
PFBA	0.00848	J	ND		ND		ND		ND		ND		ND		ND		ND	
PFBS	0.00418	J	ND		0.142	J	ND		0.021	J	ND		ND		ND		ND	
PFDA	0.014	J	0.013	J	ND		ND		ND		ND		ND		ND		ND	
PFDoA	0.00994	J	ND		ND		ND		0.233	J	ND		0.013	J	ND		ND	
PFHpA	ND		ND		ND		ND		0.021	J	0.00431	J	0.011	J	ND		ND	
PFHxA	0.035	J	ND		0.226	J	0.059	J	ND		ND		ND		ND		ND	
PFHxS	ND		ND		0.916	J	ND		0.034	J	ND		0.033	J	ND		ND	
PFOA	ND		ND		0.055	J	ND		ND		ND		ND		ND		ND	
PFOS	0.039	J	0.014	J	0.478	J	ND		0.526	J	ND		0.135	J	ND		ND	
PFPeA	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFTeDA	ND		ND		ND		ND		0.13	J	0.012	J	0.015	J	ND		ND	
PFTrDA	ND		ND		ND		ND		0.238	J	0.00534	J	ND		ND		ND	
PFUnDA	0.00496	J	ND		ND		ND		0.14	J	ND		ND		ND		ND	

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
NEtFOSAA	N-ethyl perfluorooctane- sulfonamidoacetic acid
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
ft	feet
ID	identification
LCMSMS	Liquid Chromatography 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 6-4
PFAS Detections in Deep Subsurface Soil
Site Inspection Report, Fort William Henry Harrison

Area of Interest	AOI01								AOI02						AOI03			
Sample ID	AOI01-05-SB-15-17		AOI01-05-SB-30-32		AOI01-06-SB-15-17		AOI01-06-SB-30-32		AOI2-SB1-18-20		AOI2-SB2-18-20		AOI02-03-SB-25-27		AOI3-SB1-18-20		AOI3-SB1-40-42	
Sample Date	10/08/2020		10/08/2020		10/09/2020		10/09/2020		05/21/2019		05/23/2019		10/10/2020		05/22/2019		05/22/2019	
Depth	15 - 17 ft		30 - 32 ft		15 - 17 ft		30 - 32 ft		18 - 20 ft		18 - 20 ft		25 - 27 ft		18 - 20 ft		40 - 42 ft	
Analyte									Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																		
6:2 FTS	ND		ND		ND		ND		ND		0.014	J	ND		ND		ND	
8:2 FTS	ND		ND		ND		ND		ND		0.00707	J	ND		ND		ND	
NEtFOSAA	ND		ND		ND		ND		ND		ND		ND		ND		ND	
NMeFOSAA	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	ND		ND		ND		ND		ND		ND		ND		ND		0.059	J
PFBS	ND		ND		ND		ND		ND		0.00186	J	ND		ND		0.147	J
PFDA	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFDoA	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFHpA	ND		ND		ND		ND		ND		ND		ND		ND		0.022	J
PFHxA	ND		ND		ND		ND		ND		ND		ND		0.046	J	0.314	J
PFHxS	ND		ND		ND		ND		ND		0.029	J	ND		0.00812	J	0.128	J
PFOA	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFOS	ND		ND		ND		ND		0.00678	J	ND		0.237	J	0.056	J	0.021	J
PFPeA	ND		ND		ND		ND		ND		ND		ND		ND		0.129	J
PFTeDA	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFTrDA	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFUnDA	ND		ND		ND		ND		ND		ND		ND		ND		ND	

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
NEtFOSAA	N-ethyl perfluorooctane- sulfonamidoacetic acid
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
ft	feet
ID	identification
LCMSMS	Liquid Chromatography 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
PFAS Detections in Groundwater
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI01																			
Sample ID		AOI1-MW1		AOI1-MW1-GW		AOI1-MW2		AOI1-MW2-DUP		AOI1-MW2-GW		AOI1-MW3		AOI1-MW3-GW		AOI1-MW3-GW-DUP		AOI01-MW04-GW		AOI01-MW05-GW	
Sample Date		05/28/2019		10/11/2020		05/29/2019		05/29/2019		10/12/2020		05/25/2019		10/10/2020		10/10/2020		10/14/2020		10/12/2020	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)																					
6:2 FTS	-	ND		ND		ND		ND		ND		3.24	J	ND		ND		ND		ND	
PFBA	-	4.52	J	ND		8.34	J	9.18		17.2		30.2		25.9		27.1		2.90	J	18.4	
PFBS	40000	3.16	J	3.00	J	4.52	J	4.74	J	11.2		34.1		23.1		25.8		3.24	J	21.7	
PFDA	-	ND	UJ	ND		ND		ND		ND		ND	UJ	ND		ND		ND		ND	
PFHpA	-	1.83	J	ND		4.00	J	3.84	J	4.90	J	22.4		23.0		23.8		ND		11.5	
PFHxA	-	7.81		4.32	J	15.2		15.2		33.4		80.9		72.6		84.2		5.05	J	53.3	
PFHxS	-	22.3		21.0		33.9		34.3		18.0		213		184	J+	197	J+	12.2		77.0	
PFNA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFOA	40	1.17	J	2.10	J	4.58	J	4.43	J	2.75	J	12.4	J+	13.5		14.3		2.34	J	8.19	J
PFOS	40	8.82		5.53	J	29.2		27.3		25.4		24.8		62.2		61.6		5.26	J	34.4	
PFPeA	-	9.46		4.68	J	16.7		16.7		47.3		103		78.6		88.6		6.51	J	56.5	

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

J+ = Estimated concentration, biased high

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-5
PFAS Detections in Groundwater
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI01										AOI02									
Sample ID		AOI01-MW06-GW		BH-02		BH-02-101020		FH-02		FH-02-101120		AOI2-MW1		AOI2-MW1-GW		AOI2-MW1-GW-DUP		AOI2-MW2		AOI2-MW2-GW	
Sample Date		10/13/2020		05/28/2019		10/10/2020		05/28/2019		10/11/2020		05/29/2019		10/12/2020		10/12/2020		5/30/2019		10/13/2020	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)																					
6:2 FTS	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	11.6		6.30		4.02	J	7.59		6.42	J	36.2		41.6		43.2		3.74	J	ND	
PFBS	40000	14.7		1.66	J	ND		2.65	J	2.06	J	27.3		16.5		17.5		1.36	J	ND	
PFDA	-	ND		1.74	J	ND		ND		ND		ND		ND		ND		ND		ND	
PFHpA	-	15.7		2.69	J	ND		3.97	J	3.90	J	19.0		21.8		23.0		ND		ND	
PFHxA	-	25.2		10.2		7.25	J	13.8		11.6		102	J-	108		109		3.03	J	ND	
PFHxS	-	114		5.06		4.89	J	16.7		20.4		155	J-	154		153		27.6		1.86	J
PFNA	-	1.71	J	0.861	J	ND		ND		ND		1.86	J	ND		ND		ND		ND	
PFOA	40	9.16	J	4.68	J+	ND		7.31	J+	7.25	J	10.7	J+	12.6		14.6		3.07	J+	ND	
PFOS	40	34.2		6.88		2.61	J	9.25		8.74	J	118		89.4		110		9.14		4.67	J
PFPeA	-	21.6		10.2		7.30	J	16.5		13.1		121		151		153		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

J+ = Estimated concentration, biased high

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-5
PFAS Detections in Groundwater
Site Inspection Report, Fort William Henry Harrison

Area of Interest		AOI02												AOI03							
Sample ID		AOI02-MW03-GW		MW-06		MW-06-DUP		MW-07		MW-08		MW-08-101120		AOI3-MW1		AOI3-MW1-GW		AOI03-MW02-GW		MW-10	
Sample Date		10/14/2020		05/29/2019		05/29/2019		05/30/2019		05/29/2019		10/11/2020		05/29/2019		10/09/2020		10/13/2020		05/29/2019	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)																					
6:2 FTS	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	39.2		10.4		ND		ND		45.3		45.8		14.8		4.84	J	ND		3.38	J
PFBS	40000	17.2		ND		ND		ND		20.9		14.6		59.2		18.5		2.07	J	ND	
PFDA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFHpA	-	24.6		ND		ND		ND		20.6		25.3		1.60	J	ND		ND		2.47	J
PFHxA	-	87.2		ND		1.82	J	1.74	J	112		116		48.7		16.8		2.40	J	3.52	J
PFHxS	-	113		1.99	J	ND		2.17	J	69.9		88.3		5.66	J	3.91	J	5.86	J	2.66	J
PFNA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFOA	40	10.0		ND		ND		ND		10.8	J+	12.8		ND		ND		ND		1.71	J+
PFOS	40	6.29	J	1.83	J	ND		ND		8.74		8.50	J	1.63	J	2.28	J	2.32	J	ND	
PFPeA	-	152		ND		ND		ND		171		178		15.4		5.85	J	ND		4.65	J

