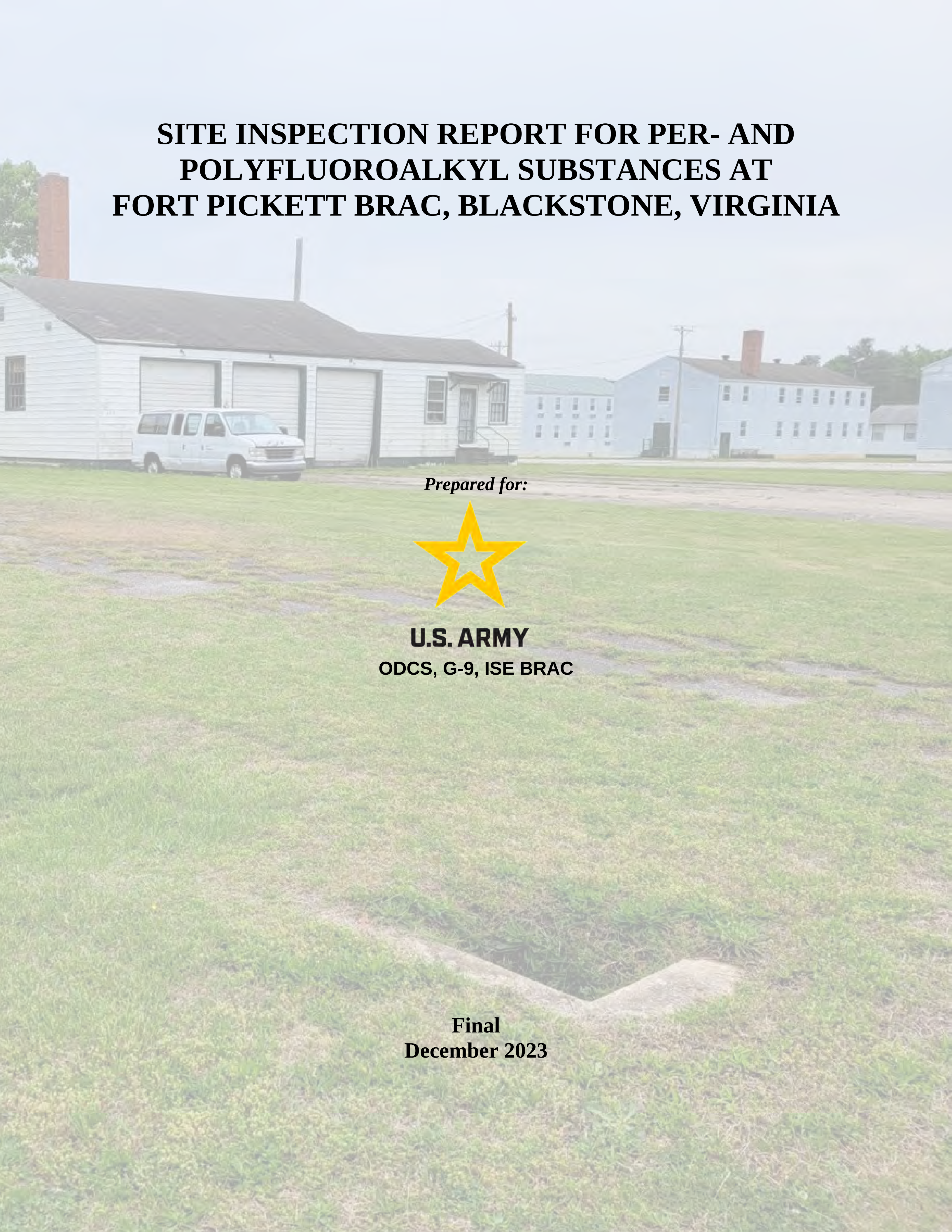

SITE INSPECTION REPORT FOR PER- AND POLYFLUOROALKYL SUBSTANCES AT FORT PICKETT BRAC, BLACKSTONE, VIRGINIA

Prepared for:

U.S. ARMY

ODCS, G-9, ISE BRAC

Final
December 2023

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LIST OF ACRONYMS AND ABBREVIATIONS

AFFF	Aqueous Film-Forming Foam
amsl	Above Mean Sea Level
AOPI	Area of Potential Interest
Army	U.S. Army
bgs	Below Ground Surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CoC	Chain-of-Custody
CSM	Conceptual Site Model
DERP	Defense Environmental Restoration Program
DO	Dissolved Oxygen
DoD	U.S. Department of Defense
DPT	Direct-Push Technology
DQO	Data Quality Objective
DUA	Data Usability Assessment
EDR	Environmental Data Resources
EIS	Extracted Internal Standard
FASTC	Foreign Affairs Security Training Center
FOST	Findings of Suitability to Transfer
GPS	Global Positioning System
HDPE	High-Density Polyethylene
HFPO-DA	Hexafluoropropylene Oxide Dimer Acid (GenX)
HQ	Hazard Quotient
ID	Identifier
IDW	Investigation-Derived Waste
IPaC	Information for Planning and Consultation
IRA	Interim Remedial Action
ISE	Installation Services Environmental
ITRC	Interstate Technology & Regulatory Council
LC/MS/MS	Liquid Chromatography with Tandem Mass Spectrometry
LCS	Laboratory Control Sample
LOD	Limit of Detection
LRA	Local Redevelopment Authority
LUC	Land Use Control
MDEQ	Michigan Department of Environmental Quality
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MTC	Maneuver and Training Center
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
ODCS	Office of the Deputy Chief of Staff
ORP	Oxidation-Reduction Potential
OSD	Office of the Secretary of Defense
P.E.	Professional Engineer
P.G.	Professional Geologist
PA	Preliminary Assessment
PFAS	Per- and Polyfluoroalkyl Substances
PFBA	Perfluorobutanoic Acid

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

PFBS	Perfluorobutane Sulfonate
PFHxA	Perfluorohexanoic Acid
PFHxS	Perfluorohexane Sulfonate
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PID	Photoionization Detector
PMP	Project Management Professional
ppb	Parts per Billion
PPE	Personal Protective Equipment
ppt	Parts per Trillion
QA	Quality Assurance
QC	Quality Control
QSM	Quality Systems Manual
REM	Registered Environmental Manager
RPD	Relative Percent Difference
RSL	Regional Screening Level
RV	Recreational Vehicle
SDG	Sample Delivery Group
SI	Site Inspection
SL	Screening Level
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
TCLP	Toxicity Characteristic Leaching Procedure
U.S.C.	United States Code
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VAARNG	Virginia Army National Guard
Virginia Tech	Virginia Polytechnic Institute and State University
VOC	Volatile Organic Compound
WWII	World War II
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The U.S. Army (Army) is conducting Preliminary Assessments (PAs) and Site Inspections (SIs) to determine the use, storage, disposal, or release of per- and polyfluoroalkyl substances (PFAS) at multiple Base Realignment and Closure (BRAC) installations, nationwide. This report documents SI activities conducted for three areas of potential interest (AOPIs) on BRAC property at the former Fort Pickett in Blackstone, Virginia (herein referred to Fort Pickett BRAC). AOPIs were identified during the PA phase for investigation through multimedia sampling in an SI phase to determine whether a PFAS release occurred. Activities were completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 United States Code [U.S.C.] §9601, et seq.); the Defense Environmental Restoration Program (DERP, 10 U.S.C. §2700, et seq.); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 Code of Federal Regulations [CFR] Part 300); Army and U.S. Department of Defense (DoD) policy and guidance; and U.S. Environmental Protection Agency (USEPA) guidance.

The PA identified areas where PFAS-containing materials were used, stored, and/or disposed of, or areas where known or suspected releases to the environment occurred. Based on recommendations from the PA, soil, groundwater, sediment, and/or surface water samples were collected from the three AOPIs. The field investigation at Fort Pickett BRAC was conducted in accordance with the Programmatic Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a). Samples collected during this SI were analyzed for PFAS using procedures compliant with the DoD Quality Systems Manual (QSM) Version 5.4, Table B-15 (DoD 2021) and the laboratory standard operating procedure (SOP).

To determine if future investigation was warranted at each AOPI, this SI followed established USEPA guidance and DoD policy and guidance for perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanoic acid (PFBA), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexanoic acid (PFHxA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) (also known as GenX) (DoD 2023). Samples collected during this SI were compared to risk screening levels (SLs) established as the residential scenario SLs calculated using the USEPA regional screening level (RSL) calculator for soil and the tap water criteria for groundwater and published in the 2023 Office of the Secretary of Defense (OSD) Memorandum (DoD 2023). Since PFAS are a large grouping consisting of thousands of individual chemicals, PFOA, PFOS, PFBA, PFBS, PFNA, PFHxA, PFHxS, and HFPO-DA altogether will be referred to in this report as “Target PFAS.”

Conceptual site models (CSMs) were developed during the PA and then updated for each AOPI where Target PFAS were detected at concentrations greater than the limit of detection (LOD). The updated CSMs detail site geological conditions; determine primary and secondary release mechanisms; identify potential human receptors; and detail complete, potentially complete, and incomplete exposure pathways for current and reasonably anticipated future exposure scenarios. PFAS were detected and concentrations exceeded SLs in at least one medium at all three AOPIs. PFAS concentrations exceeded SLs in groundwater at all three of the AOPIs, in soil at two AOPIs, in surface water at two AOPIs, and in sediment at two AOPIs. HFPO-DA was not detected at any AOPI. Figure ES-1 depicts the facility-wide map of AOPIs and PFAS groundwater and surface water results, including the distribution of SLs exceedances and proximity to facility boundaries.

Table ES-1 summarizes the AOPIs investigated during the SI and recommendations for further investigation.

Table ES-1. Summary of AOPIs and Recommendations for Further Investigation

AOPI	Exceedance of SLs		Recommendation
	Groundwater	Soil	
Former Fire Station and Extinguisher Building (Buildings 460 and 484)	Yes	Yes	Further investigation recommended
Material and Chemical Storage (Building 493 and Storage Yard)	Yes	No	Further investigation recommended
Blackstone Army Airfield Burn Pits (EBS-103)	Yes	Yes	Further investigation recommended

1. INTRODUCTION

The U.S. Army (Army) is conducting Preliminary Assessments (PAs, 40 Code of Federal Regulations [CFR] §300.420(b)) and Site Inspections (SIs, 40 CFR §300.420(c)) to investigate the presence or release of per- and polyfluoroalkyl substances (PFAS), by investigating the use, storage, or disposal of PFAS at multiple Base Realignment and Closure (BRAC) installations, nationwide. This SI is focused on the BRAC property at the former Fort Pickett in Blackstone, Virginia (herein referred to Fort Pickett BRAC) and was conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 United States Code [U.S.C.] §9601 et seq.); the Defense Environmental Restoration Program (DERP, 10 U.S.C. §2701 et seq.); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 CFR Part 300); Army and U.S. Department of Defense (DoD) policy and guidance; and U.S. Environmental Protection Agency (USEPA) guidance. The former Fort Pickett is not on the National Priorities List (NPL), and the Army is responsible for compliance with CERCLA in accordance with Executive Order 12580, as amended. During the time frame of this investigation, the name of the property changed to Fort Barfoot. For consistency purposes, this report will refer to the property as Fort Pickett BRAC.

Based on results of the Fort Pickett BRAC PFAS PA (Leidos 2023b), three areas of potential interest (AOPIs) were identified for investigation through multimedia sampling in an SI to determine whether a PFAS release occurred. Fort Pickett is located in Nottoway and Brunswick Counties, Blackstone, Virginia, as shown in Figure 1-1. The property is generally divided into two segments: 1) land retained by the Army under Virginia Army National Guard (VAARNG) command and control, and 2) conveyed or transferred property. The transferred property comprises the entirety of the Fort Pickett BRAC property and is referred to as the “site,” “facility,” or “installation” throughout this document. Any references to “offsite” refer to areas that are outside the boundary of Fort Pickett BRAC.

1.1 SCOPE AND OBJECTIVES

The overall objective of the SI is to determine the presence or absence of PFAS at each AOPI. This SI Report uses the findings from the PA in conjunction with soil, groundwater, surface water, and sediment sampling data to determine whether PFAS have been released to the environment and whether a release has affected or may affect specific human health targets. Furthermore, the SI evaluates and summarizes the need for additional investigation (40 CFR §300.420(c)(1)).

The SI scope included preparation of project planning documents, field investigation, validation and management of analytical data, comparison of analytical data to the Office of the Secretary of Defense (OSD) screening levels (SLs) published in the 2023 OSD Memorandum (DoD 2023), and documentation of the investigation results. This SI was conducted in accordance with the Programmatic Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a). The field activities followed site-specific sampling and health and safety protocols, as identified in the Programmatic Accident Prevention Plan (Leidos 2022b) and the Fort Pickett BRAC Site Safety and Health Plan (Appendix A of the Fort Pickett BRAC UFP-QAPP Addendum [Leidos 2023a]).

1.2 FORT PICKETT DESCRIPTION

Fort Pickett is a former combat training facility that encompassed approximately 45,000 acres at the time of closure (U.S. Army 2020). Located at 1729 Military Road, Blackstone, Virginia, Fort Pickett is approximately 40 miles southwest of downtown Richmond and immediately east of the town of Blackstone. The majority of Fort Pickett is in the eastern portion of Nottoway County, adjacent to Blackstone; however, southern reaches of the installation are in Brunswick County and eastern reaches are in Dinwiddie County (Matrix 2021). The BRAC property evaluated for this SI is entirely within Nottoway County.

The entire Fort Pickett was selected for BRAC in 1995 and began undergoing closure except for minimum essential training areas and facilities. The Fort Pickett BRAC property was evaluated in the PFAS PA (Leidos 2023b). For the purposes of this SI, the conveyed property in question will be referred to as the BRAC property. There are two non-contiguous areas of the BRAC property. Part of the former Fort Pickett is now operated by VAARNG and will be referred to as the VAARNG property.

As a result of BRAC closure, VAARNG assumed command and control of the installation on October 1, 1997. Between 1998 and 2005, 2,873 acres of BRAC property were transferred to Nottoway County and Virginia Polytechnic Institute and State University (Virginia Tech) Southern Piedmont Agricultural Research and Extension Center; subsequently, VAARNG retained approximately 42,000 acres (U.S. Army 2020). According to the Fort Pickett Local Redevelopment Authority (LRA) and Nottoway County database, since the initial property conveyance to Nottoway County and Virginia Tech Southern Piedmont Agricultural Research and Extension Center, numerous parcels have been transferred to other owners. Current property owners include, but are not limited to, Foreign Affairs Security Training Center (FASTC), LRA, town of Blackstone, Nottoway County, Commonwealth of Virginia, Virginia Tech Southern Piedmont Agricultural Research and Extension Center, and numerous small businesses and private owners (Nottoway GIS 2022).

Except for the town of Blackstone, Fort Pickett is surrounded by rural areas primarily composed of forested and agricultural lands. The land between Fort Pickett and downtown Blackstone is zoned primarily for agriculture, conservation, and rural/urban residential. Blackstone is predominantly residential with areas of light industry/manufacturing and public use open space (Matrix 2021).

During the PA records reviews, interviews, aerial photographic analysis, and site reconnaissance, Leidos reviewed available documentation and physical evidence for areas having a potential historical PFAS release. The sites evaluated include fire stations, fire training areas, salvage yards, wastewater treatment plants (WWTPs), metal plating facilities, motor pools, photographic laboratories, fuel stations, and auto centers. The Fort Pickett BRAC PFAS PA recommended three AOPIs for further investigation in an SI due to known or potential historical PFAS use, storage, and/or disposal. The AOPIs, as well as the dates of operation and sizes of each area, are presented in Table 1-1 and illustrated in Figure 1-2.

Table 1-1. List of AOPIs at Fort Pickett BRAC

AOPI Name	Dates of Operation	Size (acres)	Rationale
Former Fire Station and Extinguisher Building (Buildings 460 and 484)	1942 to 1987	0.40	Fire station and storage area with reported AFFF storage
Material and Chemical Storage (Building 493 and Storage Yard)	1945 to circa 1987	0.60	Storage facility with reported AFFF storage
Blackstone Army Airfield Burn Pits (EBS-103)	Unknown to 1989	1.62	Fire training activities with reported use of AFFF

1.3 REPORT ORGANIZATION

The contents of the remaining sections of this SI Report are summarized below:

- ***Section 2. Environmental Setting***—This section discusses the environmental setting at Fort Pickett. Demographics, land use, geology, hydrogeology, hydrology, soil, and climate are described.
- ***Section 3. Field Investigation Activities***—This section provides field procedures followed during the implementation of the SI.

- ***Section 4. Data Analysis and Quality Assurance Summary***—This section describes the laboratory chemical analysis program for the investigation. Sample handling procedures, laboratory equipment calibration, laboratory analytical methods, data reporting and validation, and sample data quality assurance (QA)/quality control (QC) are discussed.
- ***Section 5. Site Inspection Screening Levels***—This section presents the Target PFAS with SLs outlined in the 2023 OSD Memorandum (DoD 2023) and the SLs to which SI results are compared.
- ***Section 6. Site Inspection Results***—This section presents the data gathered during the SI activities and updated conceptual site models (CSMs).
- ***Section 7. Conclusions and Recommendations***—This section summarizes the SI conclusions and presents recommendations for the Fort Pickett BRAC AOPIs.
- ***Section 8. References—***This section lists the references that were used in the preparation of this report.
- ***Appendices***—Appendices A through H include data from field activities or related assessments:
  - Appendix A. Daily Field Summary Notes
  - Appendix B. Photograph Log
  - Appendix C. Field Activity Logs
  - Appendix D. Boring Logs
  - Appendix E. Sampling Forms and Calibration Logs
  - Appendix F. Investigation-Derived Waste (IDW) Documents
  - Appendix G. Data Usability Assessment (DUA)
  - Appendix H. Data Presentation Tables.

2. ENVIRONMENTAL SETTING

This section provides general information about Fort Pickett, including the site location, operational history, current and projected land use, climate, topography, geology, hydrogeology, surface water hydrology, potable wells within a 4-mile radius of the installation, and applicable ecological receptors.

2.1 SITE LOCATION

Fort Pickett is a former combat training facility that encompassed approximately 45,000 acres at the time of closure (U.S. Army 2020). Located at 1729 Military Road, Blackstone, Virginia, Fort Pickett is approximately 40 miles southwest of downtown Richmond and immediately east of the town of Blackstone. The majority of Fort Pickett is in the eastern portion of Nottoway County, adjacent to Blackstone; however, southern reaches of the installation are in Brunswick County and eastern reaches are in Dinwiddie County (Matrix 2021). The BRAC property evaluated for this SI is located entirely within Nottoway County. Figure 2-1 depicts the Fort Pickett BRAC site features.

2.2 SITE OPERATIONAL HISTORY

Prior to inception, Fort Pickett was primarily agricultural lands (USACE 1997). Fort Pickett was purchased by the U.S. Government in 1941 and activated as the Blackstone Military Area (Woodward Clyde 1997). In late 1941, it was dedicated as Camp Pickett as a 46,000-acre Army installation and has primarily been used for military training operations since its inception. Air transportation to and from Camp Pickett became possible in late 1942 upon completion of the Blackstone Army Airfield (U.S. Army 2020).

During World War II (WWII), the camp housed a peak number of troops (85,000 circa 1943) and had 1,600 buildings in the cantonment area. Camp Pickett had four 5,000-foot-long airplane runways, 37 miles of paved roads, 125 miles of secondary roads, and 11 miles of railroad. Part of Camp Pickett was also designated as a prisoner-of-war camp (Woodward Clyde 1997).

After WWII, Camp Pickett's mission was redefined for essential training purposes (U.S. Army 2020). The Army discontinued combat training at the camp in the fall of 1944 and closed the facility at the end of WWII. The installation reopened for several short time periods prior to being fully reactivated in 1950 at the beginning of the Korean War as a medical replacement Army training center (Woodward Clyde 1997). By 1960, areas of Camp Pickett were remodeled to support visiting battalions for specialized training maneuvers, including but not limited to, U.S. Army National Guard and Reserve units, Navy, and Marine Corps personnel. Camp Pickett was redesignated as Fort Pickett in 1974 as a full-time training facility for active and Reserve Component forces (U.S. Army 2020).

In 1995, Fort Pickett was selected by the BRAC Commission and began undergoing closure except for minimum essential training areas and facilities. As a result, VAARNG assumed command and control of the installation on October 1, 1997. Between 1998 and 2005, 2,873 acres of BRAC property was transferred to Nottoway County and Virginia Tech Southern Piedmont Agricultural Research and Extension Center; subsequently, VAARNG retained approximately 42,000 acres (U.S. Army 2020).

2.3 DEMOGRAPHICS, PROPERTY TRANSFER, AND LAND USE

Fort Pickett is located directly east of Blackstone and is in Nottoway, Brunswick, and Dinwiddie Counties. Except for the eastern portion of Blackstone, Fort Pickett is surrounded by rural areas primarily composed of forested and agricultural lands. The land between Fort Pickett and downtown Blackstone is zoned primarily for agriculture, conservation, and rural/urban residential. Blackstone is predominantly residential and zoned for light, medium, and heavy residential land uses with smaller zoned areas for residential/suburban and residential/business (Matrix 2021). The BRAC property lies exclusively in

Nottoway County, and Blackstone is the only adjacent town. The population of Blackstone and Nottoway County at the time of the 2020 Census was 3,352 and 15,642, respectively (U.S. Census Bureau 2021).

The land that encompasses Fort Pickett is generally divided into two segments and includes the VAARNG property (approximately 42,000 acres) and the BRAC property (approximately 2,873 acres). Currently, the VAARNG property of Fort Pickett (redesignated Fort Barfoot on March 24, 2023) is used year-round as a maneuver and training center (MTC) and the land use is not expected to change (AECOM 2020). The VAARNG property includes approximately 678 acres of the Allen C. Perkinson Airport/Blackstone Army Airfield (herein referred to as the Airfield). In addition, the Navy leases approximately 158 acres from VAARNG for training purposes (Matrix 2021).

In 2015, approximately 1,400 acres within the installation boundary were leased to the U.S. State Department to construct the FASTC. Of the 1,400 acres, approximately 626 acres are leased from VAARNG and approximately 727 acres of BRAC property were purchased from Nottoway County (Matrix 2021).