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

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J- = Estimated concentration, biased low

J+ = Estimated concentration, biased high

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

Chemical Abbreviations

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PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

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

Table 6-5
PFAS Detections in Groundwater
Site Inspection Report, Fort William Henry Harrison

	Area of Interest										
	Sample ID	MW-11		MW-11-100920		OBTMW-01		PH-1		PH-2-DUP	
	Sample Date	05/30/2019		10/09/2020		05/30/2019		05/30/2019		05/30/2019	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)											
6:2 FTS	-	ND		ND		ND		ND		ND	
PFBA	-	5.03		2.23	J	5.32		ND		ND	
PFBS	40000	ND		ND		ND		ND		ND	
PFDA	-	ND		ND		ND		ND		ND	
PFHpA	-	ND		ND		ND		ND		ND	
PFHxA	-	5.11		2.71	J	1.36	J	ND		ND	
PFHxS	-	2.27	J	ND		0.955	J	ND		ND	
PFNA	-	ND		ND		ND		ND		ND	
PFOA	40	ND		ND		ND		ND		ND	
PFOS	40	ND		ND		1.10	J	ND		ND	
PFPeA	-	6.49		ND		ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Level

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

J+ = Estimated concentration, biased high

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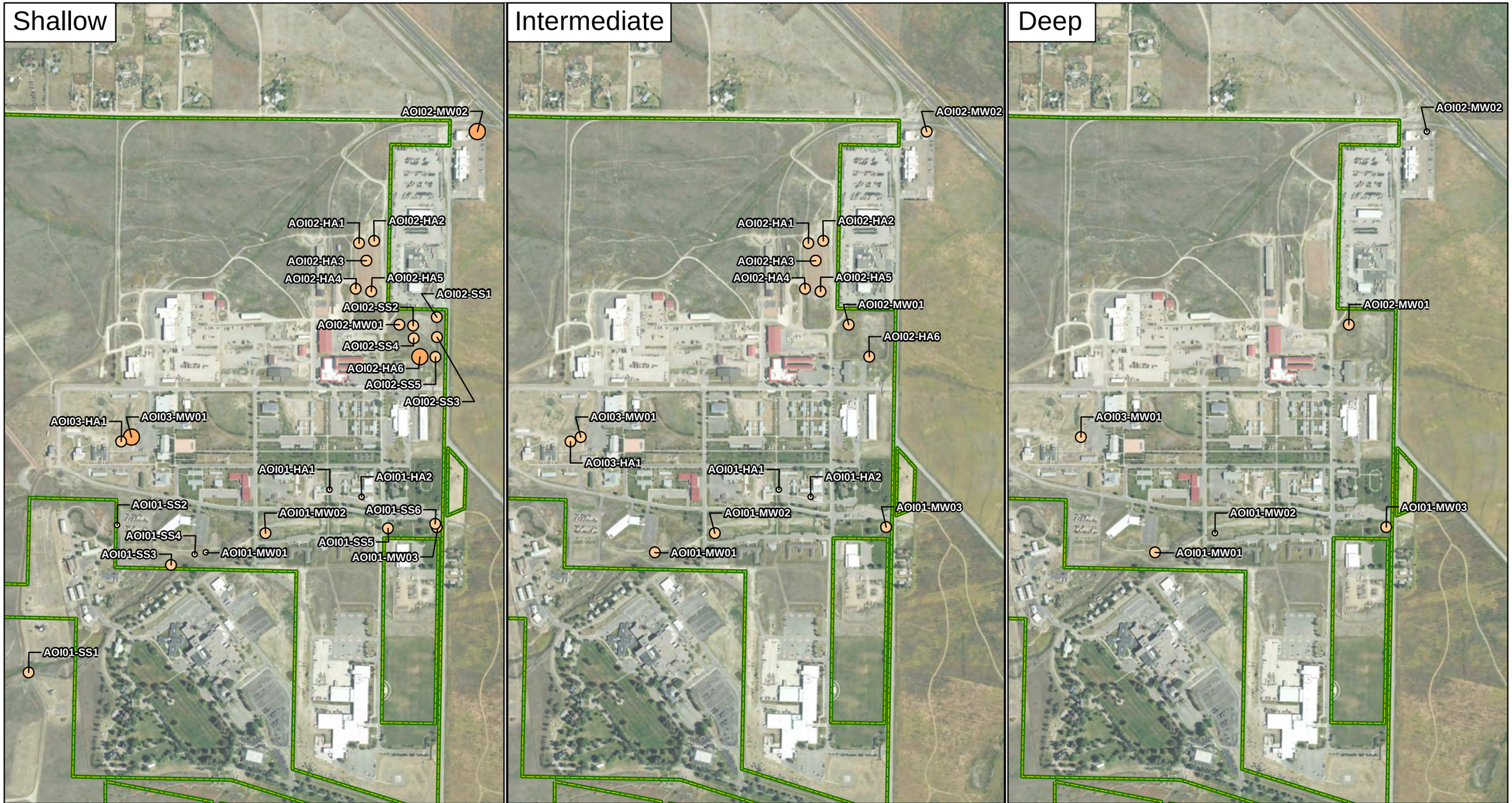
Chemical Abbreviations

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

Acronyms and Abbreviations

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



CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT			
REVISED	6/7/2021	GIS BY	MS	6/7/2021
SCALE	1:9,360	CHK BY	AB	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	6/7/2021

Facility Boundary

PFOS Results (µg/Kg)

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

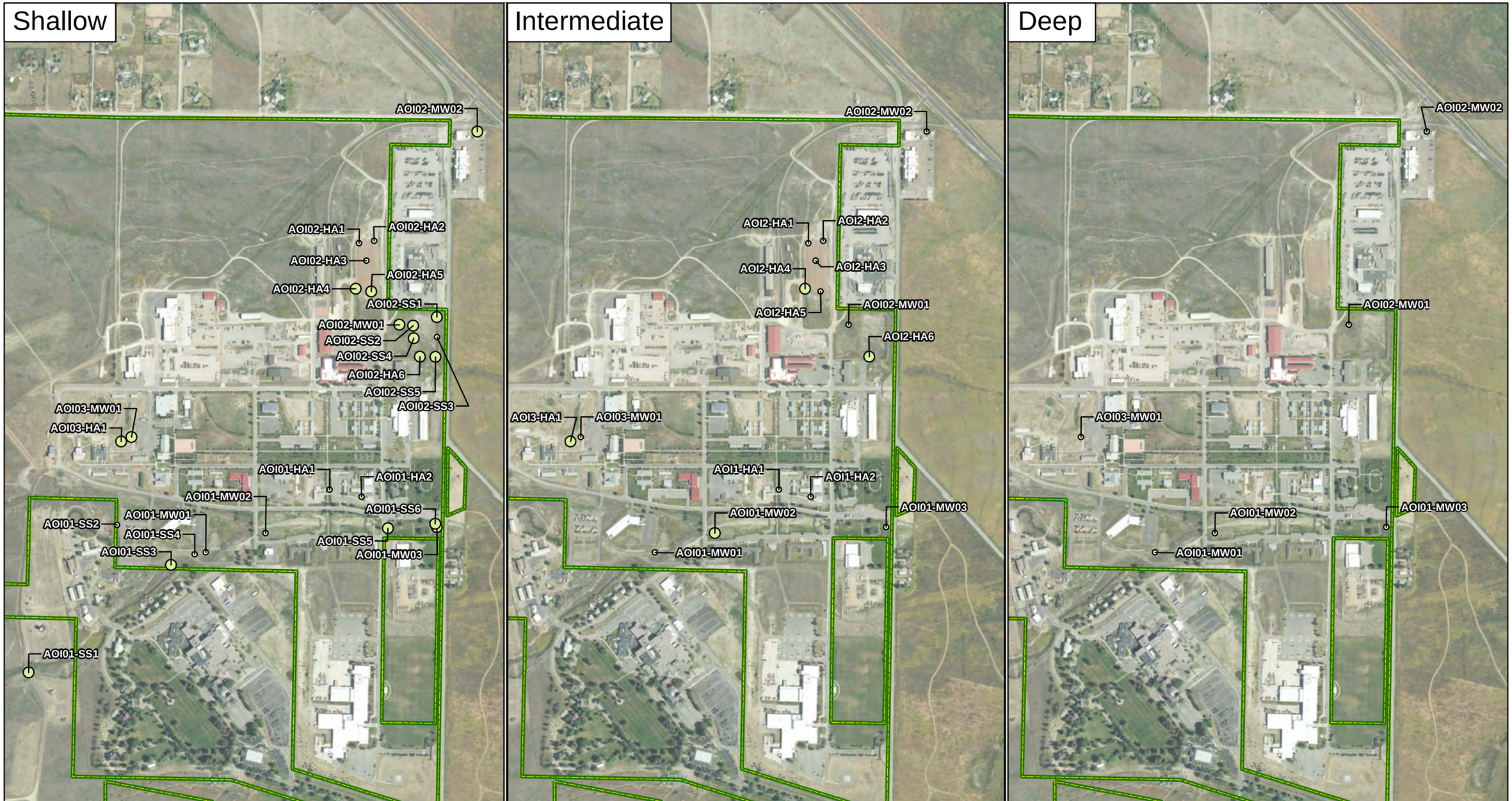
0 390 780 1,560 Feet

N

PFOS Detections in Soil During SI Mobilization 1 (AOI 1-3)

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1



CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT			
REVISED	6/7/2021	GIS BY	MS	6/7/2021
SCALE	1:9,360	CHK BY	JH	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	6/7/2021

Facility Boundary

PFOA Results (µg/Kg)

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

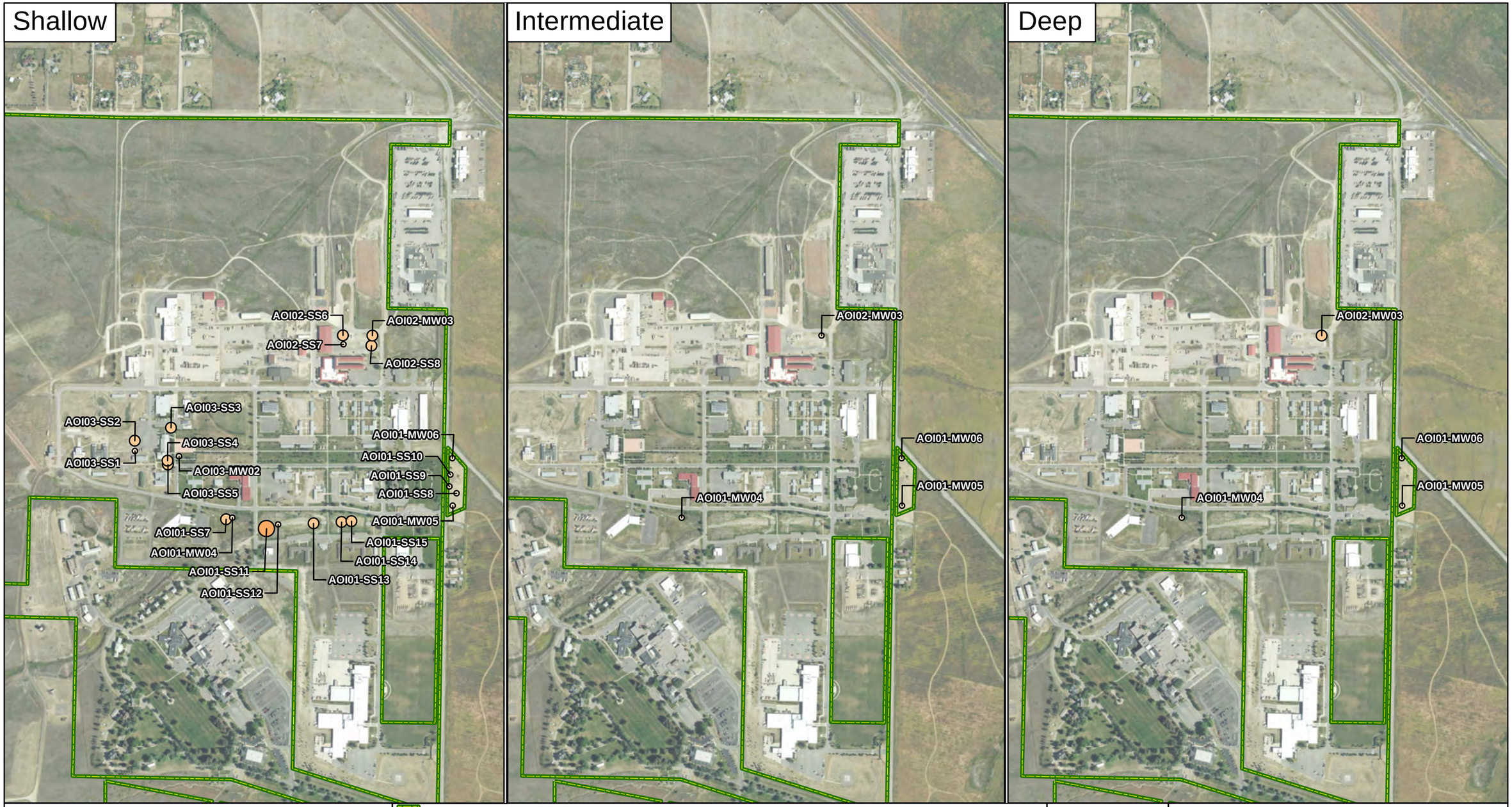
0 390 780 1,560 Feet

N

PFOA Detections in Soil During SI Mobilization 1 (AOI 1-3)

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-2



CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT			
REVISED	6/7/2021	GIS BY	MS	6/7/2021
SCALE	1:9,360	CHK BY	AB	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	6/7/2021

Facility Boundary

PFOS Results (µg/Kg)

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

0 390 780 1,560 Feet

N

PFOS Detections in Soil During SI Mobilization 2 (AOI 1-3)

AECOM
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Germantown, MD 20876

Figure 6-3

Shallow

AOI02-SS6
AOI02-MW03
AOI02-SS7
AOI02-SS8
AOI03-SS3
AOI03-SS2
AOI03-SS4
AOI03-SS1
AOI03-MW02
AOI01-MW06
AOI01-SS10
AOI03-SS5
AOI01-SS9
AOI01-SS8
AOI01-MW04
AOI01-SS7
AOI01-MW05
AOI01-SS11
AOI01-SS15
AOI01-SS12
AOI01-SS14
AOI01-SS13

Intermediate

AOI02-MW03
AOI01-MW06
AOI01-MW05
AOI01-MW04

Deep

AOI02-MW03
AOI01-MW06
AOI01-MW05
AOI01-MW04

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT			
REVISED	6/7/2021	GIS BY	MS	6/7/2021
SCALE	1:9,360	CHK BY	JH	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	6/7/2021

Facility Boundary

PFOA Results (µg/Kg)

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

0 390 780 1,560 Feet

N

PFOA Detections in Soil During SI Mobilization 2 (AOI 1-3)