Between October 15, 1998, and April 1, 2005, 2,873 acres of property were conveyed to Nottoway County and Virginia Tech Southern Piedmont Agricultural Research and Extension Center and now makes up the BRAC property (Matrix 2021, U.S. Army 2020). According to the Fort Pickett LRA and Nottoway County database, since the initial property conveyance to Nottoway County and Virginia Tech Southern Piedmont Agricultural Research and Extension Center, numerous parcels have been transferred to other owners (Nottoway GIS 2022).

The FASTC and Pickett Park business complex occupy most of the area within the BRAC property boundary. The State Department's FASTC facility trains personnel on anti-terrorism and security requirements and uses most of the southern BRAC property. Numerous small businesses use the northeastern BRAC portion for community support functions and educational and training purposes (Matrix 2021).

The town of Blackstone assumed ownership of the water and wastewater treatment facilities in 1996 and 2000, respectively (Matrix 2021); however, Blackstone assumed operational control of the WWTP in 1995 (Woodward Clyde 1997). Blackstone is responsible for operations and maintenance of the WWTP and provides services to Fort Pickett in addition to the town. The water and wastewater treatment facilities are part of the BRAC property. Furthermore, Blackstone owns approximately 33 acres of the Airfield (Matrix 2021).

Land use controls (LUCs) are in place at the Former Recycling Center and Former Fuel Station No. 1 within the BRAC property. LUCs at the Former Recycling Center were implemented as part of the final Remedial Assessment (Tetra Tech 2005) and follow the Finding of Suitability to Transfer (FOST) the Army provided (U.S. Army 2005a). These LUCs include groundwater, residential reuse, and excavation or soil disturbance restrictions and affect approximately 21 acres of the BRAC property. LUCs for the Former Fuel Station No. 1 are provided in the FOST (U.S. Army 2005b) and included in the deed (USACE 2005). The entire Former Fuel Station parcel (approximately 1.5 acres) is subject to groundwater use and ground disturbance restrictions (Tetra Tech 2005).

2.4 TOPOGRAPHY

Fort Pickett is located in the Piedmont upland section of the Piedmont physiographic province where topography typically consists of low, well-rounded hills and long, northeast trending valleys and ridges. The Piedmont province typically consists of gentle slopes where valley bottoms and sides, hillsides, and hilltops merge and are absent of a distinct break in slopes (USACE 1997).

The topography at Fort Pickett is characterized by low, gently rolling terrain with generally level uplands dissected by stream drainages. The northwestern portion of the facility exhibits dendritic drainage patterns and is considered level upland, while the southeastern region shows more relief with deeply dissected topography with steeper slopes and ravines (AECOM 2020). Elevation on Fort Pickett ranges from approximately 450 feet above mean sea level (amsl) in the uplands to approximately 200 feet amsl along the Nottoway River to the south (Matrix 2021).

2.5 GEOLOGY

Fort Pickett lies in the Piedmont upland section of the Piedmont physiographic province, extending northeast to southwest across Virginia, and is bounded by the Blue Ridge Province to the west and the Coastal Plain Province to the east (Woodward Clyde 1997). The Piedmont physiographic province is underlain by igneous, metamorphic, and sedimentary bedrock ranging in age from Precambrian to Mesozoic. Bedrock includes massive granites and gneisses, foliated phyllites and schists, and consolidated sandstones. Metamorphic rocks predominate the crystalline rock regimes. In most places, the consolidated rocks are overlain by regolith (USACE 1997).

A layer of weathered metamorphic and igneous rock (saprolite) extends across Fort Pickett. From ground surface, a typical sequence at the installation includes a thin layer of soil, a highly variable saprolite deposit that could be up to 45 feet thick, followed by bedrock. Alluvial deposits have been noted in the floodplains of Fort Pickett's drainage systems; however, the similar grain sizes between the saprolite and alluvial deposits make differentiation difficult (AECOM 2020). Alluvial deposits of sand, silt, and clay occur in the floodplains of the principal drainages, such as the Nottoway River, Tommeheton Creek, Birchin Creek, and Hurricane Branch (Woodward Clyde 1997).

The soils at Fort Pickett are deep, well-drained, coarse to fine silty clayey sands. These soils consist of moderately fine- to fine-grained soils formed from weathered granite and granite gneiss. The soils are strongly acidic and low in organic matter. The profile of the soil is generally a pale-yellow to brownish yellow coarse to fine silty clayey sand with a reddish yellow to yellowish-red friable silty clay subsoil in some places. Some areas have a surface layer of gritty silty sandy clay scattered with small, angular quartz pebbles. Permeability is moderately rapid in the surface layer of the soil and moderate in the subsoil. There is medium internal drainage with a moderate capacity for holding available moisture. Surface runoff is slow, and the hazard of erosion is slight to moderate. The potential for frost development in the soil extends to a depth of 18 inches in the Fort Pickett site area (USACE 1997).

Petersburg granite with Maidens Gneiss are the primary bedrock units underlying Fort Pickett at variable depths (USACE 1997). A layer of saprolite overlies the granite and metamorphic rocks throughout most of the installation. Bedrock grades upward starting with undeformed basement, then a thin zone of fractured rock, a variable layer of saprolite, and finally a thin layer of soil. The saprolite thickness and the associated bedrock surface are highly irregular. Rock can be present at the ground surface or be as deep as 45 feet below ground surface (bgs) (Woodward Clyde 1997); however, it has been reported that depth to unweathered bedrock in some place may be up to 150 feet bgs (USACE 1997). Saprolite is generally clay-rich and of low permeability, with the clay fraction increasing upward from the parent bedrock (Woodward Clyde 1997).

2.6 HYDROGEOLOGY

The yield of wells in the Piedmont physiographic province is greatly impacted by the abundance of fractures within the bedrock. Because fractures act as conduits for the flow of groundwater, well yields are greatest where wells intersect large or numerous fractures. The formations of granite and gneiss have good water-bearing potential because they are highly weathered and contain many fissures or closely spaced joints. Bored wells in the vicinity of Fort Pickett, are generally less than 50 feet deep, and drilled wells are normally greater than 60 feet deep (USACE 1997).

Groundwater systems within the Piedmont province include a combination of saprolite and fractured bedrock occurrences. Groundwater at Fort Pickett may occur in a multi-aquifer system, with water-producing zones in local silt, sand, and/or gravel lenses; broken rock, gravel, sand, silt, and clay within the saprolite; and perhaps in fractures within the bedrock. These water-producing zones may be separated both laterally and vertically by impermeable sediments, unfractured rock, or differentially weathered rock. The original rock texture is generally impermeable (AECOM 2020).

Precipitation infiltrates into water-producing zones and recharges the water table aquifer. A component of groundwater flows horizontally, while another component flows vertically downward through interconnected fractures in the underlying bedrock aquifers. The shallow water table aquifer is presumed to be unconfined. Therefore, groundwater flows under the influence of gravity with flow patterns resembling a subdued reflection of local topography. It is assumed that groundwater discharges to local streams in the area. The general shallow groundwater flow direction across the entire facility likely follows topography and ranges from northwest to southeast. For deeper aquifers, groundwater is under the influence of the presumed controlling hydraulic head for the region, namely the Nottoway River. Deep groundwater may underflow small streams and tributaries at the facility, but it will ultimately discharge to the Nottoway River (AECOM 2020). Regionally, groundwater at Fort Pickett flows in a southeasterly direction toward the Nottoway River.

A study conducted in 1989 showed depth to groundwater ranges from 7 to 33 feet bgs at Fort Pickett (Woodward Clyde 1997). The water table begins to fall in April and is replenished in the winter months. Most of the natural springs on Fort Pickett occur at the head of major drainages and are associated with seepage wetlands (AECOM 2020).

2.7 SURFACE WATER HYDROLOGY

The Nottoway River drainage basin overlies the majority of Fort Pickett, including the entirety of the BRAC property. A small area in the northeastern corner of the installation drains to Butterwood Creek. Three tributaries dissect Fort Pickett that drain into the Nottoway River: Hurricane Branch, Birchin Creek, and Tommeheton Creek. Principally, the headwaters of these tributaries originate within the installation's boundaries. Surface water generally flows south to the Nottoway River, drains into the Blackwater River at the Virginia/North Carolina border, and terminates into the Albemarle Sound in North Carolina (AECOM 2020).

The streams at Fort Pickett partly originate as groundwater discharge from shallow aquifers; however, some stream segments recharge the aquifer. Many portions of the streams are slow moving and marshy, forming extensive wetlands (AECOM 2020). The Nottoway River Basin contains 10,000 acres of wetlands with high value and high priority for protection spread over seven counties. In addition, the U.S. Fish and Wildlife Service (USFWS) has identified several detached wetlands of various sizes as having high value and priority for protection (Dewberry & Davis 2009).

Of the major stream networks on Fort Pickett (i.e., Nottoway River; Hurricane Branch; and Tommeheton, Birchin, and Butterwood Creeks), Hurricane Branch and Tommeheton and Birchin Creeks drain into the Nottoway River within the boundaries of Fort Pickett. Butterwood Creek eventually drains into the Nottoway River farther downstream from the installation (AECOM 2020). These Nottoway River tributaries are fed by a dendritic system of perennial and intermittent streams (USACE 1998).

The predominant discharge of surface water drainage of the BRAC property is Hurricane Branch, including most of FASTC, Fort Pickett LRA, and WWTP and freshwater treatment plant properties. Pickett Park predominantly drains to Birchin Creek, and the area north of the Airfield drains to Tommeheton Creek.

Fort Pickett has approximately 13 lakes, ponds, and surface water impoundments (approximately 600 acres). The largest impoundment, the Nottoway Reservoir, is located in the southwestern corner of the installation and covers approximately 384 acres in water surface area. The Nottoway Reservoir is impounded on the Nottoway River, upgradient of the Fort Pickett drainage system, and, according to VAARNG personnel, is owned by Blackstone (AECOM 2020). Smaller bodies of water on the installation include Twin Lakes on Butterwood Creek, Birchin Lake on Birchin Creek, and Tommeheton Lake on Tommeheton Creek (Weston 2001).

2.8 WATER USAGE

The Nottoway Reservoir, which the town of Blackstone owns (according to VAARNG personnel), is the source of drinking water for the BRAC property, VAARNG property, Blackstone, and several private residences within a 4-mile radius of the installation boundary. The Nottoway Reservoir is located within the former installation boundary adjacent to VAARNG property in the southwestern corner and cross-gradient of most of Fort Pickett. The next nearest surface water intake downstream from the operational range boundary is on the Nottoway River, approximately 30 miles downstream from the Nottoway River's operational range exit point from VAARNG property (AECOM 2020). Multiple communities receive water from impoundments of tributaries to the Nottaway River; however, the water systems are not interconnected (Dewberry & Davis 2009).

Water drawn from the Nottoway Reservoir is treated at a freshwater treatment plant located approximately 4 miles northeast of the Reservoir and adjacent to the Blackstone WWTP in the Fort Pickett cantonment area (USACE 1998). Blackstone owns and operates the freshwater treatment plant and WWTP (Matrix 2021), and Blackstone and Fort Pickett (i.e., BRAC and VAARNG properties), as well as several private residences, share services. In addition to the plant, water distribution mains, three elevated storage tanks, and three pumping stations are located throughout the area within the boundaries of Fort Pickett (AECOM 2020). Both treatment plants are part of the BRAC property, as shown in Figure 2-1.

No drinking water wells exist at Fort Pickett (i.e., BRAC and VAARNG properties) (AECOM 2020). According to the Commonwealth of Virginia's Geology and Mineral Resources Energy Program, several domestic, industrial, public, government, and unknown use wells are located within 4 miles of the facility to the west, north, and southeast. These wells are primarily cross-gradient and upgradient of the installation. Only one domestic well was identified southeast of the installation boundary along the Nottoway River. The well is reportedly 310 feet deep, and its status is unknown. Groundwater flow beneath Fort Pickett is locally a subdued reflection of topography and controlled by numerous surface water features on the installation. Regionally, groundwater flows in a southeasterly direction toward, and ultimately into, the Nottoway River, where it exits the installation boundary in the southeastern corner (AECOM 2020). Unregistered domestic wells associated with the residences surrounding Fort Pickett possibly exist that are not included in the Commonwealth of Virginia's databases. The Environmental Data Resources (EDR) report did not identify any public supply wells within 1 mile of Fort Pickett's northwestern boundary (EDR 2021).

2.9 ECOLOGICAL PROFILE

A variety of habitats are found at Fort Pickett: woods, mowed fields and lawns, agricultural fields, fallow fields, wetlands, permanent and intermittent streams, lakes, ponds, springs, seeps, and open unvegetated land. The most prevalent habitats at Fort Pickett include dry oak-pine forest (33.7 percent), southern piedmont mesic forest (31.0 percent), developed habitat (10.9 percent), and shrubland/grassland (10.2 percent) (Klopfer and Kane 2017).

The diverse landscapes on Fort Picket provide numerous habitats for many animals common to the southeastern piedmont and coastal plain. The Nottoway River serves as an aquatic habitat for several species of native mussels, including the eastern floater (*Pyganodon cataracta*), notched rainbow (*Villosa constricta)*, creeper (*Strophitus undulatus*), yellow lance (*Ellipitio lanceolata*), and Atlantic pigtoe (*Fusconaia masoni*) (Carey, Wolf, and Emrick 2017). Although it has not been documented, the federally endangered dwarf wedgemussel (*Alasmidonta heterodon*) may exist on Fort Pickett as it has historically occurred in the upper Nottoway River both upstream of and downstream from the installation (Carey, Wolf, and Emrick 2017). Several lakes and ponds are on the property. The largest lake (Fort Pickett Reservoir) is a 384 acre impoundment of the Mainstem Nottoway River located in Nottoway and Brunswick Counties. The lake provides a warmwater fishery for largemouth bass (*Micropterus salmoides)*, bluegill (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), black crappie (*Pomoxis nigromaculatus*), and channel catfish (*Ictalurus punctatus*) (Va DWR 2022). Jurisdictional wetlands have been identified along Tommeheton Creek, Birchin Creek, Butterwood Creek, Long Branch, and other drainage pathways (NWI 2022). Fort Pickett has approximately 5 acres of jurisdictional wetlands, and based on recent land cover mapping, there may be additional areas of wetlands on the installation (Matrix 2021).

Birds typical of the piedmont and coastal plain constitute the primary avian population at Fort Pickett. Common birds that inhibit Fort Pickett include chipping sparrow (*Spizella* passerine), brown-headed cowbird (*Molothrus ater*), mourning dove (*Zenaida macroura*), and common grackle (*Quiscalus quiscula*) (eBird 2022). Common mammals that inhabit Fort Pickett include the white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), muskrat (*Ondatra zibethica*), and beaver (*Castor canadensis*). Beaver populations at Fort Pickett are active along major secondary streams on the VAARNG property, causing alterations to pond and stream hydrology throughout the area (USACE 1998).

A wide variety of reptiles and amphibians are found on Fort Pickett including, but not limited to, the spotted salamander (*Ambystoma maculatum*), Fowlers toad (*Anaxyrus fowleri*), northern cricket frog (*Acriserepitans*), eastern painted turtle (*Chrysemys picta picta*), and eastern hognose snake (*Heterodon platirhinos*) (Smith 2017, USACE 1998).

The overall flora of Fort Pickett contains numerous species that are widely distributed in eastern North America, such as loblolly pine (*Pinus taeda*), sweetgum (*Liquidambar styraciflua*), American holly (*Ilex opaca*), and southern red oak (*Quercus falcata*). Fort Pickett lies within the Oak-Pine region and includes thousands of acres of secondary forests and scrubby vegetation growing on abandoned fields and clear cuts. The composition of these communities ranges from nearly pure stands of pine to variable mixtures of fast-growing, light-demanding deciduous trees, shrubs, and vines. Less than 100 acres of Fort Picket can be characterized as old growth hardwood forests (USACE 1998).

The USFWS Environmental Conservation Online System Information for Planning and Consultation (IPaC) tool identified five threatened and endangered (T&E) species (one mammal, one fish, two clams, and one flowering plant) potentially occurring on Fort Pickett (USFWS 2022). The T&E listed species consist of the Northern Long-eared bat (*Myotis septentrionalis*), Roanoke logperch (*Percina rex*), Atlantic pigtoe (Fus*conaia masoni*), yellow lance (*Elliptio lanceolata*), and Michaux's sumac (*Rhus michauxii*). In addition, the IPaC tool identifies one candidate species under the Endangered Species Act (ESA), consisting the monarch butterfly (*Danaus plexippus*), as potentially occurring on the property (USFWS 2022). All of these T&E species have been documented at Fort Pickett (Chazal et al. 2004, Klopfer and Kane 2017, USACE 1998). The Atlantic pigtoe and yellow lance mussels and Roanoke logperch fish are found in portions of the Nottoway River on Fort Pickett (Matrix 2021). Critical habitat for the two mussel species (Atlantic pigtoe and yellow lance) is present within Fort Pickett. Seventy-five populations of Michaux's sumac, which USFWS lists as endangered, are scattered throughout Fort Pickett. Fort Pickett has the largest population of this species in the world, and almost all populations of the installation's Michaux's sumac are located within or on the border of the VAARNG property (USACE 1998).

2.10 CLIMATE

The climate at Fort Pickett is characterized as humid sub-tropical, with hot, humid summers and mild winters (AECOM 2020). The Blue Ridge Mountains to the west are a partial barrier to the cold continental air masses in the winter. The open waters of the Chesapeake Bay and Atlantic Ocean to the east contribute to the mild winters and humid summers (USACE 1997).

Rainfall occurs throughout the year but typically experiences the highest totals in September with an average of 3.6 inches. Snowfall typically occurs between November and March, with the most snowfall occurring in February. The temperature in Blackstone typically varies between 29°F and 89°F annually, with the warmest temperatures occurring in July at average highs of 89°F. The warmer months of May to September cause the region to experience extreme seasonal variation in humidity. January is typically the coldest month, with average high and low temperatures of 49°F and 30°F, respectively (Weather Spark 2022).

3. FIELD INVESTIGATION ACTIVITIES

This section provides field procedures followed during the implementation of the SI (40 CFR §300.420(c)(4)(i)). The principal guidance documents for the field investigation activities and procedures used for the Fort Pickett BRAC SI were consistent with the requirements presented in the *Army Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018).

3.1 SITE INSPECTION DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) were developed to define the problem at the AOPIs, identify the necessary decisions, specify decision-making rules and the level of confidence necessary to resolve the problem, identify the number of samples necessary to support the decision, and obtain agreement from the decision makers before the sampling program was initiated. The sample locations were determined based on current site conditions (i.e., groundwater flow direction), presence of site media (e.g., sediment and surface water may not be present), historical data (e.g., suspected location of PFAS release), and historical activities (e.g., remedial activities, disposal of potentially contaminated materials). The project stakeholders concurred that selected sampling schemes would be representative of site conditions prior to initiation of field investigation activities. The field investigation at Fort Pickett BRAC was conducted in accordance with the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a). The field activities employed to execute the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a) are described below, including any variances or deviations.

3.2 SAMPLE DESIGN AND RATIONALE

Three AOPIs were investigated during the Fort Pickett BRAC SI to determine the presence or absence of PFAS in the environment. Information inputs from the preliminary CSMs presented on Worksheet #10 of the Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a) were the basis for the sample design at each AOPI. All samples were analyzed for the Target PFAS list of perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanoic acid (PFBA), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexanoic acid (PFHxA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) (also known as GenX).

The general approach for the determination of the presence or absence of PFAS at an AOPI consisted of collecting two direct-push technology (DPT) groundwater samples within and downgradient from the AOPI; three soil samples from each of three soil borings; and one colocated surface water and sediment sample, if these media were present. Variations to the general sampling approach included modifications to sample quantities at AOPIs based on size (i.e., additional samples collected at larger AOPIs) and collecting groundwater from existing monitoring wells, where present.

Each location that was sampled, with a unique set of coordinates, was assigned specific site location FPK-XXX-##.

Where:

- XXX = abbreviation for the AOPI being sampled
- ## = the sequential number of each sample location within the AOPI.

Each sample that was collected received a unique sample number, related to the site identifier (ID) above, in the format of PKXXX##-ZZzz.

Where:

- XXX = abbreviation for the AOPI being sampled
- ## = the sequential number of each sample location within the AOPI

- ZZ = sample media (i.e., GW = grab groundwater samples, MW = groundwater from an existing monitoring well, SS = surface soil, SB = subsurface soil, SW = surface water, SD = sediment)
- zz = the location number within the AOPI (per the site location ID above).

QA/QC samples were denoted according to the sample type. Rinsate blanks, field duplicates, and matrix spike (MS) and matrix spike duplicate (MSD) samples were denoted by appending “RB,” “FD,” “MS,” and “MSD,” respectively, to the parent sample ID. Field blanks and potable/source water blanks were named using the format of FPK-YY-yy.

Where:

- YY = FB (field blank) or SRC (source blank)
- yy = sequential number of each type of blank sample collected.

3.3 FIELD INVESTIGATION ACTIVITIES

SI field activities were conducted from June 19 to June 21, 2023. The locations and methods of sample collection during the SI are described in the following sections. Sampling procedures adhered to the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a), and relevant information is summarized below.

Sampling activities at Fort Pickett BRAC included collecting surface and subsurface soil samples from soil borings, DPT groundwater samples, groundwater samples from existing monitoring wells, and sediment and surface water samples where these media were present. Samples were analyzed for 26 PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Table B-15 of DoD Quality Systems Manual (QSM) Version 5.4 (DoD 2021) to determine the presence or absence of PFAS. A total of 41 samples, excluding QA/QC samples, were collected among the 3 AOPIs, including groundwater samples from 3 existing monitoring wells, 7 DPT groundwater samples, 8 surface soil samples, 18 subsurface soil samples, 2 surface water samples, and 3 sediment samples. A breakdown of samples collected at each AOPI is provided in Table 3-1. Prior to beginning sampling, site reconnaissance and utility clearance were conducted. Soil, sediment, and surface water sampling was completed at one AOPI before moving to the next AOPI. Groundwater sampling was completed at all of the AOPIs once sufficient water was present for collection. Any variances or deviations in sampling procedure, such as moving a location due to site conditions, were discussed with the project team and communicated in daily field summary emails (Appendix A). Field procedures and any deviations are discussed in the following sections. Photographs of SI field activities are provided in Appendix B.