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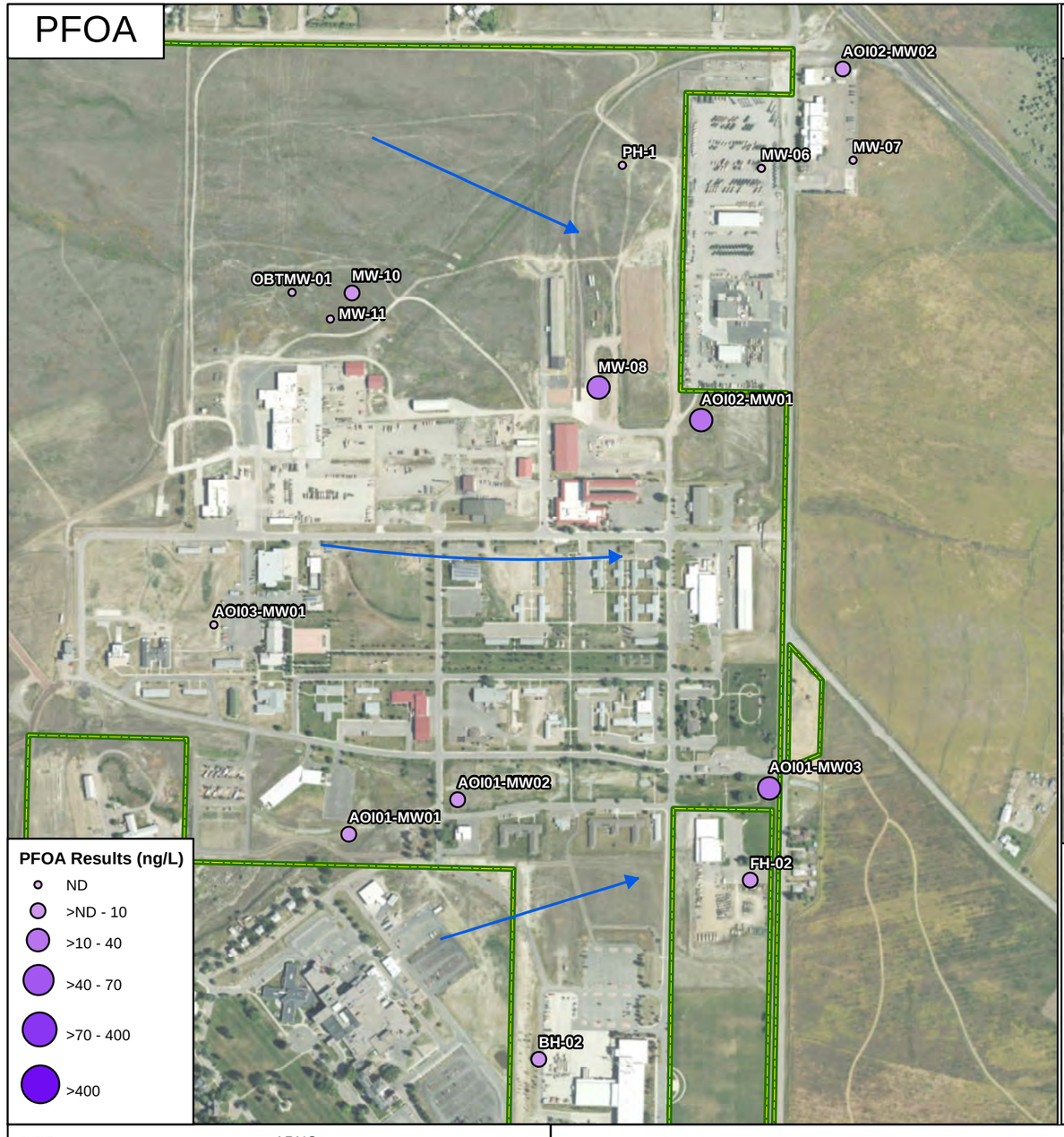
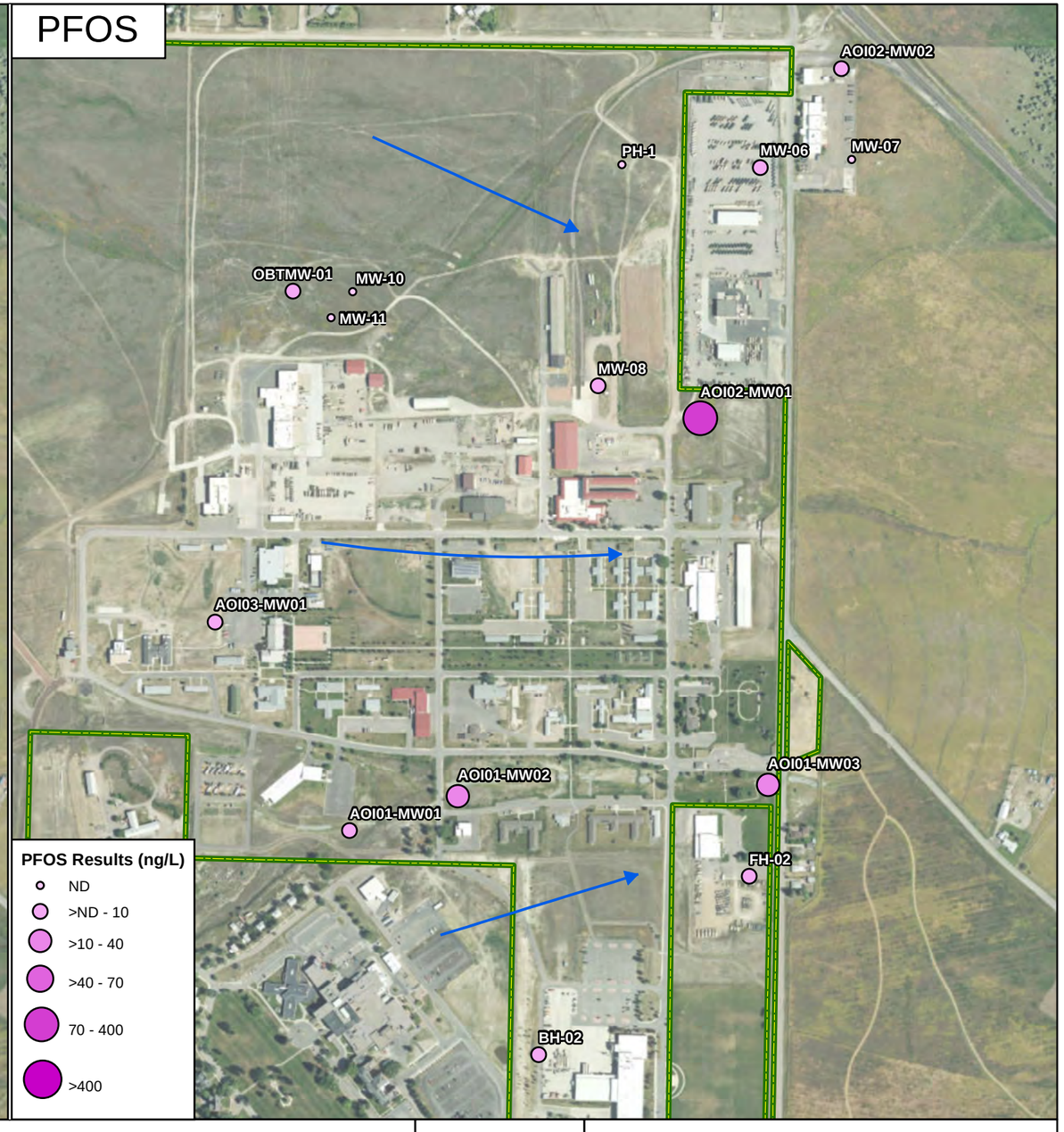
Germantown, MD 20876

Figure 6-4





CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT			
REVISED	6/7/2021	GIS BY	MS	6/7/2021
SCALE	1:7,200	CHK BY	JH	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	6/7/2021

Legend

Facility Boundary

Groundwater Flow Direction

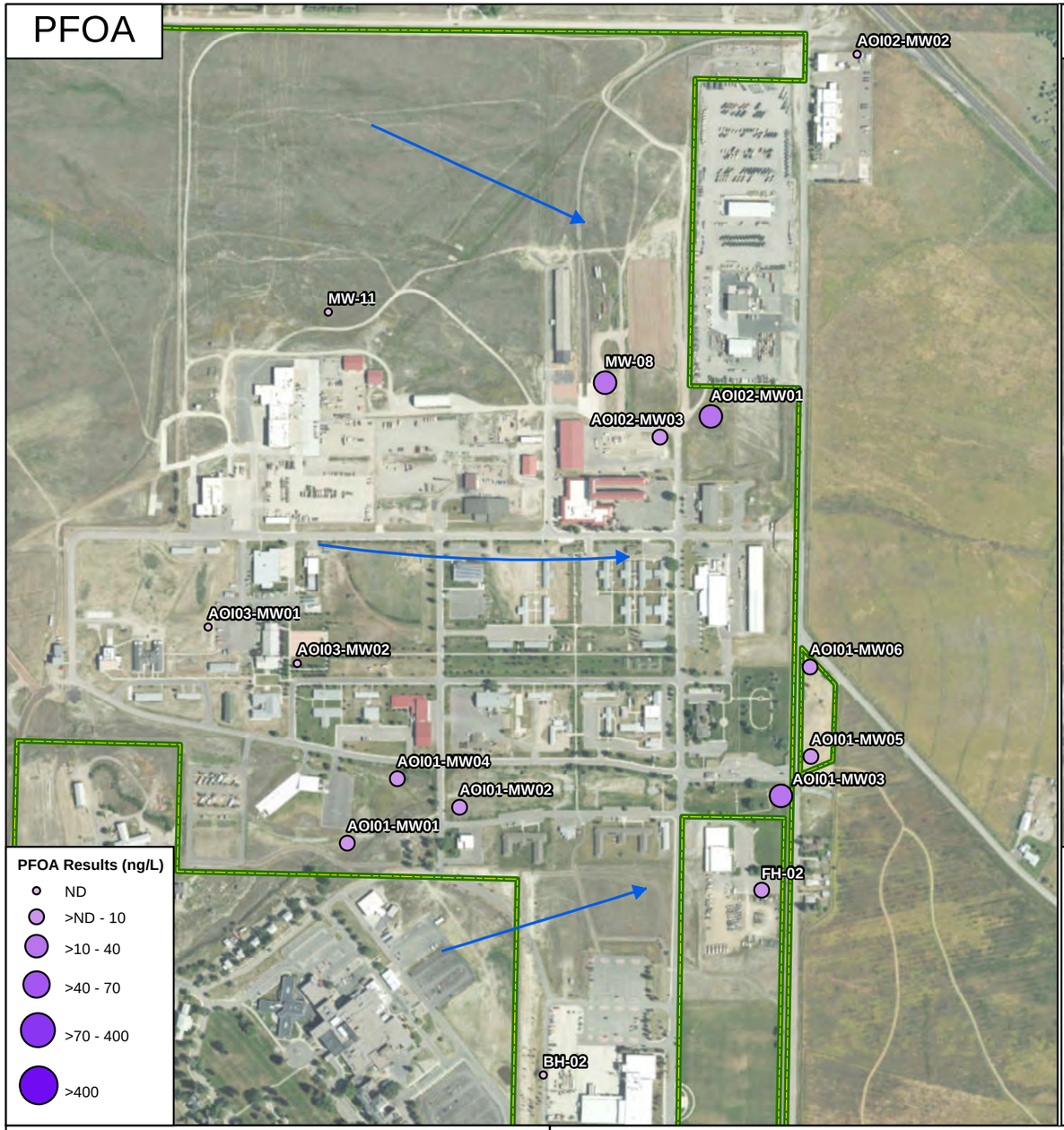
0 300 600 1,200 Feet

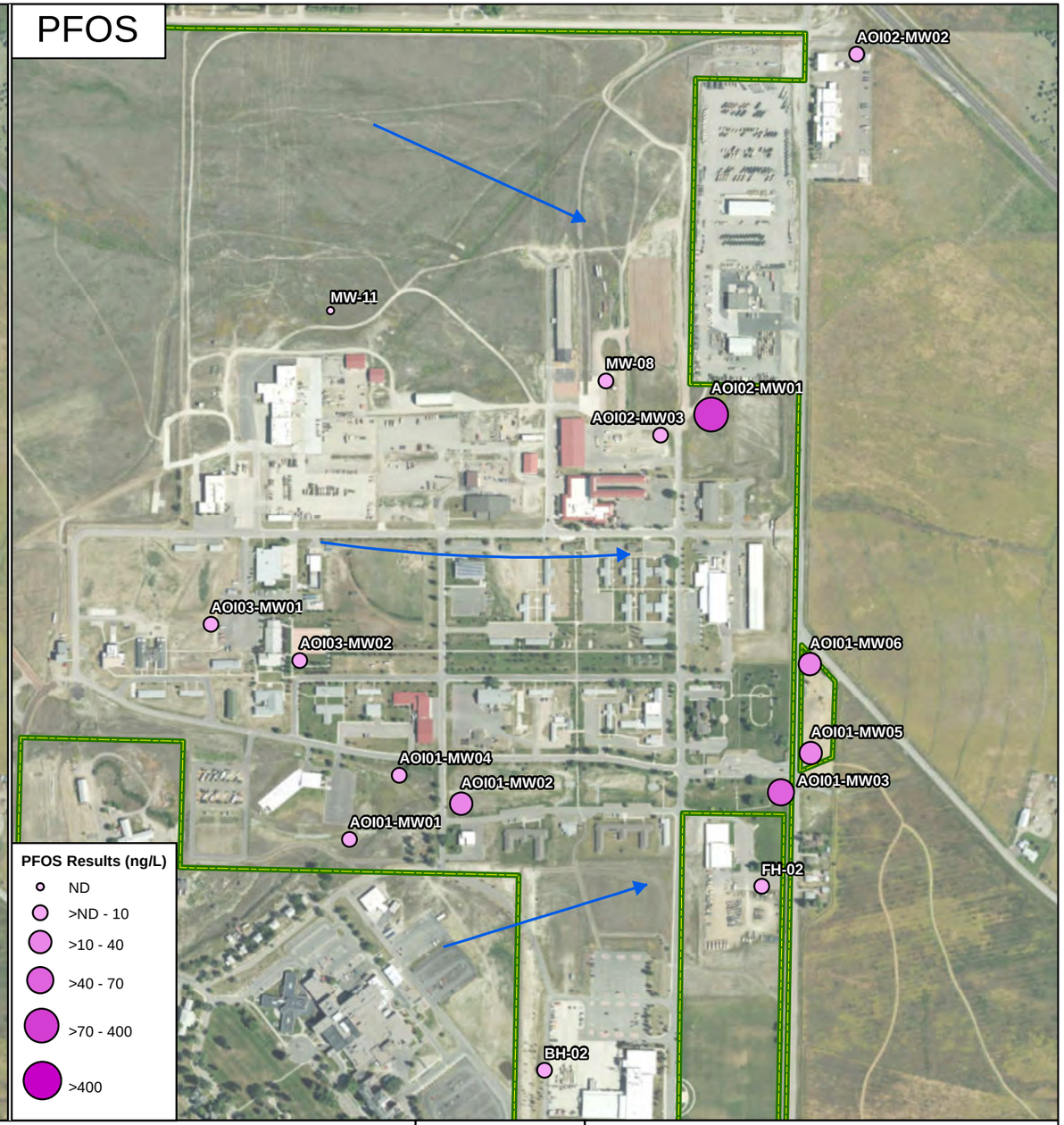
N

PFOA and PFOS Detections in Groundwater During SI Mobilization 1 (AOI 1-3) May 25-30, 2019

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-5





CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Fort William Henry Harrison, MT			
REVISED	6/7/2021	GIS BY	MS	6/7/2021
SCALE	1:6,992	CHK BY	JH	6/7/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	6/7/2021

Legend

- Facility Boundary
- Groundwater Flow Direction

0 300 600 1,200 Feet

N

PFOA and PFOS Detections in Groundwater During SI Mobilization 2 (AOI 1-3) October 9-14, 2020

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-6

7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-3**. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

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

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with an incomplete pathway generally warrant no further action; however, the pathway is considered potentially complete if PFOA, PFOS, or PFBS are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of PFOA, PFOS, or PFBS above the SLs. Areas with an identified potentially complete pathway may warrant further investigation. In general, the potential routes of exposure to PFAS are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of PFAS toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2001). Receptors 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 for PFOA, PFOS, and PFBS in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at each AOI based on the aforementioned criteria.