Table 3-1. Fort Pickett BRAC AOPI SI Sample Collection

AOPI Name	Groundwater Samples	Soil Samples	Sediment Samples	Surface Water Samples
Former Fire Station and Extinguisher Building (Buildings 460 and 484)	3	2 SS / 6 SB	1	1
Material and Chemical Storage (Building 493 and Storage Yard)	4	3 SS / 6 SB	2	1
Blackstone Army Airfield Burn Pits (EBS-103)	3	3 SS / 6 SB	0	0
Total	**10**	**8 SS / 18 SB**	**3**	**2**

SS = Surface soil sample
SB = Subsurface soil sample

3.4 FIELD PROCEDURES

The following sections describe the field activities and procedures for utility clearance, PFAS-free source water sampling, soil boring installation and sampling, groundwater sampling, surface water and sediment sampling, equipment calibration, and location survey. Specific details regarding each of these activities are documented on Task Team Activity Log Sheets that are provided in Appendix C.

Because many materials routinely used during environmental investigations can potentially contain PFAS, the field crew conducted SI activities in accordance with the PFAS sampling standard operating procedure (SOP) presented in Appendix A of the Programmatic UFP-QAPP (Leidos 2022a). Procedures include requirements for equipment, containers, handling, and sampling, including PFAS-specific requirements, to ensure that sample contamination does not occur during collection and transport. New, clean nitrile gloves were donned prior to each new sample collected. Sampling containers were labeled with the following information: site name, sample identification, date and time of sample collection, name of sampler, sample preservation, and type of analysis (i.e., PFAS).

3.4.1 Utility Clearance

Prior to initiating intrusive activities, the site was verified to be free of underground utilities. The Field Manager coordinated underground utility clearances through BRAC and VA811 "Call Before You Dig." Other utility clearance activities included consulting individual utility companies (as needed), reviewing available as-built drawings, walking the areas to verify that utilities were marked, looking for signs of unidentified utilities (including overhead utilities), and completion of a Subsurface Clearance Checklist prior to initiating drilling operations. Prior to conducting powered drilling within 25 feet of known or suspected subsurface utilities, boreholes were excavated to a minimum of 5 feet bgs using a low-impact technique (i.e., hand auger) that would not damage the utility.

3.4.2 Bulk Source Water Sampling

Prior to beginning work, three source water samples (FPK-SRC-01, FPK-SRC-02, and FPK-SRC-03) were collected on April 13, 2023, for PFAS analysis to determine if the source water was PFAS-free and could be used for SI field activities (e.g., decontamination). Sample FPK-SRC-01 was collected from Water Point #1 (overhead hydrant on VAARNG property), and FPK-SRC-02 and FPK-SRC-03 were collected from an outdoor spigot at Building 229 on VAARNG property, all of which are supplied by the Blackstone freshwater treatment plant, which pulls from the Nottoway Reservoir. Water sources were purged for a minimum of 1 minute prior to filling high-density polyethylene (HDPE) bottles. Water from the Blackstone freshwater treatment plant was determined to be PFAS-free (i.e., PFAS were not detected at concentrations exceeding the limit of detection [LOD] at sampled locations) and was used as a drilling and decontamination water source during field sampling.

3.4.3 Soil Boring Installation and Sampling

All soil samples were collected in accordance with the procedures outlined in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a). QC samples, including, duplicates, rinsate blanks, and MS/MSDs, were also collected.

Soil samples were collected in disposable, PFAS-free acetate liners using a Geoprobe® 7822DT. If a sample location was within 25 feet of a known or suspected subsurface utility, the boring was excavated using a low-impact technique (i.e., stainless steel hand auger) to 5 feet bgs. Each soil core was logged for lithology in accordance with U.S. Army Corps of Engineers (USACE) guidance (ASTM International D2488 [2017]) and recorded on a soil boring log (provided in Appendix D). Soil sample intervals were homogenized in disposable HDPE bags prior to placing the soil into HDPE sample bottles. Sample bottles were labeled and sealed in zip-lock bags and placed on wet ice for cooling to ≤6°C. Additional details on protocols for obtaining soil samples are outlined on Worksheet #18 and the Leidos SOP "Soil Sampling" provided in the Programmatic UFP-QAPP (Leidos 2022a).

Surface soil samples from 0 to 1 foot bgs were collected from each of the AOPIs. Surface soil sample depths did not exceed 1 foot bgs.

Two subsurface soil samples were collected from each soil boring advanced at each AOPI. During the advancement of the soil borings, continuous soil cores were collected for recording lithology and documenting visual observations. Subsurface soil samples were collected as grab samples from 2-foot intervals, and the interval from which the sample was collected was recorded on the boring log. One subsurface soil sample was collected immediately above the water table to evaluate the potential for leaching. Samples for laboratory analysis were biased toward organic-rich zones, as PFAS may sorb to organics, but were generally collected from the midpoint of the boring and the bottom 2 feet of the boring.

Soil borings were abandoned following sample collection by backfilling the borehole with bentonite chips and hydrating with PFAS-free water. Surface restoration matched the surrounding surface (e.g., concrete, grass).

3.4.4 Groundwater Sampling and Well Redevelopment

All groundwater samples were collected in accordance with the procedures outlined in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a). QC samples, including duplicates and MS/MSDs, were also collected.

3.4.4.1 Existing Monitoring Well Sampling

Groundwater was sampled by the low-flow drawdown method using a peristaltic pump in existing monitoring wells. Prior to commencing low-flow drawdown methods, existing monitoring wells were purged of at least three well volumes using a non-PFAS containing peristaltic pump and new tubing to minimize residual PFAS cross-contamination from previous, non-PFAS-related investigations. The pump intake was positioned near the middle of the screened interval of the well to ensure that standing water was removed and fresh formation water was drawn into the well. Samples were collected once water quality parameters (temperature, pH, and conductivity) met the stabilization criteria established in the Programmatic UFP-QAPP (Leidos 2022a). Calibrated field instruments were used to collect water quality parameters (i.e., temperature, specific conductivity, pH, dissolved oxygen [DO], turbidity, and oxidation-reduction potential [ORP]). Prior to sampling, static water level measurements were collected to the nearest 0.01 foot using an electronic water level meter. Following completion of monitoring well purging and stabilization, samples were collected in laboratory-supplied HDPE bottles. All samples were collected and handled while wearing clean non-powdered, disposable nitrile gloves. Sample bottles were labeled and sealed in zip-lock bags and placed on wet ice for cooling to ≤6°C. New, clean nitrile gloves were donned prior to each new sample collection. Sample containers were labeled with the following information: site name, sample ID, date and time of sample collection, name of sampler, sample preservation, and type of analysis.

3.4.4.2 Grab Groundwater Sampling

Grab groundwater samples were collected from seven DPT sample locations. Collection methods for DPT groundwater samples are outlined in USEPA's *Groundwater Sampling and Monitoring with Direct Push Technologies* (USEPA 2005). Following completion of drilling each borehole for soil lithology and sample collection, the inner drill rods were removed and a decontaminated SP22 DPT groundwater sampling assembly, which included a 3-foot slotted stainless steel screen attached to the inner drill rods, was installed in the borehole. The outer drilling rods were then retracted, allowing formation water to enter the screened interval.

Groundwater samples were collected using a peristaltic pump with new HDPE tubing inserted through the drilling rods. Laboratory-supplied HDPE bottles were directly filled from the tubing, labeled, sealed, placed in zip-lock bags, and then placed on wet ice for cooling to ≤6°C. Sample containers were labeled with the following information: site name, sample identification, date and time of sample collection, name of sampler, sample preservation, and type of analysis.

If sufficient groundwater volume allowed, locations were purged for a maximum of approximately 5 minutes in an attempt to clear the groundwater of excess turbidity. Water quality measurements were collected for all grab groundwater samples, and turbidity measurements exceeded 50 nephelometric turbidity units at all grab groundwater locations. Once sampling was complete, all tooling and materials were removed and the borehole abandoned. The borehole was sealed with bentonite chips to approximately 1 foot bgs, and the chips were hydrated with PFAS-free source water. Surface restoration matched the surrounding surface (e.g., asphalt or grass).

3.4.5 Surface Water and Sediment Sampling

All surface water and sediment samples were collected in accordance with the procedures outlined in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a). QC samples, including duplicates and MS/MSDs, were also collected.

Surface water samples were collected from the selected locations by submerging the bottle ware below the water surface, while avoiding sediment agitation. Sediment samples were collected directly from the selected locations from 0 to 6 inches bgs using a disposable HDPE scoop. Each sediment sample was homogenized in a disposable HDPE bag prior to placing the sediment into laboratory-supplied HDPE sample bottles. Sample containers were labeled, sealed in zip-lock bags, and placed on wet ice for cooling to ≤6°C.

Water quality parameters (pH, temperature, conductivity, DO, ORP, and turbidity) were measured and recorded on the surface water/sediment sampling form. Observations made during surface water and sediment sampling were recorded on the sediment/surface water sampling forms provided in Appendix E.

3.4.6 Equipment Calibration

Water quality instruments (i.e., YSI and turbidity meter) and the photoionization detector (PID) used during groundwater sampling were calibrated daily per Worksheet #24 of the Programmatic UFP-QAPP (Leidos 2022a) against known standards in accordance with the manufacturer’s instructions and documented on the calibration logs provided in Appendix E.

3.4.7 Location Survey

Environmental sample locations and notable site features were located and mapped using a portable Trimble global positioning system (GPS) unit capable of achieving ± 3 feet accurate results. GPS data were transferred for use in ArcGIS mapping applications during data evaluation and reporting.

3.4.8 Deviations and Field Change Requests

No instances of field modification impacting project scope and/or data usability/quality were encountered during the SI fieldwork. Activities were completed per the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a). There was one minor deviation from the Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a) implemented during the field investigation. A surface water sample (PK49304-SW01) was proposed at FPK-493-04 and was not collected due to dry conditions. This deviation was summarized for USACE in the daily field notes.

3.5 DECONTAMINATION PROCEDURES

To ensure that chemical analysis results reflect the actual concentrations at sample locations, the non-dedicated, reusable equipment used in redevelopment and sampling activities was rigorously cleaned and decontaminated between sample locations in accordance with the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a). The non-disposable sampling equipment used to conduct sampling activities (e.g., hand augers, stainless steel pumps, water level meters) was decontaminated before sampling activities began, between locations, and after sampling activities were completed. Decontamination guidelines followed the direction provided in the July 2022 Interstate Technology & Regulatory Council (ITRC) fact sheet that discusses site characterization considerations (ITRC 2022) and PFAS decontamination procedures described by the Michigan Department of Environmental Quality (MDEQ) (MDEQ 2018). Wastewater generated from decontamination activities was handled as IDW. Decontamination water was combined with well development and sampling purge water and managed as one medium.

The decontamination process included an initial scrub with a laboratory-grade, phosphate-free, biodegradable detergent (e.g., Liquinox®) and PFAS-free bulk source water to remove particulate matter and surface film. Equipment was scrubbed using polyethylene or polyvinyl chloride brushes. Following this scrub, the equipment was then rinsed twice in separate bins containing bulk source water. Decontaminated sampling equipment was wrapped in thin sheets of HDPE to prevent subsequent contamination if being stored and not used immediately.

3.6 DISPOSITION OF FIELD INVESTIGATION-DERIVED WASTE

The IDW generated during the SI at Fort Pickett BRAC included solids (e.g., soil, sediment, acetate liners, and groundwater sampling material) and liquids (decontamination rinse water and well purge water). These materials were managed in accordance with the IDW Management Plan provided in Appendix C of the Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a).

All containers used to hold any amount of IDW, including temporary containers, were properly labeled as soon as they were filled in accordance with the IDW Management Plan (Appendix C of the Fort Pickett BRAC UFP-QAPP Addendum [Leidos 2023a]). Liquid and solid wastes were placed in United Nations-approved, 55-gallon drums for storage, transport, and disposal. Permanent labels for the drums included a unique container number, a description of the contents (e.g.., soil or wastewater), the fill date, the source location, the generator's name (i.e., Fort Pickett BRAC), and a telephone number for the generator's point of contact (e.g., the Army BRAC Environmental Coordinator). Each bucket or carboy used to temporarily store liquid IDW before it was transferred to a 55-gallon drum was marked "Non-potable Water" or "Decontamination Waste" to comply with requirements of the IDW Management Plan.

The contents of the IDW drums were sampled for characterization and profiling. A solid waste sample was composited by collecting aliquots from each borehole over the course of the field event. The solids were homogenized in an HDPE plastic bag and then placed into laboratory-supplied sample containers. Solid, non-regulated waste and general refuse, including acetate liners and disposable sampling materials (i.e., HDPE bags and tubing) were contained in separate drums. For drums containing liquid IDW, nitrile gloves were donned and sample bottles were filled directly from the drum. The waste hauler (US Ecology) was contacted prior to sampling to determine parameters required for disposal of waste potentially containing PFAS. The waste hauler provided guidance to analyze for suspected contaminants based on site history and previous investigations. The samples were analyzed for PFAS, toxicity characteristic leaching procedure (TCLP) volatile organic compounds (VOCs), TCLP semivolatile organic compounds, TCLP metals, TCLP pesticides, TCLP herbicides, pH, and flashpoint. The sample results indicated the material was non-hazardous waste.

On November 16, 2023, US Ecology removed the solid and liquid IDW waste drums from Fort Pickett BRAC for disposal. Both solid and liquid waste were removed for disposal at the Michigan Disposal Waste Treatment Plant at 49350 N I-94 Service Drive, Belleville, Michigan. Soiled personal protective equipment (PPE) was bagged and disposed of as municipal waste. Copies of the signed waste manifests are included in Appendix F. Copies of final signed manifests and certificates of disposal are managed by BRAC Headquarters.

4. DATA ANALYSIS AND QUALITY ASSURANCE SUMMARY

This section summarizes the QA/QC program and laboratory chemical analysis program implemented as part of the Fort Pickett BRAC SI field activities (40 CFR §300.420(c)(4)). Additional information on these procedures is presented in the Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a).

Merit Laboratories, Inc., located in East Lansing, Michigan, was the analytical laboratory under contract for the analysis of PFAS during the Fort Pickett BRAC SI field activities. Sections 4.1 through 4.4 summarize sample handling procedures, laboratory analytical methods, data QA/QC, data reporting and validation, and sample QA/QC. A QA summary of the analytical data is presented in Section 4.5. Appendix G provides the DUA, which details the quality and usability of the SI analytical data and the process performed to evaluate the data for compliance with established QC criteria.

4.1 SAMPLE HANDLING PROCEDURES

A critical aspect of sample collection and analysis protocols is the maintenance of strict chain-of-custody (CoC) procedures, which include tracking and documentation during sample collection, shipment, and laboratory processing. The Sample Manager was responsible for sample custody until the samples were properly packaged, documented, and released to the commercial carrier. The laboratory was responsible for sample custody thereafter in accordance with approved procedures.

4.1.1 Chain-of-Custody Record

CoC forms were used to document the traceability and integrity of all samples from the point of collection to the laboratory by maintaining a record of sample collection, shipment, and receipt by the laboratory. A CoC form was filled out and was signed and dated by each sample custodian.

Shipping containers were sealed with custody tape. Sealed coolers were transported to the commercial carrier for overnight delivery to the laboratory. The air bill number, written on the CoC form, acted as the custody documentation while the sealed coolers were in the possession of the commercial carrier. The CoC form was placed in a resealable plastic bag and taped to the inside lid of the cooler.

When the possession of samples was transferred, the individual relinquishing the samples and the individual receiving the samples signed, dated, and noted the time of transferal on the CoC. This record represents the official documentation for all transferal of sample custody until the samples arrived at the laboratory.

4.1.2 Laboratory Sample Receipt

All samples received by the Laboratory Sample Custodian or designee were checked for proper preservation (e.g., pH, temperature of coolant blank <6°C); integrity (e.g., leaking, broken bottles); and proper, complete, and accurate documentation and ID of the samples. The temperature of the coolant blank was noted. No insufficiencies and/or discrepancies were noted.

Samples received at the laboratory were logged into the laboratory computer database. Initial entries included field sample number, date of receipt, and analyses required. As samples were received, they were assigned a laboratory sample ID. The sample custodian labeled each container with its sample ID, and the samples then were transferred to their designated storage areas.

Samples received by the laboratory were considered to be physical evidence and were handled according to USEPA procedural safeguards. In addition, all data generated from the sample analyses, including all associated calibrations, method blanks, and other supporting QC analyses, were identified with the project name, project number, and sample delivery group (SDG) designation. All data were maintained under the proper custody. The laboratory provided complete security for samples, analyses, and data.

4.2 LABORATORY ANALYTICAL METHODS

The chemical analysis program for the Fort Pickett BRAC SI conforms to the analytical requirements presented in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a) for the chemical analysis of field investigation samples. All samples were analyzed for PFAS using LC/MS/MS procedures compliant with DoD QSM Version 5.4, Table B-15 (DoD 2021) and the laboratory SOP.

4.3 DATA QUALITY ASSURANCE/QUALITY CONTROL

This section presents the QA/QC procedures applied during sampling and laboratory analysis. This discussion includes laboratory QA/QC (Section 4.3.1) and field QA/QC (Section 4.3.2) procedures. Details on the results of the QC samples (field and laboratory) are presented in the DUA included in Appendix G.

4.3.1 Laboratory Quality Assurance/Quality Control

Samples were analyzed for PFAS using LC/MS/MS in compliance with DoD QSM Version 5.4, Table B-15 (DoD 2021). QC checks included holding times, method blanks, calibration standards, extracted internal standards (EISs), laboratory control samples (LCSs), MS/MSDs, and detection limits. The acceptance criteria and laboratory SOP are provided in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a).

Method Blanks—Method blanks were used to monitor the possibility of laboratory-induced contamination by running a volume of approved reagent water through the entire analytical scheme (i.e., extraction, concentration, analysis). Blank requirements are specified in the DoD QSM Version 5.4, Table B-15 (DoD 2021) and the laboratory SOP.

Matrix Spike/Matrix Spike Duplicates—Additional sample volume was collected from select field sample locations to evaluate accuracy and precision using MS/MSD analyses. MS/MSDs are aliquots of environmental samples to which known concentrations of certain target analytes have been added before sample preparation, cleanup, and determinative procedures have been implemented (SW846 Chapter One). Accuracy was expressed as the percent recovery of each added compound. Precision was expressed as the relative percent difference (RPD) between the MS and the MSD results. MS/MSD samples were collected and analyzed at a frequency of 1 for every 20 samples of similar matrix received at the laboratory.

Laboratory Control Samples—LCSs were analyzed to evaluate the accuracy of the analysis in the absence of sample matrix impacts. A known concentration of select compounds were added to the LCS. The spiked samples were analyzed in the same manner as the environmental samples. Accuracy was expressed as the percent recovery of each added compound. An LCS was analyzed with each SDG.

4.3.2 Field Quality Assurance/Quality Control

Table 4-1 summarizes the frequency of field QC samples that were collected during the Fort Pickett BRAC field investigation. The requirements for field QC were established on Worksheet #20 of the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a).

Table 4-1. Frequency of Field QC Samples for Fort Pickett BRAC Field Investigation

QC Sample	Frequency
Field Blank	1 per water source used as final rinse of equipment
Source Water Blank	1 per bulk rinse water source
Equipment Rinsate Blank	1 for every 10 or fewer investigative samples
Field Duplicate	1 for every 10 or fewer investigative samples
Reagent Blank	1 per drinking water sampling event; none required for this event
MS/MSD	1 for every 20 or fewer investigative samples

4.4 DATA REPORTING AND VALIDATION

The Leidos QA Manager or designee initiated a validation of the analytical data packages. One hundred percent of the data were validated using objective criteria taken from the requirements of the Programmatic UFP-QAPP (Leidos 2022a) and DoD QSM Version 5.4 (DoD 2021) and qualified in accordance with the DoD Data Validation Guidelines Module 3 (DoD 2020) and the revised table for sample qualification in the presence of blank contamination (DoD 2022).

Reported laboratory data were reviewed in accordance with DoD QSM Stage 2B validation guidelines to ensure that the QC results fell within appropriate QC limits for holding times, blank contamination, EISs, calibrations, MS/MSDs, LCSs, and ion ratios. Any data validation qualifiers resulting from outlier QC results were applied and a data validation report, as previously described, was prepared. In addition, 10 percent of the data were validated in accordance with DoD QSM Stage 3 guidelines, and analytical results were checked and recalculated from raw data.

Equipment rinsate blanks and field blanks were associated with the corresponding environmental samples. These blanks were evaluated following the same criteria as method blanks, and the associated environmental samples were appropriately qualified as needed. After the data validation for the project was completed, a project DUA (Appendix G) was prepared.

4.5 QUALITY ASSURANCE SUMMARY

A comprehensive QA/QC program was implemented during the sampling event at the Fort Pickett BRAC property in June 2023. Samples and associated QC samples (e.g., field duplicates, equipment rinsate blanks, field and source water blanks, MSs, MSDs) were collected and analyzed for PFAS using methods specified in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a). Consistent with the data quality requirements established in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a) and DQOs, all sample data and associated QC data were evaluated during the review and validation process. Individual sample results were qualified, as necessary, to designate usability of the data toward meeting project objectives. Data qualifiers were applied as appropriate to results for 41 primary samples and 6 field duplicates (approximately 1,128 data points were evaluated) based on deviations from the measurement performance criteria in the Programmatic UFP-QAPP (Leidos 2022a). Results of the validation are provided in the DUA (Appendix G). The analyses associated with each data quality indicator are summarized below, with details of the results of the QC checks provided in the DUA (Appendix G).

4.5.1 Precision

Precision was evaluated by the analysis of MS/MSDs and field duplicate samples and the RPD between the duplicate spike results. Except for one MS/MSD RPD, QC results associated with analytical precision met measurement performance criteria.

4.5.2 Accuracy

Bias introduced due to blank contamination (in method, instrument, or field blanks) and any impact on accuracy were evaluated during validation. Analytical accuracy was measured through the use of LCSs, MS/MSDs, isotope dilution standards, initial and continuing calibration, and target compound quantitation requirements. A few field/rinsate blank results indicated low-level contamination, which did not impact samples data. Accuracy measurements for a few MS/MSD recoveries, EIS recoveries, calibration results, and ion ratios were outside control limits, and data were qualified as estimated accordingly.