7.1.1 AOI 1

From approximately 1995 to 2003, AFFF was released by the MTARNG to soil in AOI 1 through firetruck washing and emptying near the 1049th Engineer Detachment Building (1010 Building) into the Mt. Defensa Avenue Drainage Ditch. In addition, the 1049th also trained with foam in the Navy Parking Lot north of AOI1-MW1 (1049th Firefighting Training Area 1) and in the channel area east of AOI1-MW2 before the channel was excavated (1049th Firefighting Training Area 3). Specific details regarding the frequency, volume, chemical composition, and concentration of any potential AFFF used at either FTA are not known. There is adjacent, offsite potential PFAS releases that have occurred upgradient of FTWHH near this ditch from VA fire department activities. PFOA, PFOS, and PFBS were detected in soil in this AOI 1; however, concentrations were below SLs. Based on the results of the SI in AOI 1, ground-disturbing activities could potentially result in site worker, construction worker, trespasser, resident, and recreational user exposure to PFOA, PFOS, and PFBS via inhalation of dust. Ground-disturbing activities could potentially result in site worker, construction worker, trespasser, and recreational user exposure

to PFOA, PFOS, and PFBS via ingestion of surface soil. Additionally, ground-disturbing activities to subsurface soil could potentially result in construction worker exposure. No current construction is occurring at AOI 1. Additionally, off-facility residents may potentially be exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities, although this exposure is likely insignificant. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

AFFF was released to soil at three potential PFAS release areas within the AOI 2. The Former Weasel Barn located in the northeast section of the Cantonment Area, north of Sanananda Drive, was demolished in the winter of 2002 as part of a fire training exercise. Due to flooding of the Mt. Defensa Avenue Drainage Ditch (in AOI 1) during rapid snowmelt and large rainfall events, the central portion of the ditch was widened in 2016 via excavation. Excavated soil was used to create a vehicle staging area in AOI 2, adjacent to the retention pond. AFFF was stored at the MTARNG 1049th Engineer Detachment buildings. Due to the corrosive nature of AFFF to the firetruck storage tanks, AFFF was added just prior to imminent use. The firetrucks were washed near Building M1. In addition, the 1049th trained with foam in the parking lot south of MW-08. Specific details regarding the frequency, volume, chemical composition, and concentration of any potential AFFF used at the FTA are not known. PFAS were detected in soil in this area; however, concentrations were below SLs. Based on the results of the SI in AOI 2, ground-disturbing activities could potentially result in site worker, construction worker, trespasser, resident, and recreational user exposure to PFOA, PFOS, and PFBS via inhalation of dust. Ground-disturbing activities could potentially result in site worker, construction worker, trespasser, and recreational user exposure to PFOA, PFOS, and PFBS via ingestion of surface soil. Additionally, ground-disturbing activities to subsurface soil could potentially result in construction worker exposure. No current construction is occurring at AOI 2. Additionally, off-facility residents may potentially be exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities, although this exposure is likely insignificant. The CSM for AOI 2 is presented on **Figure 7-2**.

7.1.3 AOI 3

A structure was burned in the northwest portion of the Cantonment Area near the current Dining Facility (Building 410). The structure was burned sometime between 1995 and 2002. No information was available on the concentration or amount of AFFF used during the event. In addition, the 1049th trained with foam near the former location of Building 410 (Planned Fire Structure). Specific details regarding the frequency, volume, chemical composition, and concentration of any potential AFFF used at the FTA are not known. During the SI, PFAS were detected in soil in this area; however, concentrations were below SLs. Based on the results of the SI in AOI 3, ground-disturbing activities could potentially result in site worker, construction worker, trespasser, resident, and recreational user exposure to PFOA, PFOS, and PFBS via inhalation of dust. Ground-disturbing activities could potentially result in site worker, construction worker, trespasser, and recreational user exposure to PFOA, PFOS, and PFBS via ingestion of surface soil. Additionally, ground-disturbing activities to subsurface soil could potentially result in construction worker exposure. No current construction is occurring at AOI 3. The CSM for AOI 3 is presented on **Figure 7-3**.

7.2 Groundwater Exposure Pathway

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

7.2.1 AOI 1

PFOA, PFOS, and PFBS were detected in groundwater from permanent monitoring wells at AOI 1 and exceeded the SL for PFOS at AOI1-MW3, which is located near the facility boundary. Private residential drinking water well sampling downgradient of AOI 1 was performed in 2019, and PFOA, PFOS, and PFBS were detected in groundwater, but were below SLs. Therefore, the ingestion exposure pathway for groundwater is considered potentially complete for offsite residents. The facility is on city water, which has been tested and confirmed to be PFAS-free (see **Section 2.2.2**); therefore, the ingestion pathway is incomplete for site workers. Further, due to the depth of groundwater, the ingestion pathway for construction workers, off-facility recreational users, and trespassers is also considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

PFOA, PFOS, and PFBS were detected in groundwater from permanent monitoring wells at AOI 2 and exceeded the SL for PFOS at AOI2-MW1, which is located near the facility boundary. Private residential drinking water well sampling downgradient of AOI 1 was performed in 2019, and PFOA, PFOS, and PFBS were detected in groundwater, but were below SLs. Therefore, the ingestion exposure pathway for groundwater is considered potentially complete for offsite residents. The facility is on city water, which has been tested and confirmed to be PFAS-free (see **Section 2.2.2**); therefore, the ingestion pathway is incomplete for site workers. Further, due to the depth of groundwater, the ingestion pathway for construction workers, off-facility recreational users, and trespassers is also considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.2.3 AOI 3

PFOA, PFOS, and/ or PFBS were detected in groundwater, but did not exceed SLs at AOI 3. PFOA, PFOS, and PFBS were detected in groundwater from permanent monitoring wells at AOI 3 at concentrations below the SLs. Therefore, the ingestion exposure pathway for groundwater is considered potentially complete for offsite residents. The facility is on city water, which has been tested and confirmed to be PFAS-free (see **Section 2.2.2**); therefore, the ingestion pathway is incomplete for site workers. Further, due to the depth of groundwater, the ingestion pathway for construction workers, off-facility recreational users, and trespassers is also considered incomplete. The CSM for AOI 3 is presented on **Figure 7-3**.

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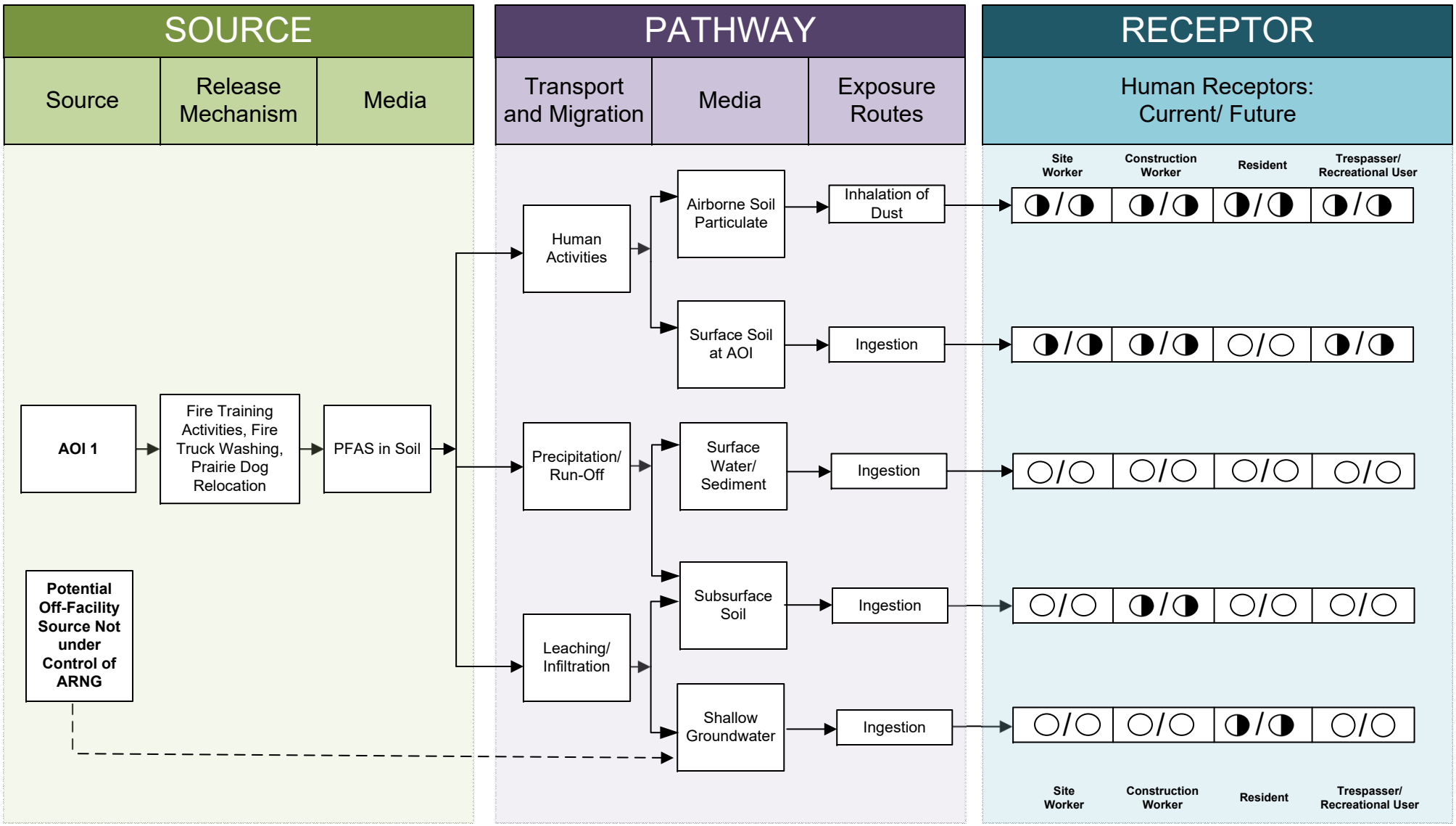

LEGEND

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

Notes:
1. The resident and recreational user receptors refer to an off-site resident and recreational user.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 7-1
Conceptual Site Model
AOI 1 Mt. Defensa Avenue Drainage Ditch

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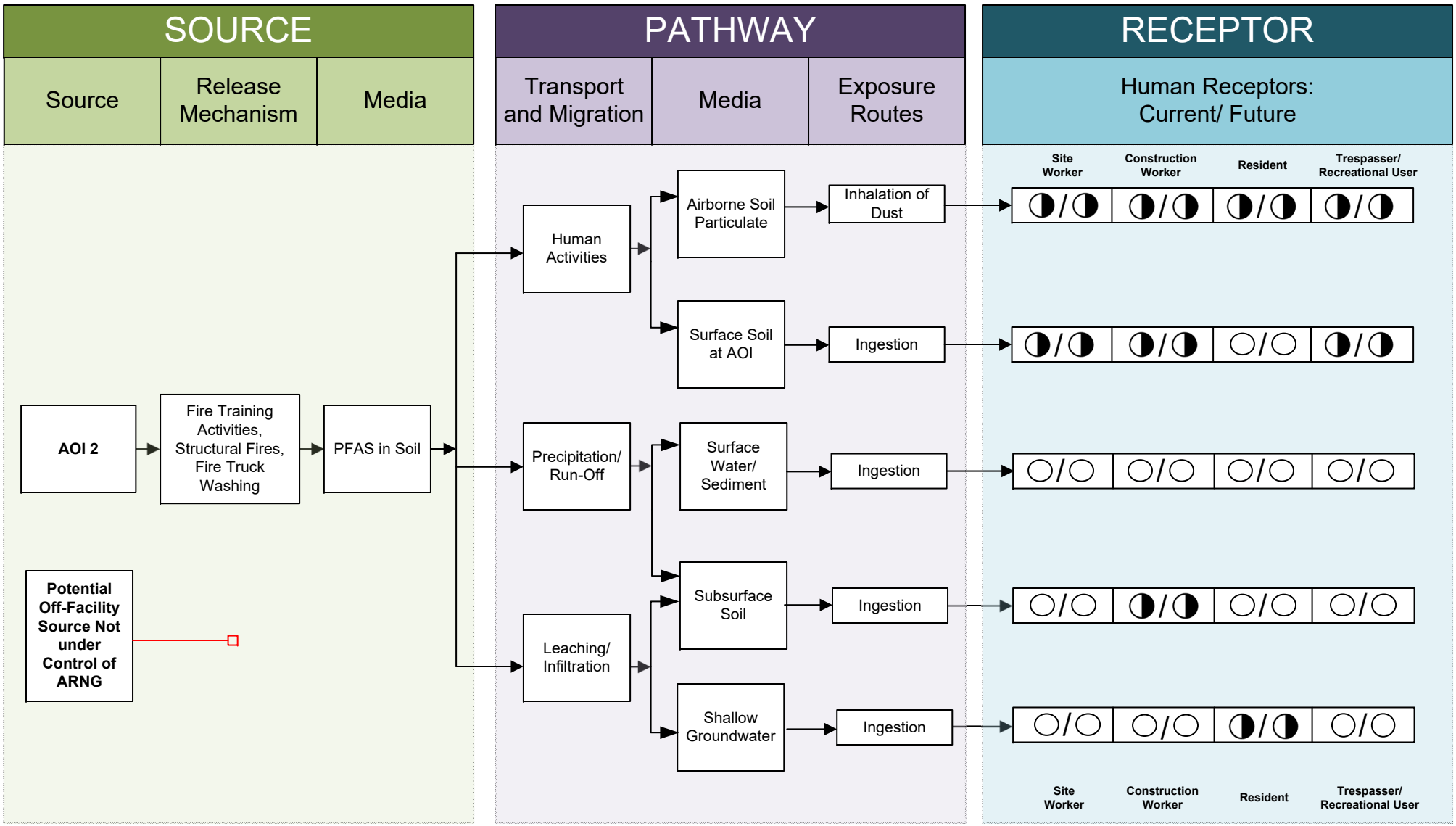

LEGEND

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

Notes:
1. The resident and recreational user receptors refer to an off-site resident and recreational user.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 7-2
Conceptual Site Model
AOI 2 Cantonment Area Northeast

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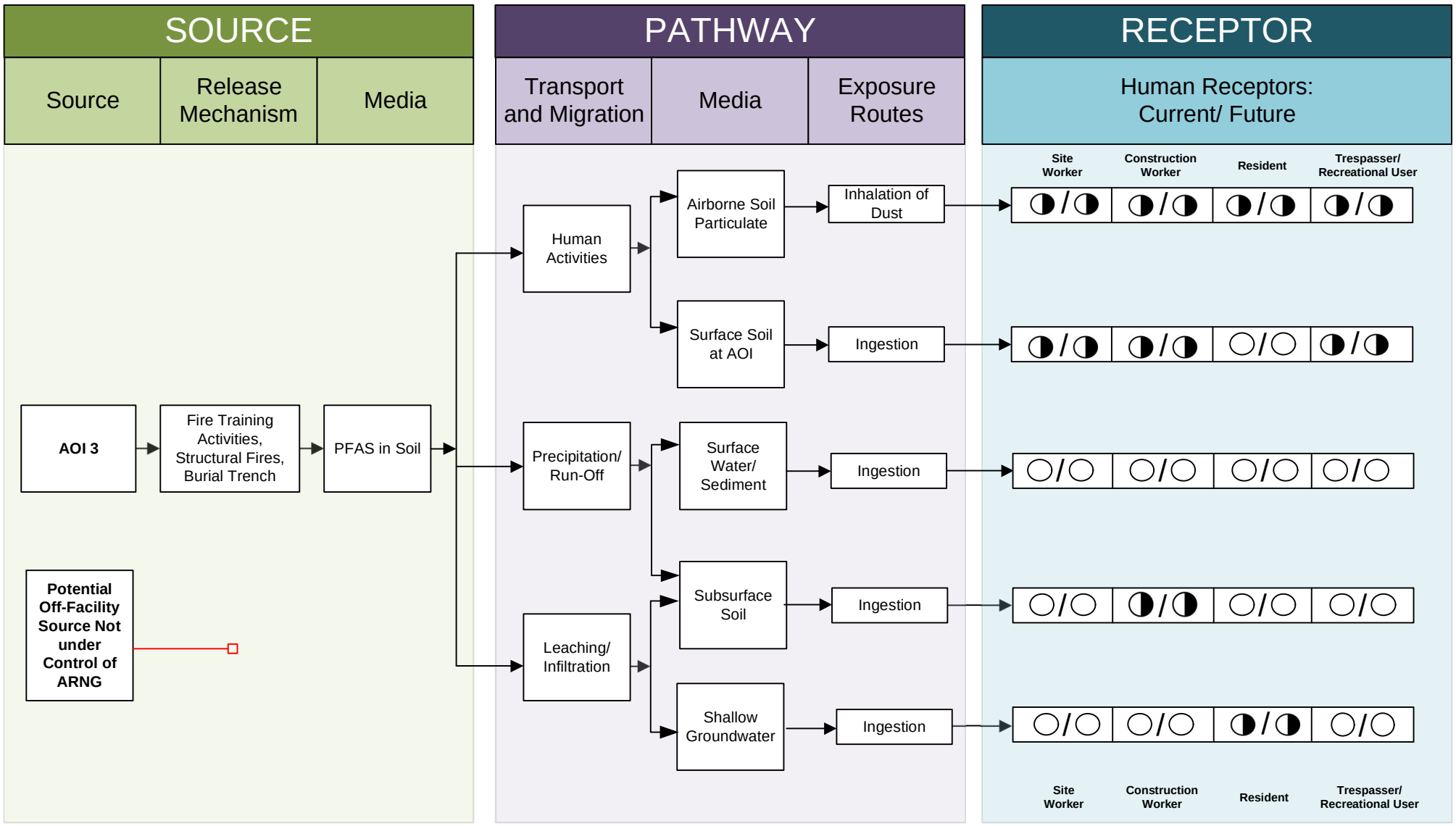

LEGEND

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

Notes:
1. The resident and recreational user receptors refer to an off-site resident and recreational user.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 7-3
Conceptual Site Model
AOI 3 Cantonment Area Northwest

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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 the report. The outcome provides general and comparative interpretations of the findings relative to the SLs.