4.5.3 Sensitivity

Sensitivity requirements were evaluated against minimum required limits of quantitation and LODs in the Programmatic UFP-QAPP (Leidos 2022a), and these criteria were met.

4.5.4 Representativeness

Representativeness was satisfied by ensuring that the Programmatic UFP-QAPP (Leidos 2022a) and Fort Pickett BRAC UFP-QAPP Addendum (Leidos 2023a) protocols were followed, appropriate sampling techniques were used, established analytical procedures were implemented, and analytical holding times of the samples were not exceeded. Based on an overall evaluation of sample collection and receipt, holding times, and precision and accuracy, the samples collected during the SI sampling and analysis event are considered to be representative of the environmental conditions.

4.5.5 Comparability

Comparability was achieved by using consistent, documented, and Programmatic UFP-QAPP (Leidos 2022a) approved methods and meeting project accuracy and precision objectives. Based on the results of QC samples that assessed precision and accuracy, along with the use of established method criteria (i.e., DoD QSM Version 5.4, Table B-15 [DoD 2021]), the data collected during the SI are considered to meet project objectives for comparability.

4.5.6 Completeness

Completeness measures the amount of valid data obtained from the sampling and analysis effort. For analytical data to be usable, each data point must be validated and meet criteria without significant non-conformance. The DQOs for the Fort Pickett BRAC SI were set at 90 percent for field sampling and laboratory completeness. All groundwater and soil samples proposed were collected except for one surface water sample (PK49304-SW01) as it was dry at the time sampling was attempted. Rinse blanks related to groundwater were not collected because non-dedicated equipment was not used (a peristatic pump and new tubing were used at each location). Analytical completeness was 100 percent.

4.5.7 Data Usability Assessment

Data that have been qualified as estimated (J, UJ) during validation indicate accuracy, precision, or sensitivity QC measurements may have exceeded criteria, but the results are considered valid. No samples were recommended for exclusion.

5. SITE INSPECTION SCREENING LEVELS

Detected concentrations of Target PFAS in samples collected during this SI are compared to residential scenario SLs calculated using the USEPA regional screening level (RSL) calculator for soil and the tap water criteria for groundwater, as published in the 2023 OSD Memorandum (DoD 2023). This SI uses the SLs and a target hazard quotient (HQ) of 0.1 to evaluate Target PFAS concentrations. These SLs (Table 5-1) are used to evaluate the data and determine if further investigation is warranted at each AOPI. SLs for the other PFAS analyzed during this SI currently do not exist.

Table 5-1. Screening Levels from the 2023 OSD Memorandum

Chemical	Residential Tap Water HQ = 0.1 (ng/L or ppt)	Residential Soil HQ = 0.1 (µg/kg or ppb)
HFPO-DA	6	23
PFBA	1,800	7,800
PFBS	600	1,900
PFHxA	990	3,200
PFHxS	39	130
PFNA	5.9	19
PFOA	6	19
PFOS	4	13

Note: The residential tap water SLs are used to evaluate groundwater and surface water data. The residential soil SLs are used to evaluate soil and sediment data. The surface water and sediment data are qualitatively evaluated against the SLs. Laboratory results are reported to two significant figures.

6. SITE INSPECTION RESULTS

This section presents the background, summary of analytical results, and the CSM for each AOPI at Fort Pickett BRAC where Target PFAS were detected. Sampled media and QA/QC samples were analyzed for the list of 26 PFAS specified in the Programmatic UFP-QAPP (Leidos 2022a). The sample results discussed below by AOPI focus on the eight Target PFAS outlined in the 2023 OSD Memorandum (DoD 2023): PFOS, PFOA, PFBA, PFBS, PFNA, PFHxA, PFHxS, and HFPO-DA. Analytical data presentation tables for all PFAS analyzed using approved methods are provided in Appendix H.

6.1 CONCEPTUAL SITE MODELS

The preliminary CSMs developed for each AOPI during the PFAS PA were further refined for each AOPI where Target PFAS were detected at concentrations greater than the LOD in sampled media. Based on the SI sample results, CSMs presented for each AOPI represent the current understanding of site conditions with respect to known or suspected sources of PFAS-containing materials, potential transport mechanisms and migration pathways, and potentially exposed human receptors.

The CSMs evaluate ingestion, dermal contact, and inhalation exposure routes for human receptors. The exposure pathways are evaluated as complete, potentially complete, or incomplete in the CSMs presented in figures in each AOPI-specific CSM section. In the absence of toxicity information for the inhalation route, the inhalation exposure pathway of PFAS (via dust) is considered potentially complete for soil where Target PFAS are detected. The remaining exposure pathway designations are determined as follows:

- ***Complete*** – Human exposure pathways are considered complete where Target PFAS have been detected at concentrations exceeding the SLs and no LUCs are in place restricting access or use of the media.
- ***Potentially Complete*** – Human exposure pathways are considered potentially complete if Target PFAS have been detected at concentrations less than the SLs for soil, groundwater, surface water, or sediment or if the SLs have been exceeded along the migration pathway. For example, if Target PFAS are not detected in soil but are detected at concentrations exceeding the SLs in groundwater, the exposure pathway for soil is considered potentially complete. In addition, a groundwater exposure pathway is considered potentially complete where Target PFAS have been detected and could migrate from the AOPI source area to offsite groundwater that is used for drinking water. Exposure pathways are also potentially complete for media where existing LUCs are in place for non-PFAS because the LUCs are not specific to Target PFAS.
- ***Incomplete*** – Human exposure pathways are considered incomplete for media where Target PFAS have not been detected at concentrations greater than the LODs.

No LUCs are in place at any of the AOPIs; however, LUCs are in place at the Former Recycling Center and Former Fuel Station No. 1 within the Fort Pickett BRAC property. LUCs at the Former Recycling Center were implemented as part of the final Remedial Assessment (Tetra Tech 2005) and follow the FOST the Army provided (U.S. Army 2005a) and included in the deed (USACE 2005). The entire Former Fuel Station parcel (approximately 1.5 acres) is subject to groundwater use and ground disturbance restrictions. All current and post-transfer use by future property owners and users will be responsible for implementing, monitoring, and maintaining the LUCs at Fort Pickett BRAC (Tetra Tech 2005).

6.2 FORMER FIRE STATION AND EXTINGUISHER BUILDING (BUILDINGS 460 AND 484) AOPI

The following subsections describe the background, sampling results, CSM, and recommendation for the Former Fire Station and Extinguisher Building AOPI.

6.2.1 AOPI Background

The Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI is located at the corner of W. 10th Street and Baker's Row on LRA-owned property. Building 460 (Former Fire Station) was constructed in 1942 and operated as a fire station until approximately 1987. Fire trucks potentially storing aqueous film-forming foam (AFFF) were stored inside the building and reportedly washed in the driveway. The building has been used for storage since closure of the fire station and is currently used for storage of construction material. Building 484 (Extinguisher Building) was constructed in 1942 and operated as storage for extinguisher chemicals for the fire department until the mid- to late 1980s. According to personnel interviews, AFFF was stored in the building for use during fire training exercises. Based on aerial photographs, the roadway to Building 484 was reverted to grass in the late 1990s or early 2000s. This AOPI is no longer owned by the Army, and there are no restrictions at this AOPI.

6.2.2 SI Sampling and Results

Soil, groundwater, surface water, and sediment samples were collected from the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI at the following locations (Figure 6-1):

- Eight soil samples and one QC duplicate sample were collected from three soil borings (FPK-460-01, FPK-460-02, and FPK-460-03). All three soil borings were within the suspected release area. One surface soil and two subsurface soil samples were collected from FPK-460-02 and FPK-460-03. A surface soil sample was not collected from FPK-460-01 due to the presence of concrete.
- Three groundwater samples were collected from two DPT groundwater locations (FPK-460-01 and FPK-460-02) and one existing monitoring well (FPK-460-MW05). FPK-460-01 and FPK-460-02 were within the suspected release area and FPK-460-MW05 was downgradient from the suspected release area.
- One colocated surface water and sediment sample and one colocated QC duplicate surface water sample were collected from an unnamed creek downgradient from the suspected release area at FPK-460-04.

The Target PFAS analytical results for soil, groundwater, surface water, and sediment samples collected at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI are summarized below and presented in Table 6-1 and Figure 6-2.

6.2.2.1 Soil

PFOS, PFOA, PFBA, PFHxA, PFHxS, PFNA, and PFBS were detected in soil samples collected at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI. PFOS was detected in surface soil at 67 µg/kg at FPK-460-02, which exceeds the SL of 13 µg/kg. In addition, PFOS was detected at concentrations less than the SL in subsurface soil at FPK-02, including the deepest interval (18 to 20 feet bgs), surface soil and subsurface soil at FPK-460-03, and subsurface soil at location FKP-460-01.

PFHxS was detected in soil at concentrations less than the SL at all three soil borings and in every sample collected. PFOA was detected in surface soil at concentrations less than the SL at all three borings, and PFBA was detected in surface soil at concentrations less than the SL at FPK-460-02 and FPK-460-03.

PFHxA and PFNA were detected in surface soil at concentrations less than the SLs at FPK-460-02 and FPK-460-03 and in subsurface soil at FPK-460-01 (8 to 10 feet bgs). In addition, PFHxA was detected in the deepest subsurface soil interval (18 to 20 feet bgs) at FPK-460-01 and FPK-460-02. PFNA was detected in subsurface soil at FPK-460-03 (6 to 8 feet bgs).

PFBS was detected at estimated concentrations less than the SL in subsurface soil (18 to 20 feet bgs) at FPK-460-02.

HFPO-DA was not detected at concentrations greater than the LOD in any soil samples collected at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI.

6.2.2.2 Groundwater

PFOS, PFOA, PFBA, PFHxA, PFHxS, PFNA, and PFBS were detected in groundwater samples collected at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI. PFOS, PFOA, PFHxS, and PFNA were detected at concentrations greater than the SLs in groundwater samples collected from within the suspected release area at DPT groundwater sample locations FPK-460-01 and FPK-460-02. In addition, PFOS, PFOA, and PFHxS were detected at concentrations greater than the SLs in groundwater samples collected downgradient from the suspected release area at existing monitoring well FPK-460-MW05.

The highest concentrations of target PFAS were detected at FPK-460-01 with PFOS (2,100 ng/L [estimated]), PFOA (970 ng/L), PFHxS (5,900 ng/L), and PFNA (130 ng/L) exceeding the SLs of 4, 6, 39, and 5.9 ng/L, respectively.

Target PFAS concentrations exceeded SLs at FPK-460-02 with PFOS (2,700 ng/L) exceeding the SL of 4 ng/L, PFOA (34 ng/L) exceeding the SL of 6 ng/L, PFHxS (480 ng/L) exceeding the SL of 39 ng/L, and PFNA (13 ng/L) exceeding the SL of 5.9 ng/L. In addition, at FPK-460-MW05, PFOS (300 ng/L [estimated]) exceeded the SL of 4 ng/L, PFOA (8.3 ng/L) exceeded the SL of 6 ng/L, and PFHxS (350 ng/L) exceeded the SL of 39 ng/L.

PFBA, PFBS, and PFHxA were detected in groundwater samples collected from all three groundwater sample locations (FPK-460-01, FPK-460-02, and FPK-460-MW05) at concentrations less than the SLs.

HFPO-DA was not detected at concentrations greater than the LOD in any groundwater samples collected at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI.

6.2.2.3 Surface Water

PFOS, PFOA, PFBA, PFHxA, PFHxS, PFNA, and PFBS were detected in a surface water sample collected downgradient from the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI. PFOS, PFOA, PFHxS, and PFNA were detected at concentrations greater than the SLs. At FPK-460-04, PFOS was detected at 610 ng/L, PFOA was detected at 38 ng/L, PFHxS was detected at 600 ng/L, and PFNA was detected at 12 ng/L, exceeding the SLs of 4, 6, 39, and 5.9 ng/L, respectively. PFBA, PFBS, and PFHxA were detected at concentrations less than the SLs at FPK-460-04.

HFPO-DA was not detected at concentrations greater than the LOD in the surface water sample collected at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI.

6.2.2.4 Sediment

PFOS, PFOA, PFHxA, PFHxS, PFNA, and PFBS were detected in a sediment sample collected downgradient from the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI. PFOS was detected at 72 µg/kg at FPK-460-04, which exceeds the SL of 13 µg/kg. PFOA, PFHxA, PFHxS, PFNA, and PFBS were detected at concentrations less than the SLs at FPK-460-04.

HFPO-DA and PFBA were not detected at concentrations greater than the LOD in the sediment sample collected at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI.

6.2.3 CSM

Building 460 is a T-shaped building and Building 484 is a small rectangular building, on 0.4 acres. A single floor drain from Building 460 discharged to the sanitary sewer system at the time of operation as a fire station. The exterior ground surface at Buildings 460 and 484 is primarily grass with a concrete driveway and a few concrete pads surrounding the Former Fire Station. The ground surface elevation is approximately

400 feet amsl. The property is bordered to the north and east by W. 10th Street and Baker's Row, respectively, and by a storm drainage ditch running north and east that directs water south toward Building 493 and the Former Fuel Station to the south. The Former Fire Station and Extinguisher Building (Buildings 460 and 484) is bounded to the north by the VAARNG property (i.e., W. 10th Street is the unofficial property boundary between the VAARNG property and BRAC property).

Shallow subsurface geology at Buildings 460 and 484 is composed of weathered metamorphic and igneous bedrock (i.e., saprolite). Shallow groundwater was encountered at approximately 20 to 22 feet bgs during the SI and flows southeast at the AOPI.

The primary release mechanism is the potential release of AFFF to surface soils related to historical operations and potential AFFF use and/or storage at the Former Fire Station and Extinguisher Building. The secondary contaminant migration and fate and transport considerations include downward contaminant migration from surface soil to subsurface soil and groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff, dissolution, and adsorption from stormwater and recharge to groundwater from surface water. Interaction and potential connectivity between surface water and groundwater (i.e., discharge and recharge) promote another potential migration pathway of constituents.

Based on the mixed land use at the Fort Pickett BRAC property in the vicinity of this AOPI, the human receptors considered in the CSM are onsite workers with the potential to work at the AOPI, onsite recreators staying at the onsite recreational vehicle (RV) park, and offsite residents living in the vicinity of Fort Pickett BRAC.

The ingestion and dermal contact exposure pathways for surface soil are complete for onsite workers and recreators because Target PFAS were detected in surface soil at concentrations greater than the SLs at the Former Fire Station and Extinguisher Building AOPI. The surface soil inhalation exposure pathway for onsite workers and recreators is potentially complete because no toxicity information is available for the inhalation route. Because Target PFAS were detected in subsurface soil at concentrations less than the SLs and in groundwater at concentrations greater than the SLs, and there are no restrictions on intrusive activities at the AOPI, the subsurface soil exposure pathways for onsite workers are potentially complete. The subsurface soil exposure pathways are incomplete for onsite recreators, as they will not be exposed to subsurface soil. Soil exposure pathways for offsite residents are considered incomplete because migration of soil from the AOPI is not expected.

Although onsite groundwater is not currently used and drinking water at Fort Pickett is supplied by the town of Blackstone, sourced from the Nottoway Reservoir, no restrictions are in place that prevent the use or consumption of groundwater at the AOPI. Target PFAS were detected in groundwater at concentrations greater than the SLs; however, the groundwater exposure pathways for onsite workers are potentially complete because the depth the shallow groundwater is greater than 15 feet bgs. Because no onsite potable groundwater source exists, groundwater exposure pathways for onsite recreators are considered incomplete. Due to the presence of wells within 4 miles of Fort Pickett, the groundwater exposure pathways for offsite residents are potentially complete.

Target PFAS were detected in surface water and sediment at concentrations greater than the SLs, making the onsite surface water and sediment exposure pathways complete for onsite workers and recreators. In addition, the surface water and sediment exposure pathways for offsite residents are potentially complete because surface water flows from the AOPI toward the Nottoway River.

Figure 6-3 presents the CSM for the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI.

6.2.4 Recommendation

Detected concentrations of Target PFAS in soil, groundwater, surface water, and sediment at the Former Fire Station and Extinguisher Building AOPI exceed the SLs; therefore, further investigation is recommended.

Table 6-1. Target PFAS Results and Screening for the Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI

Location ID	Sample ID	Sample Type	Depth (ft)	Sample Date	HFPO-DA or GenX	PFBA	PFBS	PFHxA	PFHxS	PFNA	PFOA	PFOS
Soil				**Units**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
				Screening Levels	**23**	**7800**	**1900**	**3200**	**130**	**19**	**19**	**13**
FPK-460-01	PK46001-SB02	BORE	8.00-10.00	06/20/2023	0.081 U	0.081 U	0.081 U	**0.19**	**9.9**	**1.0**	**4.3 J**	**11**
	PK46001-SB03	BORE	18.00-20.00	06/20/2023	0.062 U	0.062 U	0.062 U	**0.21**	**7.1**	0.062 U	0.062 U	0.062 U
FPK-460-02	PK46002-SS01	SURF	0.00-1.00	06/20/2023	0.068 U	**0.16**	0.068 U	**0.096 J**	**0.41**	**0.70**	**0.12 J**	**67**
	PK46002-SB02	BORE	8.00-10.00	06/20/2023	0.061 U	0.061 U	0.061 U	0.061 U	**17**	0.061 U	0.061 U	**0.11 J**
	PK46002-SB03	BORE	18.00-20.00	06/20/2023	0.062 U	0.062 U	**0.11 J**	**0.23**	**3.5**	0.062 U	0.062 U	**0.13**
	PK46002-SB03FD	BORE	18.00-20.00 (D)	06/20/2023	0.069 U	0.069 U	**0.10 J**	**0.19**	**3.7**	0.069 U	0.069 U	**0.089 J**
FPK-460-03	PK46003-SS01	SURF	0.00-1.00	06/20/2023	0.057 U	**0.15**	0.057 U	**0.081 J**	**0.12**	**0.068 J**	**0.13**	**0.77**
	PK46003-SB02	BORE	6.00-8.00	06/20/2023	0.067 U	0.067 U	0.067 U	0.067 U	**0.26**	**0.13 J**	0.067 U	**0.59**
	PK46003-SB03	BORE	13.00-15.00	06/20/2023	0.074 U	0.074 U	0.074 U	0.074 U	**0.49**	0.074 U	0.074 U	0.074 U
Groundwater				**Units**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
				Screening Levels	**6**	**1800**	**600**	**990**	**39**	**5.9**	**6**	**4**
FPK-460-01	PK46001-GW01	WELL	24.00-24.00	06/20/2023	50 U	**65 J**	**53 J**	**210**	**5900**	**130**	**970**	**2100 J**
FPK-460-02	PK46002-GW01	WELL	29.00-29.00	06/20/2023	0.96 U	**15**	**22**	**60**	**480**	**13**	**34**	**2700**
FPK-460-MW05	PK460-MW05	WELL	25.00-25.00	06/20/2023	0.96 U	**2.5**	**22**	**20**	**350**	0.96 U	**8.3**	**300 J**
Surface Water				**Units**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
				Screening Levels	**6**	**1800**	**600**	**990**	**39**	**5.9**	**6**	**4**
FPK-460-04	PK46004-SW01	SWTR	0.00-0.00	06/20/2023	0.98 U	**26**	**84**	**110**	**600**	**12**	**38**	**610**
	PK46004-SW01FD	SWTR	0.00-0.00	06/20/2023 (D)	1 U	**31**	**85**	**120**	**590**	**12**	**38**	**560**
Sediment				**Units**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
				Screening Levels	**23**	**7800**	**1900**	**3200**	**130**	**19**	**19**	**13**
FPK-460-04	PK46004-SD01	SEDI	0.00-0.00	06/20/2023	0.25 U	0.25 U	**0.40 J**	**0.44 J**	**9.7**	**0.50**	**0.55**	**72**

The SLs are the Residential Scenario SLs calculated using the USEPA RSL Calculator provided in the August 2023 OSD Memorandum for Tap Water using an HQ = 0.1.
Bolded values denote detected concentrations.
Highlighted values indicate an exceedance of the SL.
(D) = Field duplicate sample.
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
U = The analyte was analyzed for, but not detected above the reported sample quantitation limit.

6.3 MATERIAL AND CHEMICAL STORAGE (BUILDING 493 AND STORAGE YARD) AOPI

The following subsections describe the background, sampling results, CSM, and recommendation for the Material and Chemical Storage (Building 493 and Storage Yard) AOPI.

6.3.1 AOPI Background

The Material and Chemical Storage (Building 493 and Storage Yard) AOPI is located along Baker's Row directly south of the Former Fire Station and Extinguisher Building AOPI on LRA-owned property. Building 493 and the adjacent fenced-in Storage Yard were constructed in 1945 and operated as a storage facility for the Fort Pickett fire department until approximately 1987. Other departments at Fort Pickett also used the storage compound from the time of inception. According to former Fire Chiefs, AFFF was stored in Building 493. The building reportedly had a dirt floor; therefore, leaks or spills from stored materials and chemicals would be in direct contact with soil. Building 493 and the Storage Yard are still being used as a storage facility. In November 2001, 940 tons of soil were removed as part of an interim remedial action (IRA) from multiple locations in and around Building 493 and the Storage Yard (EA 2004). There are no land use restrictions at this AOPI.

6.3.2 SI Sampling and Results

Soil, groundwater, surface water, and sediment samples were collected from the Material and Chemical Storage (Building 493 and Storage Yard) AOPI at the following locations (Figure 6-4):

- Nine soil samples and one QC duplicate sample were collected from three soil borings (FPK-493-01, FPK-493-02, and FPK-493-03). All three soil borings were within the suspected release area. One surface soil and two subsurface soil samples were collected from each boring.
- Four groundwater samples and one QC duplicate sample were collected from two DPT groundwater locations (FPK-493-01 and FPK-493-03) and two existing monitoring wells (FPK-493-MW01 and FPK-493-MW03). FPK-493-01 and FPK-493-03 were located within the suspected release area, and existing monitoring wells FPK-493-MW01 and FPK-493-MW03 were located downgradient from the suspected release area.
- One sediment sample was collected from an unnamed creek downgradient from the suspected release area at FPK-493-04. One colocated surface water and sediment sample and one QC duplicate sediment sample were collected from an unnamed creek downgradient from the suspected release area at FPK-493-05.