8.1 SI Activities

SI field activities were conducted in two mobilizations. The first mobilization included permanent groundwater monitoring well installation, development, and sampling; surface and subsurface soil sampling; and groundwater sampling from existing wells from 10 to 20 February 2019 and from 19 to 31 May 2019. The second mobilization included permanent groundwater monitoring well installation, development, and sampling; surface and subsurface soil sampling; and groundwater sampling from existing wells from 5 to 15 October 2020. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2019).

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2019), samples were collected and analyzed for a subset of PFAS via LC/MS/MS compliant with DoD QSM 5.1 Table B-15 as follows. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.8** of this Report.

Mobilization 1 –

- 47 soil grab samples from 27 boring locations; and
- 15 groundwater samples, six from new monitoring well locations, eight from existing monitoring well locations, and one from an irrigation well location.

Mobilization 2 –

- 30 soil grab samples from 27 boring locations; and
- 15 groundwater samples, five from new monitoring well locations and ten from existing monitoring well locations.

This information gathered during this investigation was used to determine the PFOA, PFOS, and PFBS at or above SLs, as well as the presence or absence of an additional 15 PFAS at the facility. Additionally, the CSMs were refined to assess whether a complete pathway exists between the source and receptors for potential exposure to PFOA, PFOS, and PFBS at the AOIs, which are described in **Section 7**.

8.2 SI Goals Evaluation

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

1) *Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs, as well as the presence or absence of an additional 15 PFAS at the Site*

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

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

   Five potential PFAS release areas were removed from further consideration based on the data collected during this SI: Prairie Dog Relocation (AOI 1), 1049th Engineer Detachment Building M1 (AOI 2), Burial Trench (AOI 2), Planned Structure Fire (AOI 3), and 1049th Firefighting Training Area 2 (AOI 3). PFOA, PFOS, and PFBS results were below the SLs in soil and groundwater; therefore, these areas pose no significant threat to human health or the environment.

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

   As described in **Section 2.4**, in 2019, offsite residential drinking water samples were collected due to the exceedance of SLs observed in groundwater during the FTWHH SI. Five properties were selected to be sampled due to their proximity to FTWHH. PFOA, PFOS, and/or PFBS were detected in all five of the drinking water samples collected but were below SLs. Additionally, groundwater samples collected adjacent to the main gate at the MacDonald Property during Mobilization 2 were also below SLs. A removal action is not needed at this time because the drinking water sample results were below the SLs.

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

   The geological data collected as part of the SI is consistent with the descriptions of the Quaternary aged alluvium for the area. The alluvium is described as a gray to brown, moderately sorted, pebble to cobble gravel with fine- to coarse-grained sand matrix. Boring logs from AOI 1, AOI 2, and AOI 3 are presented in **Appendix E**. Well borings in AOI 1 along the southern facility boundary are aligned from west to east and likely parallel the depositional direction. Most of the samples were similar in that they contained varying percentages of gravel ranging from 5 to 50% in a sand matrix. The sand matrix size and size range also varied from fine to coarse.

   Typically, the gravels observed from ground surface to 5 feet bgs ranged from 0.5 inches to 1 inch in diameter and from 5 to 20 feet bgs the diameter increased to from 0.5 to 4 inches. Between 20 and 30 feet bgs the gravel ranged from 3.5 to >5 inches in diameter and generally the shape of the gravels became more rounded towards the east. At a depth of 50 feet bgs, a white silt/clay layer was encountered in the boring for AOI-MW1. The origin of this distinctive white layer is unknown, but it could possibly be the interface between the younger alluvium (weathered volcanic ash) and the older lakebed sediments. The same white layer was also observed in the boring for AOI3-MW1, and AOI03-MW02. The borings in AOI 2 were generally shallower than in the other two areas because the water table was encountered at a shallower depth at AOI 2. However, a similar pattern of better rounding of gravels in the eastern most boring for AOI 2 was observed.

   Depth to water at the facility ranges from approximately 14 to 43 feet bgs. The horizontal gradient in the northern portion of the facility between OBTMW-01 and AOI2-MW1 is 0.013 feet per feet. The horizontal gradient in the southern portion of the facility between AOI1-MW1 and AOI1-MW3 is 0.020 feet per feet.

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

   Based upon the evaluation of groundwater and soil results in comparison to SLs, in combination with the groundwater flow direction analysis, the source of PFAS contamination is likely attributable to ARNG activities.

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

PFOA, PFOS, and PFBS were detected in soil and groundwater at source areas and the facility boundary indicate a potentially complete pathway between source and receptor. However, as described in **Section 2.4**, offsite residential drinking water samples were collected due to the exceedance of SLs observed in groundwater during the FTWHH SI. Five properties were selected to be sampled due to their proximity to FTWHH. PFOA, PFOS, and PFBS were detected in all five of the drinking water samples collected but were below SLs. Additional offsite residential drinking water sampling is recommended due to the SL groundwater exceedance of PFOS at AOI 1 and AOI 2.

8.3 Outcome

The CSMs were revised based on the SI findings. There is potential for exposure to offsite residential drinking water receptors from historical firefighting training activities completed with AFFF at FTWHH. Offsite drinking water sampling was performed at several residences downgradient of AOI 1 and east of the FTWHH property boundary. PFOA, PFOS, and/or PFBS were detected in the drinking water samples but the concentrations did not exceed SLs. Drinking water samples were not collected downgradient of AOI 2. Due to historical firefighting training activities completed with AFFF, there is a potential for exposure to offsite residential drinking water receptors east of the FTWHH property boundary.

Sample chemical analytical concentrations collected during the SI were compared against the project SLs for PFOA, PFOS, and PFBS in soil and groundwater, as described in **Table 6-1**. The following bullets summarize the SI results:

- PFOA, PFOS, and PFBS were detected in soil at AOI 1, AOI 2, and AOI 3; however, results did not exceed SLs.
- PFOA, PFOS, and PFBS were detected in groundwater at AOI 1, AOI 2, and AOI 3. PFOS exceeded SLs at AOI 1 and AOI 2; however, no other results exceeded SLs at AOI 3.

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

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

Table 8-1: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Mt. Defensa Avenue Drainage Ditch	◐	◐	●
1	1049th Engineer Detachment Building 1010	◐	◐	NA
1	Prairie Dog Relocation (three locations)	◐	NA	NA
1	1049th Firefighting Training Area 1	◐	◐	NA
1	1049th Firefighting Training Area 3	◐	NA	NA
1	MacDonald Property	◐	◐	NA
2	Former Weasel Barn	◐	◐	◐
2	Excavated Soil from Mt. Defensa Ave Drainage Ditch	◐	◐	●
2	1049th Engineer Detachment Building M1	◐	◐	◐
2	1049th Firefighting Training Area 4	◐	◐	NA
3	Planned Structure Fire	◐	◐	NA
3	Burial Trench	NA	◐	NA
3	1049th Firefighting Training Area 2	◐	◐	NA

Legend:

NA = Not applicable

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

Table 8-2: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Mt. Defensa Avenue Drainage Ditch, 1049th Engineer Detachment Building 1010, 1049th Firefighting Training Area 1, 1049th Firefighting Training Area 3	No exceedances of SL in groundwater at the source area; however, exceedances of SLs in groundwater at the facility boundary. No exceedances of SLs in soil.	Proceed to RI
1	Prairie Dog Relocation (Three Release Areas)	No exceedances of SLs in soil.	No further action
2	Former Weasel Barn, Excavated Soil from Mt. Defensa Ave Drainage Ditch, 1049th Firefighting Training Area 4	No exceedances of SL in groundwater at the source area; however, exceedances of SLs in groundwater at the facility boundary. No exceedances of SLs in soil.	Proceed to RI
2	1049th Engineer Detachment Building M1	No exceedances of SLs in groundwater or soil.	No further action
3	Planned Structure Fire, Burial Trench, and 1049th Firefighting Training Area 2	No exceedances of SLs in groundwater or soil.	No further action

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