The Target PFAS analytical results for soil, groundwater, surface water, and sediment samples collected at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI are summarized below and presented in Table 6-2 and Figure 6-5.

6.3.2.1 Soil

PFOS, PFOA, and PFBA were detected in soil samples collected at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI at concentrations less than the SLs. PFOS was detected in surface soil at FPK-493-01 and FKP-493-02 (estimated) and in subsurface soil (6-8 feet bgs) at FPK-493-01 (estimated). PFOA and PFBA were detected in surface soil at estimated concentrations less than the SLs in FPK-493-01.

HFPO-DA, PFHxA, PFBS, PFHxS, and PFNA were not detected at concentrations greater than the LODs in any soil samples collected at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI.

6.3.2.2 Groundwater

PFOS, PFOA, PFBA, PFHxA, PFHxS, PFNA, and PFBS were detected in groundwater samples collected at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI. PFOS, PFOA, PFHxS, and PFNA were detected at concentrations greater than the SLs in groundwater samples collected from within the suspected release area at FPK493-01. PFOS and PFHxS were detected at concentrations greater than the SLs in groundwater samples collected from within the suspected release area at FPK-493-03. PFOS, PFOA, PFHxS, and PFNA were detected at concentrations greater than the SLs in groundwater samples collected downgradient from the suspected release area at FPK-493-MW01 and FPK-493-MW03.

PFOS was detected at concentrations exceeding the groundwater SL of 4 ng/L at all four locations, with concentrations of 780, 47, 300, and 280 ng/L at FPK-493-01, FPK-493-03, FPK-493-MW01, and FPK-493-MW03, respectively.

PFOA was detected at concentrations exceeding the groundwater SL of 6 ng/L at FPK-493-01, FPK-493-MW01, and FPK-493-MW03, with concentrations of 46, 26, and 25 ng/L, respectively. In addition, PFOA was detected at a concentration less than the SL at FPK-493-03.

PFNA was detected at concentrations exceeding the groundwater SL of 5.9 ng/L at FPK-493-01 and PFK-493-MW03, with concentrations of 100 and 6 ng/L, respectively. PFNA was also detected at concentrations less than the SL in FPK-493-03 and FPK-493-MW01.

PFHxS was detected at concentrations exceeding the groundwater SL of 39 ng/L at all four locations, with concentrations of 650, 70, 440, and 430 ng/L at FPK-493-01, FPK-493-03, FPK-493-MW01, and FPK-493-MW03, respectively.

PFBA, PFHxA, and PFBS were detected in groundwater samples collected from all four groundwater sample locations at concentrations less than the SLs.

HFPO-DA was not detected at concentrations greater than the LOD in any groundwater samples collected at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI.

6.3.2.3 Surface Water

PFOS, PFOA, PFBA, PFHxA, PFHxS, PFNA, and PFBS were detected in surface water at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI. PFOS, PFOA, PFHxS, and PFNA were detected at concentrations greater than the SLs in the surface water sample collected downgradient from the AOPI. At FPK-493-05, concentrations of PFOS (510 ng/L), PFOA (32 ng/L), PFHxS (500 ng/L), and PFNA (11 ng/L), and exceeded the SLs of 4, 6, 39, and 5.9 ng/L, respectively.

PFBA, PFHxA, and PFBS were detected at concentrations less than the SLs at FPK-493-05.

HFPO-DA was not detected at concentrations greater than the LOD in surface water samples collected at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI.

6.3.2.4 Sediment

PFOS, PFOA, PFBA, PFHxA, PFHxS, PFNA, and PFBS were detected in both sediment samples collected downgradient from the Material and Chemical Storage AOPI. PFOS was detected at concentrations exceeding the SL of 13 µg/kg at both locations (FPK-493-04 and FPK-493-05), with concentrations of 25 and 35 µg/kg, respectively. All other detected concentrations of Target PFAS were less than the SLs.

HFPO-DA was not detected at concentrations greater than the LOD in surface water samples collected at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI.

6.3.3 CSM

The Material and Chemical Storage (Building 493 and Storage Yard) AOPI is approximately 0.6 acres. Building 493 and the fenced-in Storage Yard are still intact. Building 493 is a rectangular building with an alleged dirt floor; the Storage Yard is a fenced-in polygon on the eastern and southern sides of Building 493. The exterior ground surface at Building 493 is primarily grass and vegetation with a small concrete driveway off Baker's Row. The ground surface elevation is approximately 400 feet amsl. Installation drawings from the Department of Public Works confirmed that the building was not connected to the sanitary sewer system. A storm drainage ditch runs directly in front of the storage compound, parallel to Baker's Row, and discharges to a ditch that lines the southern property boundary.

Shallow subsurface geology at Building 493 and Storage Yard is composed of weathered metamorphic and igneous bedrock (i.e., saprolite). Shallow groundwater was encountered at approximately 11 to 17 feet bgs during the SI and flows southeast.

The primary release mechanism is the potential release of AFFF to surface soils related to historical operations and potential AFFF storage at Building 493 and the Storage Yard. Constituents could migrate from surface soil to subsurface soil and groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff and dissolution from stormwater. Interaction and potential connectivity between surface water and groundwater (i.e., discharge and recharge) promote another potential migration pathway of constituents.

Based on the mixed land use at the Fort Pickett BRAC property in the vicinity of this AOPI, the human receptors considered in the CSM are onsite workers with the potential to work at the AOPI, onsite recreators staying at the onsite RV park, and offsite residents living in the vicinity of Fort Pickett BRAC.

The onsite surface soil exposure pathways are potentially complete because Target PFAS were detected in surface soil at concentrations less than the SLs at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI. Because Target PFAS were detected in subsurface soil at concentrations less than the SLs and in groundwater at concentrations greater than the SLs, and there are no restrictions on intrusive activities at the AOPI, the subsurface soil exposure pathway for onsite workers is potentially complete. The subsurface soil exposure pathways are incomplete for onsite recreators, as they will not be exposed to subsurface soil. Soil exposure pathways for offsite residents are considered incomplete because migration of soil from the AOPI is not expected.

Although onsite groundwater is not currently used and drinking water at Fort Pickett is supplied by the town of Blackstone, sourced from Nottoway Reservoir, no restrictions are in place that prevent the use or consumption of groundwater at the AOPI. Since Target PFAS were detected in groundwater at concentrations greater than the SLs and groundwater is present at less than 15 feet bgs, the groundwater exposure pathways for onsite workers are complete. Because no onsite potable groundwater source exists, groundwater exposure pathways for onsite recreators are considered incomplete. Due to the presence of wells within 4 miles of Fort Pickett, the groundwater exposure pathway for offsite residents is potentially complete.

Target PFAS were detected in surface water and sediment at concentrations greater than the SLs, making the onsite surface water and sediment exposure pathways complete. In addition, the surface water and sediment exposure pathways for offsite residents are potentially complete because surface water flows from the AOPI toward the Nottoway River.

Figure 6-6 presents the CSM for the Material and Chemical Storage (Building 493 and Storage Yard) AOPI.

6.3.4 Recommendation

Detected concentrations of Target PFAS in groundwater, surface water, and sediment at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI exceed the SLs; therefore, further investigation is recommended.

Table 6-2. Target PFAS Results and Screening for the Material and Chemical Storage (Building 493 and Storage Yard) AOPI

Location ID	Sample ID	Sample Type	Depth (ft)	Sample Date	HFPO-DA or GenX	PFBA	PFBS	PFHxA	PFHxS	PFNA	PFOA	PFOS
Soil				**Units**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
				Screening Levels	**23**	**7800**	**1900**	**3200**	**130**	**19**	**19**	**13**
FPK-493-01	PK49301-SS01	SURF	0.00-1.00	06/20/2023	0.075 U	**0.090 J**	0.075 U	0.075 U	0.075 U	0.075 U	**0.089 J**	**0.17**
	PK49301-SB02	BORE	6.00-8.00	06/20/2023	0.066 U	0.066 U	0.066 U	0.066 U	0.066 U	0.066 U	0.066 U	**0.10 J**
	PK49301-SB03	BORE	13.00-15.00	06/20/2023	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U
FPK-493-02	PK49302-SS01	SURF	0.00-1.00	06/21/2023	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	**0.073 J**
	PK49302-SB02	BORE	6.00-8.00	06/21/2023	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U
	PK49302-SB02FD	BORE	6.00-8.00 (D)	06/21/2023	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U
	PK49302-SB03	BORE	13.00-15.00	06/21/2023	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U
FPK-493-03	PK49303-SS01	SURF	0.00-1.00	06/20/2023	0.071 U	0.071 U	0.071 U	0.071 U	0.071 U	0.071 U	0.071 U	0.071 U
	PK49303-SB02	BORE	4.00-6.00	06/20/2023	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U
	PK49303-SB03	BORE	9.00-11.00	06/20/2023	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U
Groundwater				**Units**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
				Screening Levels	**6**	**1800**	**600**	**990**	**39**	**5.9**	**6**	**4**
FPK-493-01	PK49301-GW01	WELL	24.00-24.00	06/20/2023	0.92 U	**34**	**35**	**120**	**650**	**100**	**46**	**760**
	PK49301-GW01FD	WELL	24.00-24.00	06/20/2023 (D)	0.93 U	**34**	**36**	**120**	**630**	**100**	**45**	**780**
FPK-493-03	PK49303-GW01	WELL	19.00-19.00	06/20/2023	0.91 U	**5.4**	**8.7**	**16**	**70**	**3.1**	**4.9**	**47**
FPK-493-MW01	PK493-MW01	WELL	10.00-10.00	06/20/2023	0.92 U	**20**	**62**	**82**	**440**	**5.9**	**26**	**300**
FPK-493-MW03	PK493-MW03	WELL	20.00-20.00	06/20/2023	0.91 U	**19**	**61**	**82**	**430**	**6**	**25**	**280**
Surface Water				**Units**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
				Screening Levels	**6**	**1800**	**600**	**990**	**39**	**5.9**	**6**	**4**
FPK-493-05	PK49305-SW01	SWTR	0.00-0.00	06/20/2023	0.9 U	**24**	**72**	**90**	**500**	**11**	**32**	**510**
Sediment				**Units**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
				Screening Levels	**23**	**7800**	**1900**	**3200**	**130**	**19**	**19**	**13**
FPK-493-04	PK49304-SD01	SEDI	0.00-0.00	06/20/2023	0.11 U	0.11 U	**0.14 J**	**0.35**	**4.0**	**0.23**	**0.32**	**25**
FPK-493-05	PK49305-SD01	SEDI	0.00-0.00	06/20/2023	0.092 U	**0.14 J**	**0.20**	**0.38**	**3.6 J**	**0.22**	**0.20**	**26**
	PK49305-SD01FD	SEDI	0.00-0.00	06/20/2023	0.14 U	**0.26 J**	**0.27 J**	**0.68**	**5.0**	**0.23 J**	**0.30**	**35**

The SLs are the Residential Scenario SLs calculated using the USEPA RSL Calculator provided in the August 2023 OSD Memorandum for Tap Water using an HQ = 0.1.
Bolded values denote detected concentrations.
Highlighted values indicate an exceedance of the SL.
(D) = Field duplicate sample.
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
U = The analyte was analyzed for, but not detected above the reported sample quantitation limit.

6.4 BLACKSTONE ARMY AIRFIELD BURN PITS (EBS-103) AOPI

The following subsections describe the background, sampling results, CSM, and recommendation for the Blackstone Army Airfield Burn Pits AOPI.

6.4.1 AOPI Background

The Blackstone Army Airfield Burn Pits AOPI is located directly north of the Airfield adjacent to an unnamed gravel road off Dominy Cor Road, on LRA-owned property. The Blackstone Army Airfield Burn Pits were used for fire training activities until approximately 1989. Flammable liquids were reportedly poured onto stagnant water in an unlined, clay-bottom pit and ignited. The pit was surrounded by a shallow, oil-stained clay berm (Weston Solutions 2002). Unknown amounts of AFFF were reportedly used during fire training activities several times per year, but it is unknown when the Burn Pits were first used for training exercises (AECOM 2020). Former Fire Chiefs confirmed use of AFFF at the Burn Pits during training exercises. The area has been excavated multiple times to address VOCs, polynuclear aromatic hydrocarbons, total petroleum hydrocarbons, and metal contamination (Weston Solutions 2002). Approximately 1,000 tons of soil were removed from in and around the Burn Pits during an IRA in October 2000 (Weston 2001); however, exact locations of excavation are unknown. There are no land use restrictions at this AOPI.

6.4.2 SI Sampling and Results

Soil and groundwater samples were collected from the Blackstone Army Airfield Burn Pits AOPI at the following locations (Figure 6-7):

- Nine soil samples and one QC duplicate sample were collected from three soil borings (FPK-PBT-01, FPK-BPT-02, and FPK-BPT-03). All three soil borings were within the suspected release area. One surface soil and two subsurface soil samples were collected from each boring.
- Three groundwater samples were collected from three DPT groundwater locations (FPK-BPT-01, FPK-BPT-02, and FPK-BPT-03). All three groundwater sample locations were located within the suspected release area.

The Target PFAS analytical results for soil and groundwater samples collected at the Blackstone Army Airfield Burn Pits AOPI are summarized below and presented in Table 6-3 and Figure 6-8. Surface water and sediment are not present at this AOPI.

6.4.2.1 Soil

PFOS, PFOA, PFBA, PFHxA, PFHxS, PFNA, and PFBS were detected in soil samples at the Blackstone Army Airfield Burn Pits AOPI. PFOS was detected in surface soil at an estimated concentration of 47 µg/kg at FPK-BPT-02 and 31 µg/kg at FPK-BPT-03, both of which exceed the SL of 13 µg/kg. In addition, PFOS was detected at concentrations less than the SL in surface soil and subsurface soil (28 to 30 feet bgs) at FPK-BPT-01, subsurface soil (12 to 14 feet bgs) at FPK-BPT-02, and in subsurface soil (28 to 30 feet bgs) at FPK-BPT-03.

PFHxA and PFHxS were detected at concentrations less than the SLs in surface and subsurface soil samples at FPK-BPT-02 and FPK-BPT-03. In addition, PFHxA and PFHxS were detected at concentrations less than the SLs in subsurface soil samples at the deepest interval (28 to 30 feet bgs) at FPK-BPT-01.

PFOA was detected at estimated concentrations less than the SL in surface soil at FPK-BPT-02 and FPK-BPT-03 and subsurface soil at all three soil boring locations.

PFNA was detected in surface soil at concentrations less than the SL at FPK-BPT-02 and FPK-BPT-03.

PFBA and PFBS were detected at concentrations less than the SLs in the deepest subsurface soil interval (28 to 30 feet bgs) at FPK-BPT-01. In addition, PFBA was detected at concentrations less than the SL in surface soil and subsurface soil (23 to 25 feet bgs) at FPK-BPT-02.

HFPO-DA was not detected at concentrations greater than the LOD in any soil samples collected at the Blackstone Army Airfield Burn Pits AOPI.

6.4.2.2 Groundwater

PFOS, PFOA, PFBA, PFHxA, PFHxS, PFNA, and PFBS were detected in groundwater samples collected at the Blackstone Army Airfield Burn Pits AOPI. PFOS, PFOA, PFHxA, PFHxS, and PFBS were detected at concentrations greater than the SLs in groundwater samples collected from within the suspected release area at DPT groundwater location FPK-BPT-01. PFOA, PFHxA, and PFHxS were detected at concentrations greater than the SLs in groundwater samples collected from within the suspected release area at DPT groundwater location FPK-BPT-02. PFOS, PFOA, PFNA, and PFHxS were detected at concentrations greater than the SLs in groundwater samples collected from within the suspected release area at DPT groundwater location FPK-BPT-03.

PFOS was detected at concentrations exceeding the groundwater SL of 4 ng/L at FPK-BPT-01 and FPK-BPT-03, with concentrations of 8,400 J ng/L (estimated) and 200 ng/L, respectively. PFOS was not detected at a concentration greater than the LOD at FPK-BPT-02.

PFOA was detected at concentrations exceeding the groundwater SL of 6 ng/L at all three locations, with concentrations of 5,400, 1,800, and 41 ng/L at FPK-BPT-01, FPK-BPT-02, and FPK-BPT-03, respectively.

PFHxA was detected at concentrations greater than the groundwater SL of 990 ng/L at FPK-BPT-01 and FPK-BPT-02, with concentrations of 6,500 and 1,500 ng/L, respectively. In addition, PFHxA was detected at a concentration less than the SL at FPK-BPT-03. PFHxS was detected at concentrations exceeding the SL of 39 ng/L at all three locations, with concentrations of 39,000, 13,000, and 650 ng/L at FPK-BPT-01, FPK-BPT-02, and FPK-BPT-03, respectively.

PFNA was detected at concentrations exceeding the SL of 6 ng/L at DPT groundwater location FPK-BPT-03 at 140 ng/L. PFNA was not detected at concentrations greater than the LOD at DPT groundwater locations FPK-BPT-01 and FPK-BPT-02.

PFBS was detected at a concentration exceeding the groundwater SL of 601 ng/L at FPK-BPT-01 at 3,800 ng/L. In addition, PFBS was detected at concentrations less than the SL at DPT groundwater locations FPK-BPT-02 and FPK-BPT-03.

PFBA was detected at concentrations greater than the LOD but less than the SL at all three groundwater sample locations.

HFPO-DA was not detected at concentrations greater than the LOD in any groundwater samples collected at the Blackstone Army Airfield Burn Pits AOPI.

6.4.3 CSM

The Blackstone Army Airfield Burn Pits AOPI is approximately 1.62 acres and currently consists of largely undeveloped, undisturbed, old growth, southern mixed forest. A partial clearing in the wooded area indicates where suspected fire training activities and excavations historically occurred. According to historical aerial photographs, the area was used beginning in at least the 1960s as indicated by heavy ground scarring. The ground surface elevation is approximately 435 feet amsl. Historically, a manmade ditch channeled overflow during storm events from the Burn Pits to a small, intermittent creek (Weston Solutions 2002), which is no longer identifiable at the AOPI. An unknown number of excavations of the area have occurred since the early 1990s, and several concrete structures of unknown purpose were observed during the site visit. The Blackstone Army Airfield Burn Pits AOPI property is currently unused and owned by the LRA.

Shallow subsurface geology at the Blackstone Army Airfield Burn Pits AOPI is composed of weathered metamorphic and igneous bedrock (i.e., saprolite). Shallow groundwater was encountered at approximately 25 to 32 feet bgs during the SI and flows northeast at the AOPI.

The primary release mechanism is the potential release of AFFF to surface soils from fire training activities at the Blackstone Army Airfield Burn Pits AOPI. The secondary contaminant migration and fate and transport considerations include downward contaminant migration from surface soil to subsurface soil and groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff and discharge/recharge to groundwater and surface water.

Based on the land use at this AOPI, the human receptors considered in the CSM are onsite workers with the potential to work at the AOPI and offsite residents living in the vicinity of Fort Pickett BRAC.

The ingestion and dermal contact exposure pathways for surface soil are complete for onsite workers because Target PFAS were detected in surface soil at concentrations greater than the SLs at the Blackstone Army Airfield Burn Pits AOPI. The surface soil inhalation exposure pathway for onsite workers is potentially complete because no toxicity information is available for the inhalation route. Because Target PFAS were detected in subsurface soil at concentrations less than the SLs and in groundwater at concentrations greater than the SLs, and there are no restrictions on intrusive activity at the AOPI, the subsurface soil exposure pathways for onsite workers are potentially complete. Soil exposure pathways for offsite residents are considered incomplete because migration of soil from the AOPI is not expected.

Although onsite groundwater is not currently used and drinking water at Fort Pickett is supplied by the town of Blackstone, sourced from Nottoway Reservoir, no restrictions are in place that prevent the use or consumption of groundwater onsite. Target PFAS were detected in groundwater at concentrations greater than the SLs; however, the groundwater exposure pathways for onsite workers are potentially complete because the depth to shallow groundwater is greater than 15 feet bgs. Due to the presence of wells within 4 miles of Fort Pickett, the groundwater exposure pathways for offsite residents are potentially complete.

Figure 6-9 presents the CSM for the Blackstone Army Airfield Burn Pits AOPI.

6.4.4 Recommendation

Detected concentrations of Target PFAS in soil and groundwater at the Blackstone Army Airfield Burn Pits AOPI exceed the SLs; therefore, further investigation is recommended.

Table 6-3. Target PFAS Results and Screening for the Blackstone Army Airfield Burn Pits (EBS-103) AOPI

Location ID	Sample ID	Sample Type	Depth (ft)	Sample Date	HFPO-DA or GenX	PFBA	PFBS	PFHxA	PFHxS	PFNA	PFOA	PFOS
Soil				**Units**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
				Screening Levels	**23**	**7800**	**1900**	**3200**	**130**	**19**	**19**	**13**
FPK-BPT-01	PKBPT01-SS01	SURF	0.00-1.00	06/19/2023	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 UJ	**0.23**
	PKBPT01-SB02	BORE	14.00-16.00	06/19/2023	0.070 U	0.070 U	0.070 U	0.070 U	0.070 U	0.070 U	0.070 UJ	0.070 U
	PKBPT01-SB03	BORE	28.00-30.00	06/19/2023	0.058 U	**0.70**	**1.7**	**2.9**	**15**	0.058 U	**1.3 J+**	**1.5**
FPK-BPT-02	PKBPT02-SS01	SURF	0.00-1.00	06/19/2023	0.072 U	**0.20**	0.072 U	**0.41**	**3.7**	**0.45**	**0.51 J+**	**47 J**
	PKBPT02-SB02	BORE	12.00-14.00	06/19/2023	0.086 U	0.086 U	0.086 U	**0.22**	**4.0**	0.086 U	**2.3 J+**	**1.3**
	PKBPT02-SB03	BORE	23.00-25.00	06/19/2023	0.080 U	**0.13 J**	0.080 U	**0.55**	**8.4**	0.080 U	**0.81 J+**	0.080 U
FPK-BPT-03	PKBPT03-SS01	SURF	0.00-1.00	06/19/2023	0.070 U	0.070 U	0.070 U	**0.25**	**1.4**	**0.14**	**0.23 J+**	**31**
	PKBPT03-SB02	BORE	14.00-16.00	06/19/2023	0.070 U	0.070 U	0.070 U	**0.14 J**	**7.9**	0.070 U	**0.35 J+**	0.070 U
	PKBPT03-SB02FD	BORE	14.00-16.00 (D)	06/19/2023	0.071 U	0.071 U	0.071 U	**0.20**	**8.9**	0.071 U	**0.40 J+**	0.071 U
	PKBPT03-SB03	BORE	28.00-30.00	06/19/2023	0.058 U	0.058 U	0.058 U	**0.21**	**0.76**	0.058 U	0.058 UJ	**0.50**
Groundwater				**Units**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
				Screening Levels	**6**	**1800**	**600**	**990**	**39**	**5.9**	**6**	**4**
FPK-BPT-01	PKBPT01-GW01	WELL	34.00-34.00	06/19/2023	200 U	**1700**	**3800**	**6500**	**39000**	200 U	**5400**	**8400 J**
FPK-BPT-02	PKBPT02-GW01	WELL	29.00-29.00	06/19/2023	100 U	**240**	**200**	**1500**	**13000**	100 U	**1800**	100 U
FPK-BPT-03	PKBPT03-GW01	WELL	34.00-34.00	06/19/2023	0.96 U	**19**	**58**	**120**	**650**	**140**	**41**	**200**

The SLs are the Residential Scenario SLs calculated using the USEPA RSL Calculator provided in the August 2023 OSD Memorandum for Tap Water using an HQ = 0.1.
Bolded values denote detected concentrations.
Highlighted values indicate an exceedance of the SL.
(D) = Field duplicate sample.
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
J+ = The analyte was positively identified; the result is an estimated concentration and may be biased high.
U = The analyte was analyzed for, but not detected above the reported sample quantitation limit.
UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte.

7. CONCLUSIONS AND RECOMMENDATIONS

An SI is conducted when the PFAS PA determines an AOPI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multimedia sampling at AOPIs to determine whether a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required (40 CFR §300.420(5)). This SI Report used the findings from the PFAS PA in conjunction with soil, groundwater, surface water, and sediment sampling data for each AOPI to determine whether Target PFAS have been released to the environment and whether a release has affected or may affect specific human health targets.

Before the SI sampling, a preliminary CSM was developed in the PFAS PA for each AOPI based on an evaluation of existing records, personnel interviews, and site reconnaissance. The preliminary CSMs identified potential human receptors and exposure pathways for groundwater and surface water that is known to be used, or could realistically be used in the future, as a source of drinking water and identified potential soil and sediment exposure pathways. All three AOPIs were sampled during the SI at the Fort Pickett BRAC property to further evaluate PFAS-related releases and identify the presence or absence of Target PFAS.

PFOS was detected at concentrations greater than the SLs in soil collected at both the Former Fire Station and Extinguisher Building (Buildings 460 and 484) and Blackstone Army Airfield Burn Pits AOPIs. PFOA, PFBA, PFHxA, PFHxS, PFNA, and/or PFBS were detected at concentrations less than the SLs at all of the AOPIs. HFPO-DA was not detected at concentrations greater than the LOD in any soil samples.

Target PFAS were detected in samples collected from all 10 groundwater sample locations, with concentrations of PFOS, PFOA, PFHxA, PFHxS, PFNA, and PFBS all exceeding the SLs at one or more location. The highest concentrations of Target PFAS were detected at the Blackstone Army Airfield Burn Pits AOPI. HFPO-DA was not detected at concentrations greater than the LOD in any samples.

Detected concentrations of PFOS, PFOA, PFHxS, and PFNA in surface water samples exceeded the SLs at both the Former Fire Station and Extinguisher Building (Buildings 460 and 484) and Material and Chemical Storage (Building 493 and Storage Yard) AOPIs. PFBA, PFHxA, and PFBS were detected at concentrations less than the SLs in all surface water samples. PFOS was detected in sediment at concentrations greater than the SL at both the Former Fire Station and Extinguisher Building (Buildings 460 and 484) and Material and Chemical Storage (Building 493 and Storage Yard) AOPIs. PFOA, PFBA, PFBS, PFHxA, PFHxS, and PFNA were detected at concentrations less than the SLs in all sediment samples. HFPO-DA was not detected at concentrations greater than the LOD in any surface water or sediment samples.

The CSMs were updated for each AOPI where Target PFAS were detected at concentrations greater than the LODs. The updated CSMs detail site geological conditions; determine primary and secondary release mechanisms; identify potential human receptors; and detail complete, potentially complete, and incomplete exposure pathways for current and reasonably anticipated future exposure scenarios.

Complete onsite surface soil ingestion and dermal contact exposure pathways are present at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) and Blackstone Army Airfield Burn Pits AOPIs because Target PFAS were detected at concentrations greater than the SLs. The inhalation exposure pathway at both AOPIs is considered potentially complete because there is no toxicity information available for the inhalation route. The surface soil exposure pathways are considered potentially complete at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI because Target PFAS were detected in soil or exceeded the SLs in groundwater, as the SL exceedances in groundwater could indicate a source in soil that has not been identified.

The subsurface soil exposure pathways at all three AOPIs are considered potentially complete because Target PFAS were detected in soil or exceeded the SLs in groundwater, as the SL exceedances in groundwater could indicate a source in soil that has not been identified.

Due to exceedances of the groundwater SLs, the onsite groundwater exposure pathway is considered complete at the Material and Chemical Storage (Building 493 and Storage Yard) AOPI. Because the depth to shallow groundwater is greater than 15 feet bgs at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) and Blackstone Army Airfield Burn Pits AOPIs, the groundwater exposure pathways for onsite workers are potentially complete. An onsite potable groundwater source does not exist; therefore, the groundwater exposure pathways for onsite recreators are incomplete at the Former Fire Station and Extinguisher Building (Buildings 460 and 484) and Material and Chemical Storage (Building 493 and Storage Yard) AOPIs. The groundwater exposure pathways for offsite residents are potentially complete for all three AOPIs due to the potential for migration to offsite groundwater wells in the vicinity of Fort Pickett.

Due to exceedances of the SLs, the onsite surface water and sediment exposure pathways are considered complete for both the Former Fire Station and Extinguisher Building (Buildings 460 and 484) and Material and Chemical Storage (Building 493 and Storage Yard) AOPIs. The surface water and sediment exposure pathways for offsite residents are potentially complete for both AOPIs because surface water flows from the AOPI toward the Nottoway River.

SI sampling results were compared to the OSD risk-based SLs presented in Section 5 to determine if further investigation is warranted at each AOPI as follows:

- If the maximum detected concentration for a given analyte in soil or groundwater exceeds the SL, it is concluded that further investigation is warranted.
- If the maximum detected concentration is less than the SL, it is concluded that further investigation is not warranted.

Table 7-1 summarizes the conclusions and recommendations for each AOPI. All three AOPIs are recommended for further investigation or evaluation:

- Former Fire Station and Extinguisher Building (Buildings 460 and 484)
- Material and Chemical Storage (Building 493 and Storage Yard)
- Blackstone Army Airfield Burn Pits.

Table 7-1. Summary of PFAS Detected and Recommendations

AOPI	Detection of HFPO-DA, PFBA, PFBS, PFHxA, PFHxS, PFNA, PFOS, and/or PFOA				Recommendation and Rationale
	Groundwater	Soil	Surface Water	Sediment	
Former Fire Station and Extinguisher Building (Buildings 460 and 484)	Exceeds SL	Exceeds SL	Exceeds SL	Exceeds SL	SLs exceeded in groundwater, soil, surface water, and sediment; further investigation recommended
Material and Chemical Storage (Building 493 and Storage Yard)	Exceeds SL	Detected	Exceeds SL	Exceeds SL	SLs exceeded in groundwater, surface water, and sediment; further investigation recommended
Blackstone Army Airfield Burn Pits (EBS-103)	Exceeds SL	Exceeds SL	--	--	SLs exceeded in groundwater and soil; further investigation recommended

– Not Collected

8. REFERENCES

AECOM. 2020. *Final Preliminary Assessment Report, Fort Pickett, Virginia: Perfluorooctane-Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites, ARNG Installations, Nationwide*. May.

ASTM (ASTM International). 2017. ASTM D2488, 2017 Edition, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedures)*. July 15.

Carey, C.S., E.D. Wolf, and V.R. Emrick. 2017. *Freshwater Mussel Assessment in the Upper Nottoway River and its Tributaries on Fort Pickett, VA*. The Conservation Management Institute College of Natural Resources and Environment Virginia Polytechnic Institute and State University. September. Available online at: https://vtechworks.lib.vt.edu/bitstream/handle/10919/64000/FreshwaterMussels_FortPickett_CMI2014.pdf?sequence=2&isAllowed=y.

Dewberry & Davis. 2009. *Nottoway Water Supply Plan, Final Report*. October 26.

DoD (U.S. Department of Defense). 2020. *Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15*. Environmental Data Quality Working Group. May.

DoD. 2021. *Quality Systems Manual for Environmental Laboratories.* Version 5.4.

DoD. 2022. *Data Validation Guidelines Modules 1, 2, 3, and 4 Revised Table for Sample Qualification in the Presence of Blank Contamination.* February.

DoD. 2023. *Memorandum for Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program*. August 24.

EA (EA Engineering, Science, and Technology, Inc.). 2004. *Final Phase II RI/FS Report Addendum, EBS-79, Fort Pickett, Virginia.* July.

eBird. 2022. Fort Pickett Military Installation (Restricted Access) Species Sightings Checklist. Available online at: https://ebird.org/hotspot/L10284606?yr=all&m=&rank=hc.

EDR (Environmental Data Resources, Inc.). 2021. *EDR Report for Fort Pickett*.

ITRC (Interstate Technology & Regulatory Council). 2022. Sampling Precautions and Laboratory Analytical Methods for Transport Per- and Polyfluoroalkyl Substances (PFAS). Available online at: https://pfas-1.itrcweb.org/wp-content/uploads/2022/09/Sampling_and_Lab_PFAS_Fact-Sheet_082522_508.pdf.

Klopfer, S.D. and A.E. Kane. 2017. Develop Resources for Natural Resource Managers to Integrate Downscaled SWAP Information with INRMPs: Case Study for Military Training Center Fort Pickett. September 27. Available online at: https://denix.osd.mil/legacy/nr-legacy-project-deliverables/fy2016-fy2017/deliverable/case-study-pickett/.

Leidos. 2022a. *Programmatic Uniform Federal Policy-Quality Assurance Project Plan, Per- and Polyfluoroalkyl Substances Site Inspections at Multiple Base Realignment and Closure Installations, Nationwide*. Final. June.

Leidos. 2022b. *Programmatic Accident Prevention Plan (APP) for Preliminary Assessments/Site Inspections (PA/SIs) of Per- and Polyfluoroalkyl Substances (PFAS) at Multiple Base Realignment and Closure (BRAC) Installations, Nationwide.* Final. March.

Leidos. 2023a. *Per- and Polyfluoroalkyl Substances Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum at Fort Pickett BRAC, Blackstone, Virginia*. Final. June.

Leidos. 2023b. *Preliminary Assessment of Per- and Polyfluoroalkyl Substances at Fort Pickett BRAC, Blackstone, Virginia*. Final. November.

Matrix. 2021. *Army National Guard Maneuver Training Center Fort Pickett Joint Land Use Study: Public Draft Background Report.* March.

MDEQ (Michigan Department of Environmental Quality). 2018. *General PFAS Sampling Guidance.* Revised. October 16.

Nottoway GIS. 2022. Nottoway County Timmons Group Web LoGIStics. Available online at: https://nottowaygis.timmons.com/#/mwl.

NWI (National Wetlands Inventory). 2022. Wetlands Mapper. Accessed November 28, 2022. Available online at: https://www.fws.gov/wetlands/Data/Mapper.html.

Smith, T. 2017. Fort Pickett Herpetological Survey. Available online at: https://www.inaturalist.org/projects/fort-pickett-herpetological-survey?tab=about.

Tetra Tech (Tetra Tech, Inc.). 2005. *Final Remedial Action Report for the Final Action at EBS-13 Salvage Yard, Fort Pickett, Virginia.* October 7.

U.S. Army. 2005a. *Final Finding of Suitability to Transfer (FOST), Fort Pickett, Virginia, Former Recycling Center – EBS-13 (31 Acre Parcel) To Local Redevelopment Authority, Nottoway County, Virginia.* May.

U.S. Army. 2005b. *Final Finding of Suitability to Transfer (FOST), Fort Pickett, Virginia, To Local Redevelopment Authority, Nottoway County, Virginia: Former Fuel Station #1, BCT-22.* May.

U.S. Army. 2018. *Army Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances*. September 4. Available online at: https://www.fedcenter.gov/admin/itemattachment.cfm?attachmentid=1150.

U.S. Army. 2020. *Legacy Base Realignment and Closure Installations Conveyance Progress Reports*. October.

U.S. Census Bureau. 2021. Blackstone and Nottoway County Population. Available online at: https://www.census.gov/search-results.html?searchType=web&cssp=SERP&q=Blackstone%20town,%20Virginia.

USACE (U.S. Army Corps of Engineers). 1997. *U.S. Department of Defense Program Base Realignment and Closure: Ordnance and Explosives Chemical Warfare Materials Archives Search Report, Fort Pickett*. April.

USACE. 1998. *Final Environmental Assessment for BRAC 95 Disposal and Reuse of Fort Pickett, Virginia*. September.

USACE. 2005. *Quitclaim Deed, Former Fort Pickett Military Installation, Nottoway County, Virginia, Parcel No. BCT-22*. October 6.

USEPA (U.S. Environmental Protection Agency). 2005. *Groundwater Sampling and Monitoring with Direct Push Technologies*. EPA 540/R-04/005. August.

USFWS (U.S. Fish and Wildlife Service). 2022. Environmental Conservation Online System for Information for Planning and Consultation (IPaC) website. Accessed November 28, 2002. Available online at: https://ecos.fws.gov/ipac/.

Va DWR (Virginia Department of Wildlife Resources). 2022. Fort Pickett Reservoir Report 2022. Hunter Hatcher Fisheries Biologist Farmville Field Office. Available online at: https://dwr.virginia.gov/wp-content/uploads/media/Ft-Pickett-Res-2022-Popular-Report.pdf.

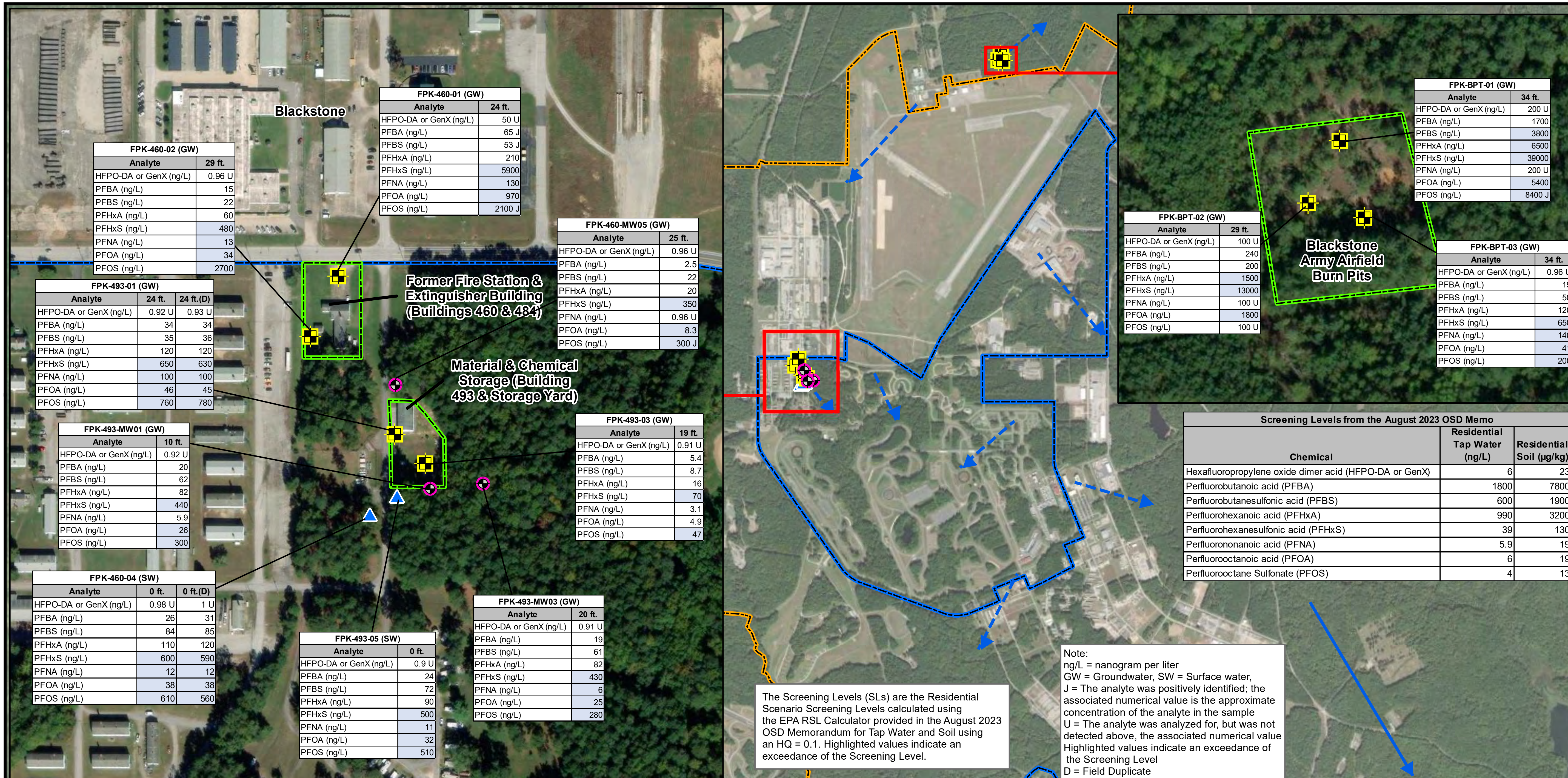
Weather Spark 2022. Climate and Average Weather Year- Round in Blackstone. Available online at: https://weatherspark.com/y/20876/Average-Weather-in-Blackstone-Virginia-United-States-Year-Round. Accessed on May 23, 2022.

Weston (Roy F. Weston, Inc.). 2001. *Final Remedial Investigation Report for EBS-103, Fort Pickett, Virginia*. June.

Weston Solutions (Weston Solutions, Inc.). 2002. *Decision Document EBS-103 Parcel, Fort Pickett Army Garrison, Blackstone, Virginia*. September 25.

Woodward Clyde. 1997. *Environmental Baseline Survey Report Fort Pickett, Virginia*. U.S. Army Base Realignment and Closure 95 Program. February.

FIGURES



FPK-460-01 (GW)

Analyte	24 ft.
HFPO-DA or GenX (ng/L)	50 U
PFBA (ng/L)	65 J
PFBS (ng/L)	53 J
PFHxA (ng/L)	210
PFHxS (ng/L)	5900
PFNA (ng/L)	130
PFOA (ng/L)	970
PFOS (ng/L)	2100 J

FPK-460-02 (GW)

Analyte	29 ft.
HFPO-DA or GenX (ng/L)	0.96 U
PFBA (ng/L)	15
PFBS (ng/L)	22
PFHxA (ng/L)	60
PFHxS (ng/L)	480
PFNA (ng/L)	13
PFOA (ng/L)	34
PFOS (ng/L)	2700

FPK-460-MW05 (GW)

Analyte	25 ft.
HFPO-DA or GenX (ng/L)	0.96 U
PFBA (ng/L)	2.5
PFBS (ng/L)	22
PFHxA (ng/L)	20
PFHxS (ng/L)	350
PFNA (ng/L)	0.96 U
PFOA (ng/L)	8.3
PFOS (ng/L)	300 J

FPK-493-01 (GW)

Analyte	24 ft.	24 ft.(D)
HFPO-DA or GenX (ng/L)	0.92 U	0.93 U
PFBA (ng/L)	34	34
PFBS (ng/L)	35	36
PFHxA (ng/L)	120	120
PFHxS (ng/L)	650	630
PFNA (ng/L)	100	100
PFOA (ng/L)	46	45
PFOS (ng/L)	760	780

FPK-493-MW01 (GW)

Analyte	10 ft.
HFPO-DA or GenX (ng/L)	0.92 U
PFBA (ng/L)	20
PFBS (ng/L)	62
PFHxA (ng/L)	82
PFHxS (ng/L)	440
PFNA (ng/L)	5.9
PFOA (ng/L)	26
PFOS (ng/L)	300

FPK-493-03 (GW)

Analyte	19 ft.
HFPO-DA or GenX (ng/L)	0.91 U
PFBA (ng/L)	5.4
PFBS (ng/L)	8.7
PFHxA (ng/L)	16
PFHxS (ng/L)	70
PFNA (ng/L)	3.1
PFOA (ng/L)	4.9
PFOS (ng/L)	47

FPK-460-04 (SW)

Analyte	0 ft.	0 ft.(D)
HFPO-DA or GenX (ng/L)	0.98 U	1 U
PFBA (ng/L)	26	31
PFBS (ng/L)	84	85
PFHxA (ng/L)	110	120
PFHxS (ng/L)	600	590
PFNA (ng/L)	12	12
PFOA (ng/L)	38	38
PFOS (ng/L)	610	560

FPK-493-MW03 (GW)

Analyte	20 ft.
HFPO-DA or GenX (ng/L)	0.91 U
PFBA (ng/L)	19
PFBS (ng/L)	61
PFHxA (ng/L)	82
PFHxS (ng/L)	430
PFNA (ng/L)	6
PFOA (ng/L)	25
PFOS (ng/L)	280

FPK-493-05 (SW)

Analyte	0 ft.
HFPO-DA or GenX (ng/L)	0.9 U
PFBA (ng/L)	24
PFBS (ng/L)	72
PFHxA (ng/L)	90
PFHxS (ng/L)	500
PFNA (ng/L)	11
PFOA (ng/L)	32
PFOS (ng/L)	510

FPK-BPT-01 (GW)

Analyte	34 ft.
HFPO-DA or GenX (ng/L)	200 U
PFBA (ng/L)	1700
PFBS (ng/L)	3800
PFHxA (ng/L)	6500
PFHxS (ng/L)	39000
PFNA (ng/L)	200 U
PFOA (ng/L)	5400
PFOS (ng/L)	8400 J

FPK-BPT-02 (GW)

Analyte	29 ft.
HFPO-DA or GenX (ng/L)	100 U
PFBA (ng/L)	240
PFBS (ng/L)	200
PFHxA (ng/L)	1500
PFHxS (ng/L)	13000
PFNA (ng/L)	100 U
PFOA (ng/L)	1800
PFOS (ng/L)	100 U

FPK-BPT-03 (GW)

Analyte	34 ft.
HFPO-DA or GenX (ng/L)	0.96 U
PFBA (ng/L)	19
PFBS (ng/L)	58
PFHxA (ng/L)	120
PFHxS (ng/L)	650
PFNA (ng/L)	140
PFOA (ng/L)	41
PFOS (ng/L)	200

Screening Levels from the August 2023 OSD Memo

Chemical	Residential Tap Water (ng/L)	Residential Soil (µg/kg)
Hexafluoropropylene oxide dimer acid (HFPO-DA or GenX)	6	23
Perfluorobutanoic acid (PFBA)	1800	7800
Perfluorobutanesulfonic acid (PFBS)	600	1900
Perfluorohexanoic acid (PFHxA)	990	3200
Perfluorohexanesulfonic acid (PFHxS)	39	130
Perfluorononanoic acid (PFNA)	5.9	19
Perfluorooctanoic acid (PFOA)	6	19
Perfluorooctane Sulfonate (PFOS)	4	13

The Screening Levels (SLs) are the Residential Scenario Screening Levels calculated using the EPA RSL Calculator provided in the August 2023 OSD Memorandum for Tap Water and Soil using an HQ = 0.1. Highlighted values indicate an exceedance of the Screening Level.

Note:
ng/L = nanogram per liter
GW = Groundwater, SW = Surface water,
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample
U = The analyte was analyzed for, but was not detected above, the associated numerical value
Highlighted values indicate an exceedance of the Screening Level
D = Field Duplicate

Legend

- Areas of Potential Interest (AOPI)
- BRAC Boundary
- Installation/VAARNG Property Boundary
- Localized Groundwater Flow
- Regional Groundwater Flow
- DPT Groundwater Sample/Soil Boring (7)
- Surface Water (2)
- Sample Existing Well (3)

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey,

0 2,000 4,000
SCALE: 1" = 2,500'

STATE PLANE EAST (NAD83)

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SUMMARY OF TARGET PFAS IN GROUNDWATER AND SURFACE WATER
FORT PICKETT
BLACKSTONE, VIRGINIA

Figure ES-1 | DATE: 10/25/2023

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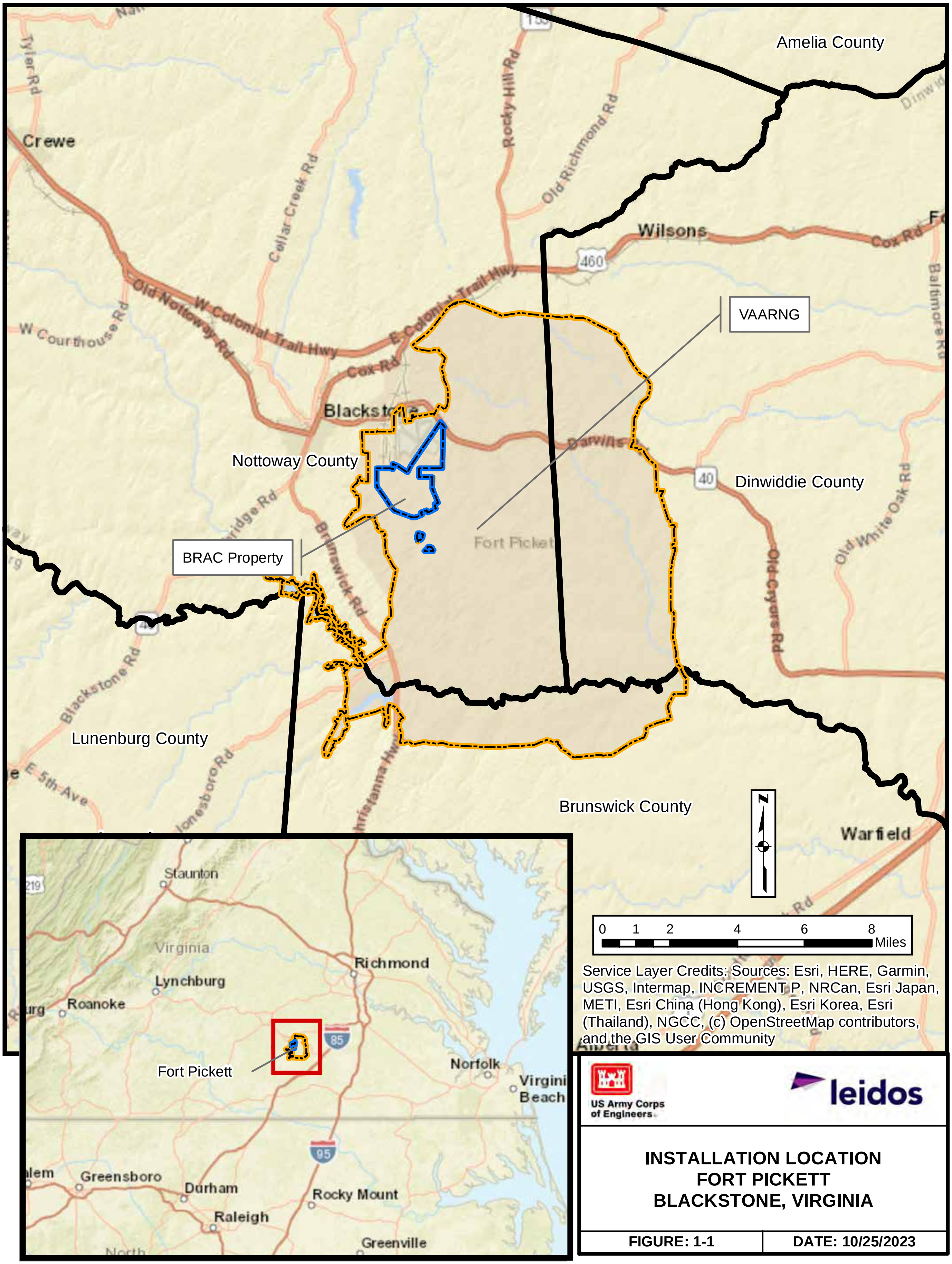

Document Path: C:\cad\21011\MXD\SI Results\Figure 1-1 Installation Location.mxd

US Army Corps of Engineers

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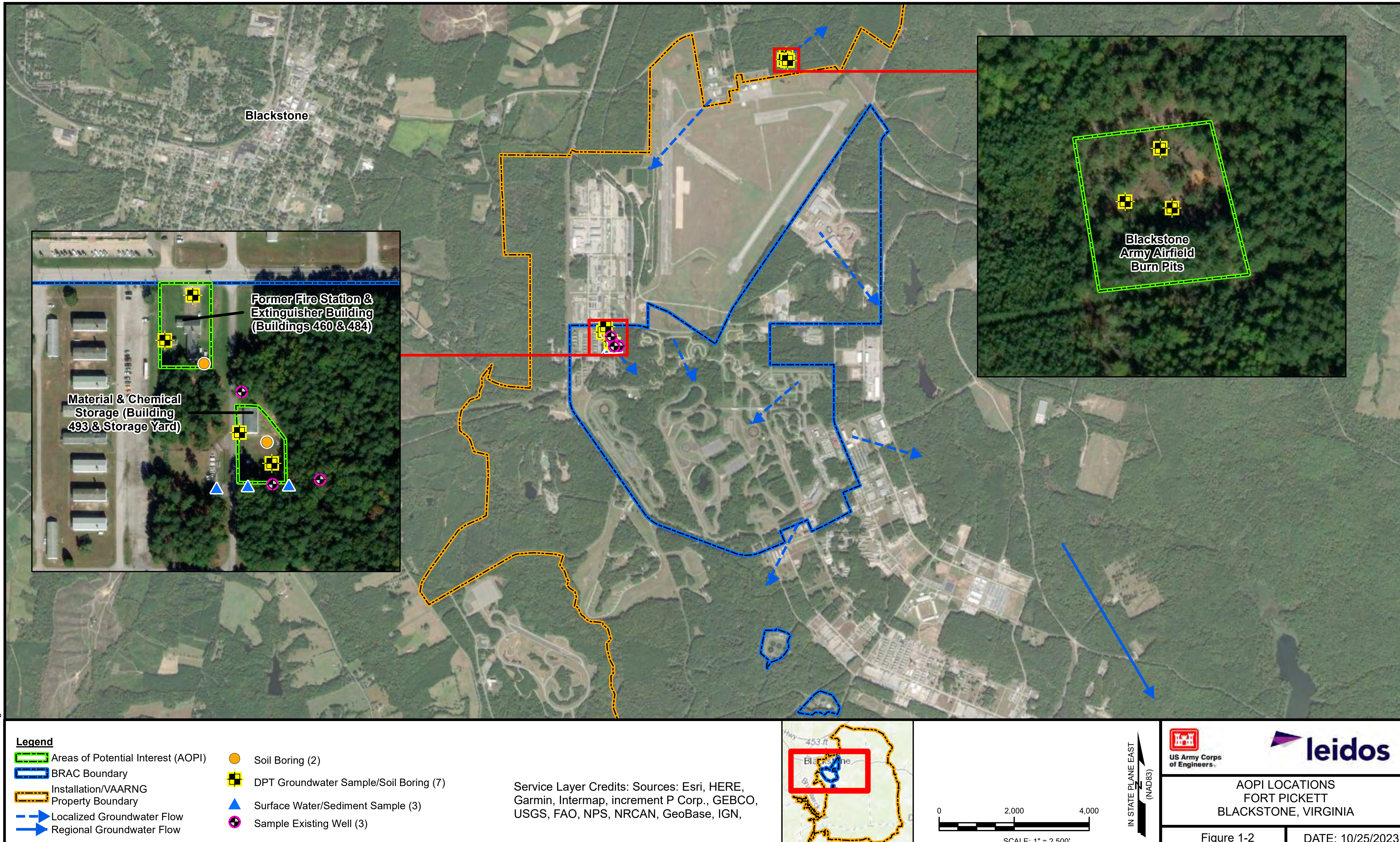
INSTALLATION LOCATION
FORT PICKETT
BLACKSTONE, VIRGINIA

FIGURE: 1-1	DATE: 10/25/2023



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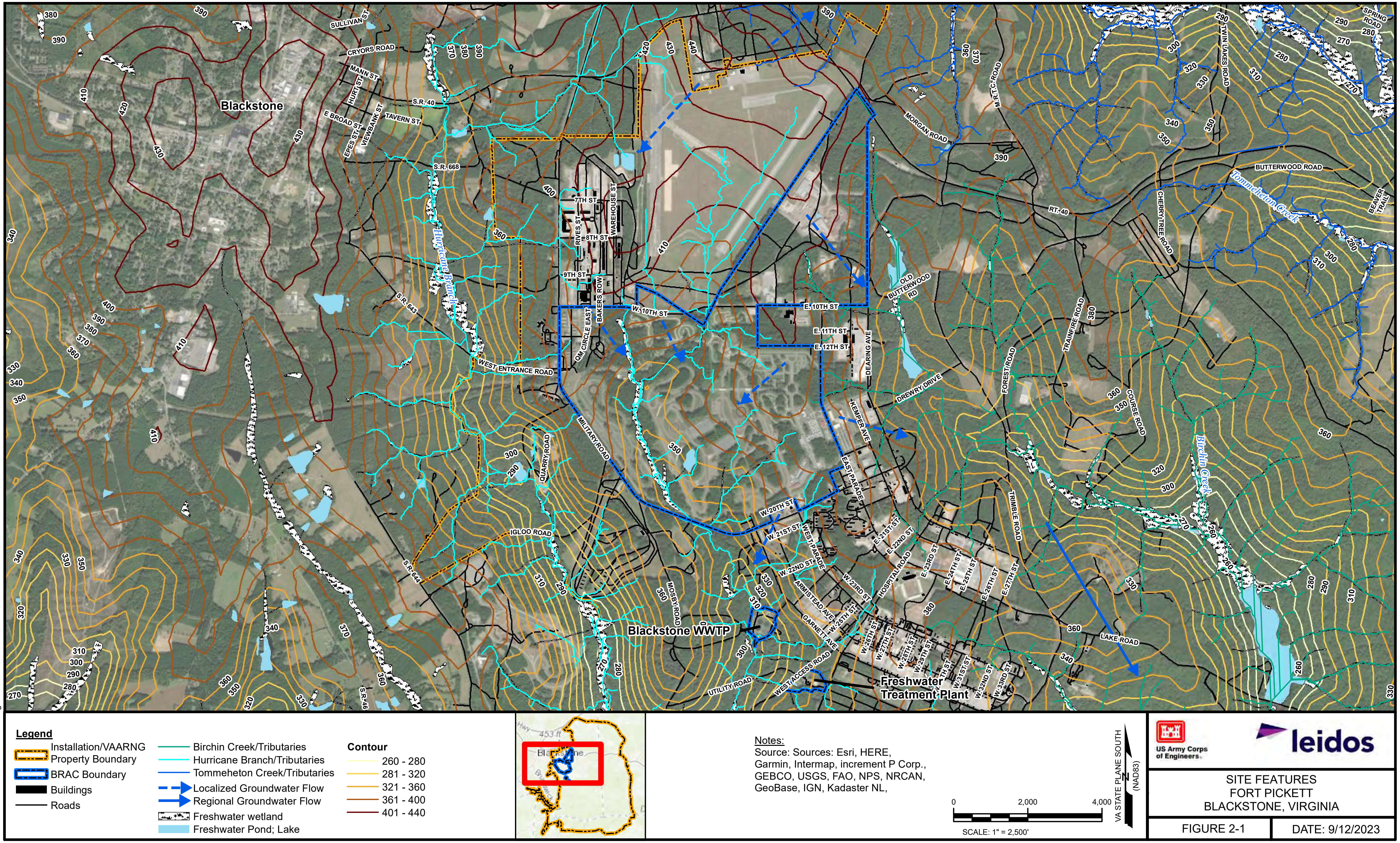

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FPK-460-01
Former Fire Station &
Extinguisher Building
(Buildings 460 & 484)
460
484
FPK-460-02
FPK-460-03
BAKERS ROW
FPK-460-MW05
QM CIRCLE EAST
Material & Chemical
Storage (Building
493 & Storage Yard)
FPK-460-04
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Legend
Monitoring Well
Areas of Potential Interest (AOPI)
BRAC Boundary
Installation/VAARNG Property Boundary
Groundwater Flow Direction
DPT Groundwater Sample/Soil Boring (2)
Surface Water/Sediment Sample (1)
Existing Well Sample (1)
Soil Boring (1)
Surface Water Flow Direction
0 25 50
SCALE:1 "= 50 '
VA STATE PLANE SOUTH (NAD83)
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US Army Corps of Engineers
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FORMER FIRE STATION AND EXTINGUISHER BUILDING (BUILDINGS 460 AND 484) AOPI SAMPLE LOCATIONS
FORT PICKETT
BLACKSTONE, VIRGINIA
FIGURE 6-1
DATE: 9/14/2023
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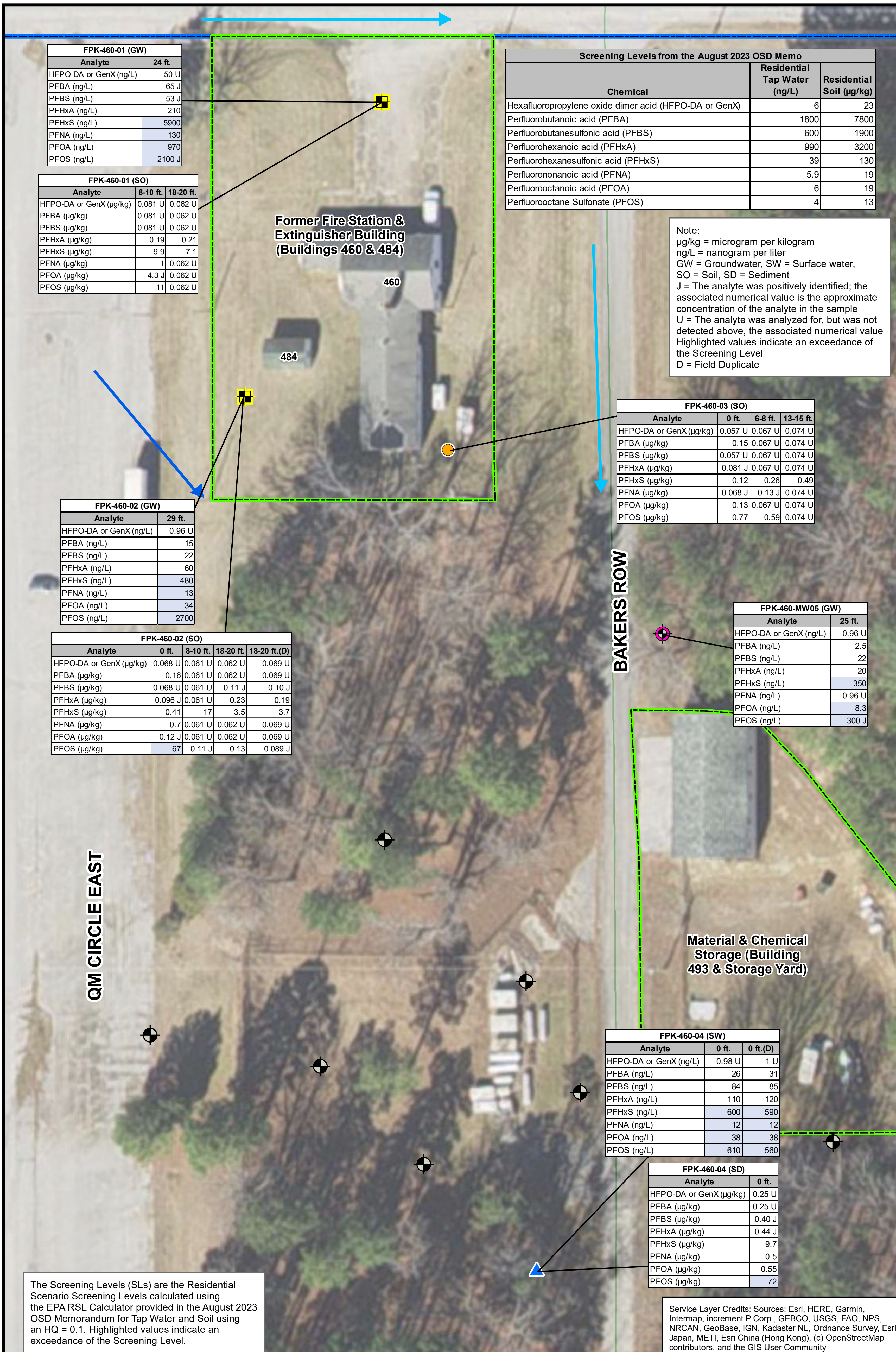

FPK-460-01 (GW)	
Analyte	24 ft.
HFPO-DA or GenX (ng/L)	50 U
PFBA (ng/L)	65 J
PFBS (ng/L)	53 J
PFHxA (ng/L)	210
PFHxS (ng/L)	5900
PFNA (ng/L)	130
PFOA (ng/L)	970
PFOS (ng/L)	2100 J

FPK-460-01 (SO)		
Analyte	8-10 ft.	18-20 ft.
HFPO-DA or GenX (µg/kg)	0.081 U	0.062 U
PFBA (µg/kg)	0.081 U	0.062 U
PFBS (µg/kg)	0.081 U	0.062 U
PFHxA (µg/kg)	0.19	0.21
PFHxS (µg/kg)	9.9	7.1
PFNA (µg/kg)	1	0.062 U
PFOA (µg/kg)	4.3 J	0.062 U
PFOS (µg/kg)	11	0.062 U

Screening Levels from the August 2023 OSD Memo		
Chemical	Residential Tap Water (ng/L)	Residential Soil (µg/kg)
Hexafluoropropylene oxide dimer acid (HFPO-DA or GenX)	6	23
Perfluorobutanoic acid (PFBA)	1800	7800
Perfluorobutanesulfonic acid (PFBS)	600	1900
Perfluorohexanoic acid (PFHxA)	990	3200
Perfluorohexanesulfonic acid (PFHxS)	39	130
Perfluorononanoic acid (PFNA)	5.9	19
Perfluorooctanoic acid (PFOA)	6	19
Perfluorooctane Sulfonate (PFOS)	4	13

Note:
µg/kg = microgram per kilogram
ng/L = nanogram per liter
GW = Groundwater, SW = Surface water,
SO = Soil, SD = Sediment
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample
U = The analyte was analyzed for, but was not detected above, the associated numerical value
Highlighted values indicate an exceedance of the Screening Level
D = Field Duplicate

FPK-460-03 (SO)			
Analyte	0 ft.	6-8 ft.	13-15 ft.
HFPO-DA or GenX (µg/kg)	0.057 U	0.067 U	0.074 U
PFBA (µg/kg)	0.15	0.067 U	0.074 U
PFBS (µg/kg)	0.057 U	0.067 U	0.074 U
PFHxA (µg/kg)	0.081 J	0.067 U	0.074 U
PFHxS (µg/kg)	0.12	0.26	0.49
PFNA (µg/kg)	0.068 J	0.13 J	0.074 U
PFOA (µg/kg)	0.13	0.067 U	0.074 U
PFOS (µg/kg)	0.77	0.59	0.074 U

FPK-460-02 (GW)	
Analyte	29 ft.
HFPO-DA or GenX (ng/L)	0.96 U
PFBA (ng/L)	15
PFBS (ng/L)	22
PFHxA (ng/L)	60
PFHxS (ng/L)	480
PFNA (ng/L)	13
PFOA (ng/L)	34
PFOS (ng/L)	2700

FPK-460-02 (SO)				
Analyte	0 ft.	8-10 ft.	18-20 ft.	18-20 ft.(D)
HFPO-DA or GenX (µg/kg)	0.068 U	0.061 U	0.062 U	0.069 U
PFBA (µg/kg)	0.16	0.061 U	0.062 U	0.069 U
PFBS (µg/kg)	0.068 U	0.061 U	0.11 J	0.10 J
PFHxA (µg/kg)	0.096 J	0.061 U	0.23	0.19
PFHxS (µg/kg)	0.41	17	3.5	3.7
PFNA (µg/kg)	0.7	0.061 U	0.062 U	0.069 U
PFOA (µg/kg)	0.12 J	0.061 U	0.062 U	0.069 U
PFOS (µg/kg)	67	0.11 J	0.13	0.089 J

FPK-460-MW05 (GW)	
Analyte	25 ft.
HFPO-DA or GenX (ng/L)	0.96 U
PFBA (ng/L)	2.5
PFBS (ng/L)	22
PFHxA (ng/L)	20
PFHxS (ng/L)	350
PFNA (ng/L)	0.96 U
PFOA (ng/L)	8.3
PFOS (ng/L)	300 J

FPK-460-04 (SW)		
Analyte	0 ft.	0 ft.(D)
HFPO-DA or GenX (ng/L)	0.98 U	1 U
PFBA (ng/L)	26	31
PFBS (ng/L)	84	85
PFHxA (ng/L)	110	120
PFHxS (ng/L)	600	590
PFNA (ng/L)	12	12
PFOA (ng/L)	38	38
PFOS (ng/L)	610	560

FPK-460-04 (SD)	
Analyte	0 ft.
HFPO-DA or GenX (µg/kg)	0.25 U
PFBA (µg/kg)	0.25 U
PFBS (µg/kg)	0.40 J
PFHxA (µg/kg)	0.44 J
PFHxS (µg/kg)	9.7
PFNA (µg/kg)	0.5
PFOA (µg/kg)	0.55
PFOS (µg/kg)	72

The Screening Levels (SLs) are the Residential Scenario Screening Levels calculated using the EPA RSL Calculator provided in the August 2023 OSD Memorandum for Tap Water and Soil using an HQ = 0.1. Highlighted values indicate an exceedance of the Screening Level.

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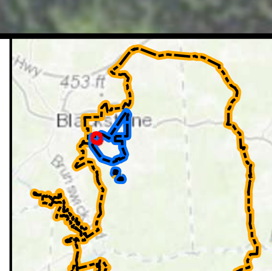
Legend
- Monitoring Well
- Areas of Potential Interest (AOPI)
- BRAC Boundary
- Installation/VAARNG Property Boundary
- Groundwater Flow Direction
- DPT Groundwater Sample/Soil Boring (2)
- Surface Water/Sediment Sample (1)
- Existing Well Sample (1)
- Soil Boring (1)
- Surface Water Flow Direction



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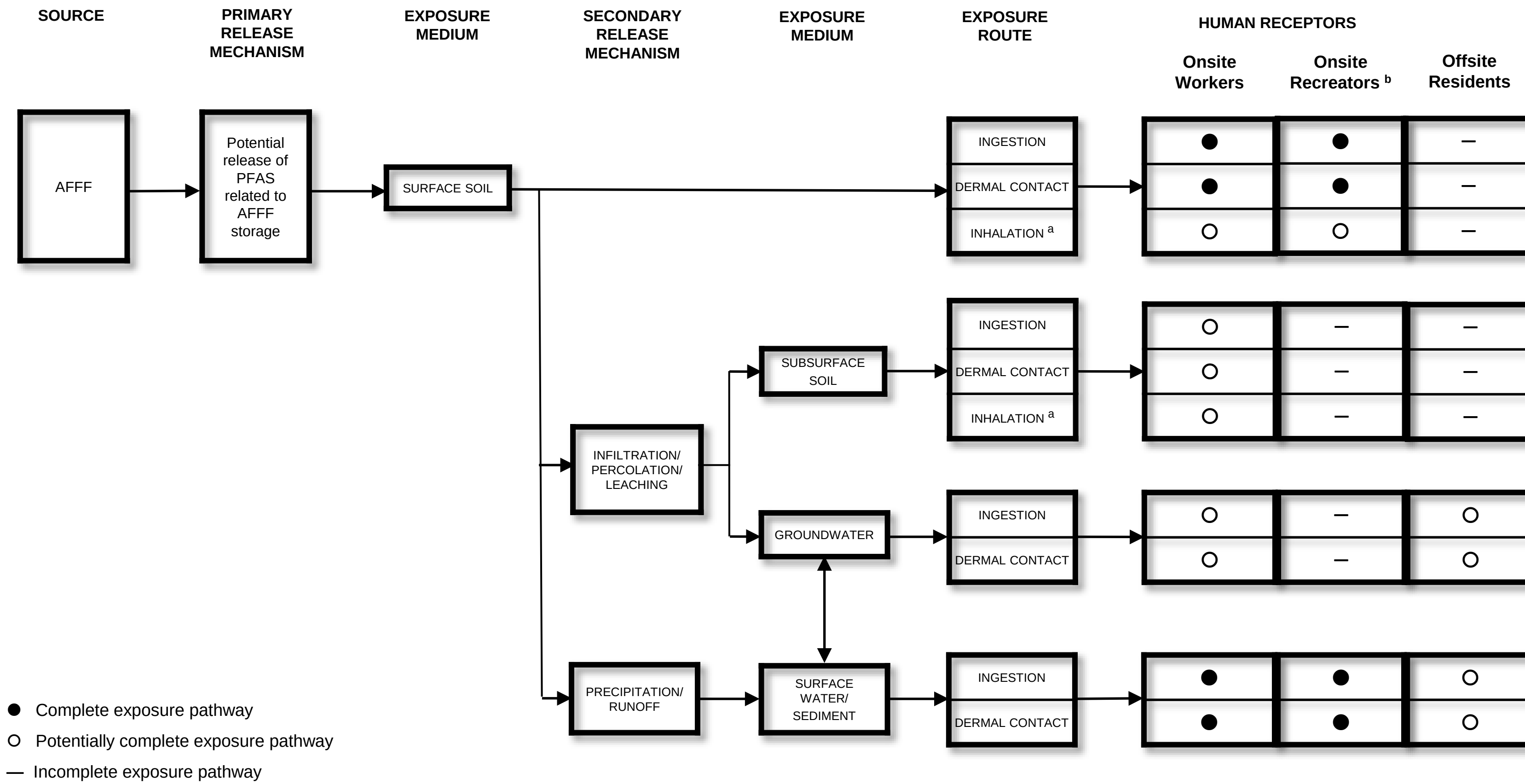
FORMER FIRE STATION AND EXTINGUISHER BUILDING (BUILDINGS 460 AND 484) AOPI SAMPLE RESULTS
FORT PICKETT
BLACKSTONE, VIRGINIA

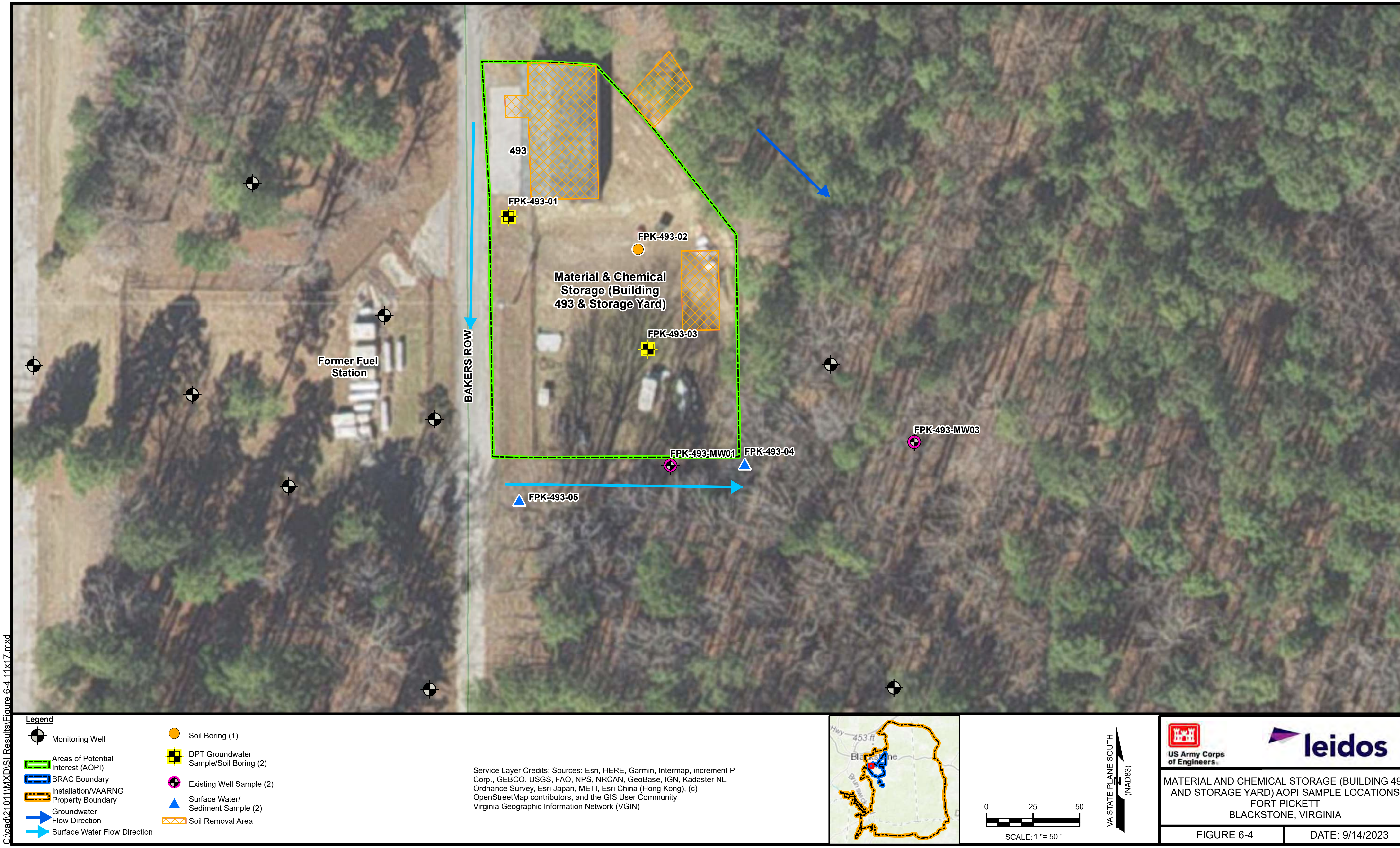
FIGURE 6-2 | DATE: 10/13/2023



[a] Inhalation of PFAS is considered potentially complete because no toxicity information is available for the inhalation route.

[b] No groundwater use restrictions; however, groundwater exposure pathways for recreators are incomplete because no onsite potable groundwater source exists.

Figure 6-3. Human Health CSM for Former Fire Station and Extinguisher Building (Buildings 460 and 484) AOPI



493
FPK-493-01
FPK-493-02
Material & Chemical Storage (Building 493 & Storage Yard)
FPK-493-03
Former Fuel Station
BAKERS ROW
FPK-493-MW03
FPK-493-MW01
FPK-493-04
FPK-493-05
C:\cad\21011\MXD\SI Results\Figure 6-4 11x17.mxd
Legend
Monitoring Well
Areas of Potential Interest (AOPI)
BRAC Boundary
Installation/VAARNG Property Boundary
Groundwater Flow Direction
Surface Water Flow Direction
Soil Boring (1)
DPT Groundwater Sample/Soil Boring (2)
Existing Well Sample (2)
Surface Water/ Sediment Sample (2)
Soil Removal Area
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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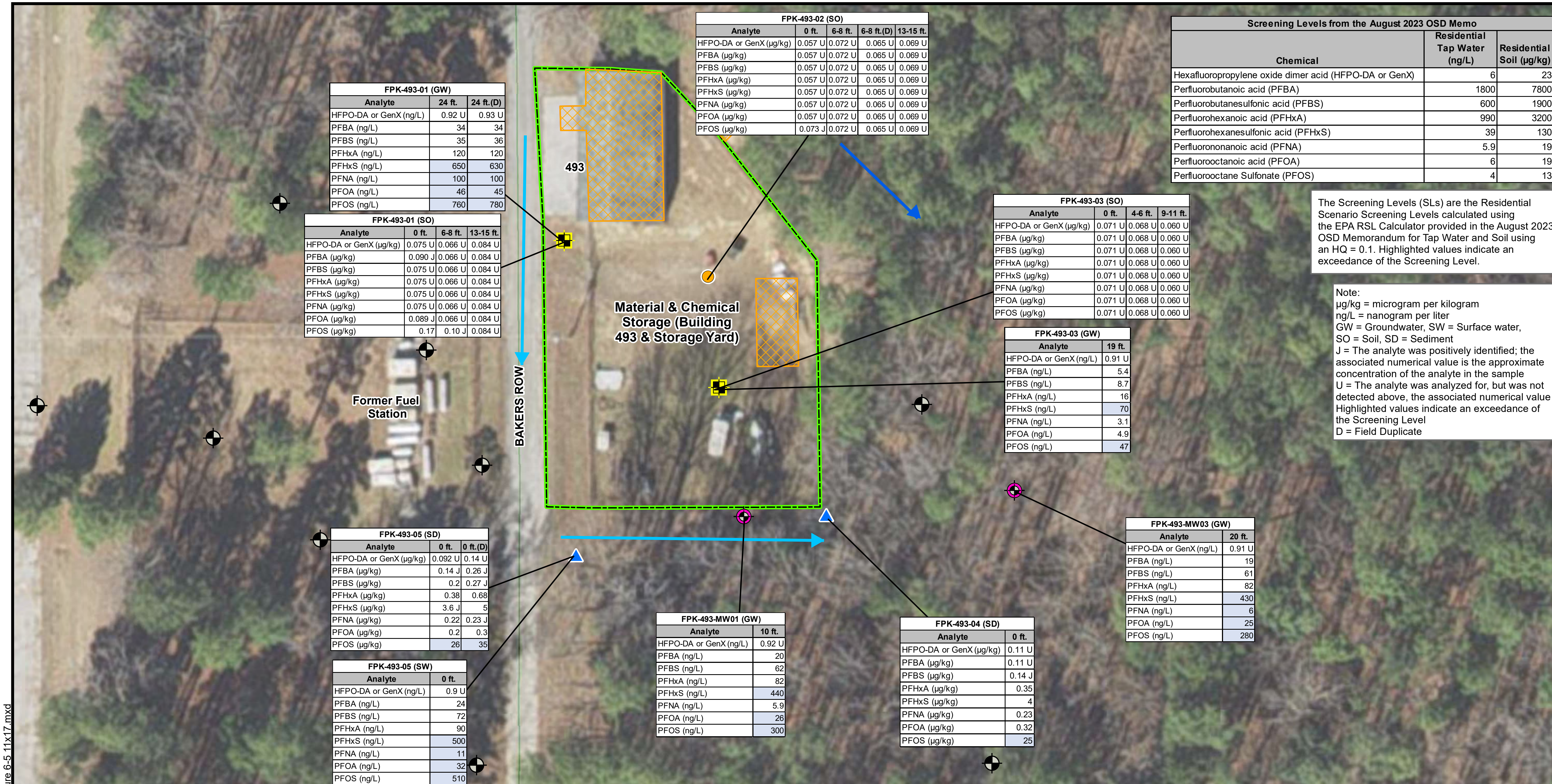
MATERIAL AND CHEMICAL STORAGE (BUILDING 493 AND STORAGE YARD) AOPI SAMPLE LOCATIONS
FORT PICKETT
BLACKSTONE, VIRGINIA
FIGURE 6-4
DATE: 9/14/2023



FPK-493-01 (GW)		
Analyte	24 ft.	24 ft.(D)
HFPO-DA or GenX (ng/L)	0.92 U	0.93 U
PFBA (ng/L)	34	34
PFBS (ng/L)	35	36
PFHxA (ng/L)	120	120
PFHxS (ng/L)	650	630
PFNA (ng/L)	100	100
PFOA (ng/L)	46	45
PFOS (ng/L)	760	780

FPK-493-01 (SO)			
Analyte	0 ft.	6-8 ft.	13-15 ft.
HFPO-DA or GenX (µg/kg)	0.075 U	0.066 U	0.084 U
PFBA (µg/kg)	0.090 J	0.066 U	0.084 U
PFBS (µg/kg)	0.075 U	0.066 U	0.084 U
PFHxA (µg/kg)	0.075 U	0.066 U	0.084 U
PFHxS (µg/kg)	0.075 U	0.066 U	0.084 U
PFNA (µg/kg)	0.075 U	0.066 U	0.084 U
PFOA (µg/kg)	0.089 J	0.066 U	0.084 U
PFOS (µg/kg)	0.17	0.10 J	0.084 U

FPK-493-02 (SO)				
Analyte	0 ft.	6-8 ft.	6-8 ft.(D)	13-15 ft.
HFPO-DA or GenX (µg/kg)	0.057 U	0.072 U	0.065 U	0.069 U
PFBA (µg/kg)	0.057 U	0.072 U	0.065 U	0.069 U
PFBS (µg/kg)	0.057 U	0.072 U	0.065 U	0.069 U
PFHxA (µg/kg)	0.057 U	0.072 U	0.065 U	0.069 U
PFHxS (µg/kg)	0.057 U	0.072 U	0.065 U	0.069 U
PFNA (µg/kg)	0.057 U	0.072 U	0.065 U	0.069 U
PFOA (µg/kg)	0.057 U	0.072 U	0.065 U	0.069 U
PFOS (µg/kg)	0.073 J	0.072 U	0.065 U	0.069 U

Screening Levels from the August 2023 OSD Memo		
Chemical	Residential Tap Water (ng/L)	Residential Soil (µg/kg)
Hexafluoropropylene oxide dimer acid (HFPO-DA or GenX)	6	23
Perfluorobutanoic acid (PFBA)	1800	7800
Perfluorobutanesulfonic acid (PFBS)	600	1900
Perfluorohexanoic acid (PFHxA)	990	3200
Perfluorohexanesulfonic acid (PFHxS)	39	130
Perfluorononanoic acid (PFNA)	5.9	19
Perfluorooctanoic acid (PFOA)	6	19
Perfluorooctane Sulfonate (PFOS)	4	13

The Screening Levels (SLs) are the Residential Scenario Screening Levels calculated using the EPA RSL Calculator provided in the August 2023 OSD Memorandum for Tap Water and Soil using an HQ = 0.1. Highlighted values indicate an exceedance of the Screening Level.

Note:
µg/kg = microgram per kilogram
ng/L = nanogram per liter
GW = Groundwater, SW = Surface water,
SO = Soil, SD = Sediment
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample
U = The analyte was analyzed for, but was not detected above, the associated numerical value
Highlighted values indicate an exceedance of the Screening Level
D = Field Duplicate

FPK-493-03 (SO)			
Analyte	0 ft.	4-6 ft.	9-11 ft.
HFPO-DA or GenX (µg/kg)	0.071 U	0.068 U	0.060 U
PFBA (µg/kg)	0.071 U	0.068 U	0.060 U
PFBS (µg/kg)	0.071 U	0.068 U	0.060 U
PFHxA (µg/kg)	0.071 U	0.068 U	0.060 U
PFHxS (µg/kg)	0.071 U	0.068 U	0.060 U
PFNA (µg/kg)	0.071 U	0.068 U	0.060 U
PFOA (µg/kg)	0.071 U	0.068 U	0.060 U
PFOS (µg/kg)	0.071 U	0.068 U	0.060 U

FPK-493-03 (GW)	
Analyte	19 ft.
HFPO-DA or GenX (ng/L)	0.91 U
PFBA (ng/L)	5.4
PFBS (ng/L)	8.7
PFHxA (ng/L)	16
PFHxS (ng/L)	70
PFNA (ng/L)	3.1
PFOA (ng/L)	4.9
PFOS (ng/L)	47

FPK-493-MW03 (GW)	
Analyte	20 ft.
HFPO-DA or GenX (ng/L)	0.91 U
PFBA (ng/L)	19
PFBS (ng/L)	61
PFHxA (ng/L)	82
PFHxS (ng/L)	430
PFNA (ng/L)	6
PFOA (ng/L)	25
PFOS (ng/L)	280

FPK-493-05 (SD)		
Analyte	0 ft.	0 ft.(D)
HFPO-DA or GenX (µg/kg)	0.092 U	0.14 U
PFBA (µg/kg)	0.14 J	0.26 J
PFBS (µg/kg)	0.2	0.27 J
PFHxA (µg/kg)	0.38	0.68
PFHxS (µg/kg)	3.6 J	5
PFNA (µg/kg)	0.22	0.23 J
PFOA (µg/kg)	0.2	0.3
PFOS (µg/kg)	26	35

FPK-493-05 (SW)	
Analyte	0 ft.
HFPO-DA or GenX (ng/L)	0.9 U
PFBA (ng/L)	24
PFBS (ng/L)	72
PFHxA (ng/L)	90
PFHxS (ng/L)	500
PFNA (ng/L)	11
PFOA (ng/L)	32
PFOS (ng/L)	510

FPK-493-MW01 (GW)	
Analyte	10 ft.
HFPO-DA or GenX (ng/L)	0.92 U
PFBA (ng/L)	20
PFBS (ng/L)	62
PFHxA (ng/L)	82
PFHxS (ng/L)	440
PFNA (ng/L)	5.9
PFOA (ng/L)	26
PFOS (ng/L)	300

FPK-493-04 (SD)	
Analyte	0 ft.
HFPO-DA or GenX (µg/kg)	0.11 U
PFBA (µg/kg)	0.11 U
PFBS (µg/kg)	0.14 J
PFHxA (µg/kg)	0.35
PFHxS (µg/kg)	4
PFNA (µg/kg)	0.23
PFOA (µg/kg)	0.32
PFOS (µg/kg)	25

Legend
- Monitoring Well
- Areas of Potential Interest (AOPI)
- BRAC Boundary
- Installation/VAARNG Property Boundary
- Groundwater Flow Direction
- Surface Water Flow Direction
- Soil Boring (1)
- DPT Groundwater Sample/Soil Boring (2)
- Existing Well Sample (2)
- Surface Water/ Sediment Sample (2)
- Soil Removal Area

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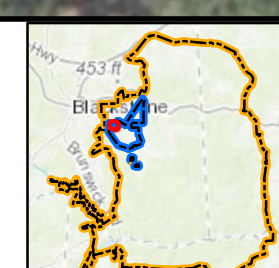
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Virginia Geographic Information Network (VGIN)



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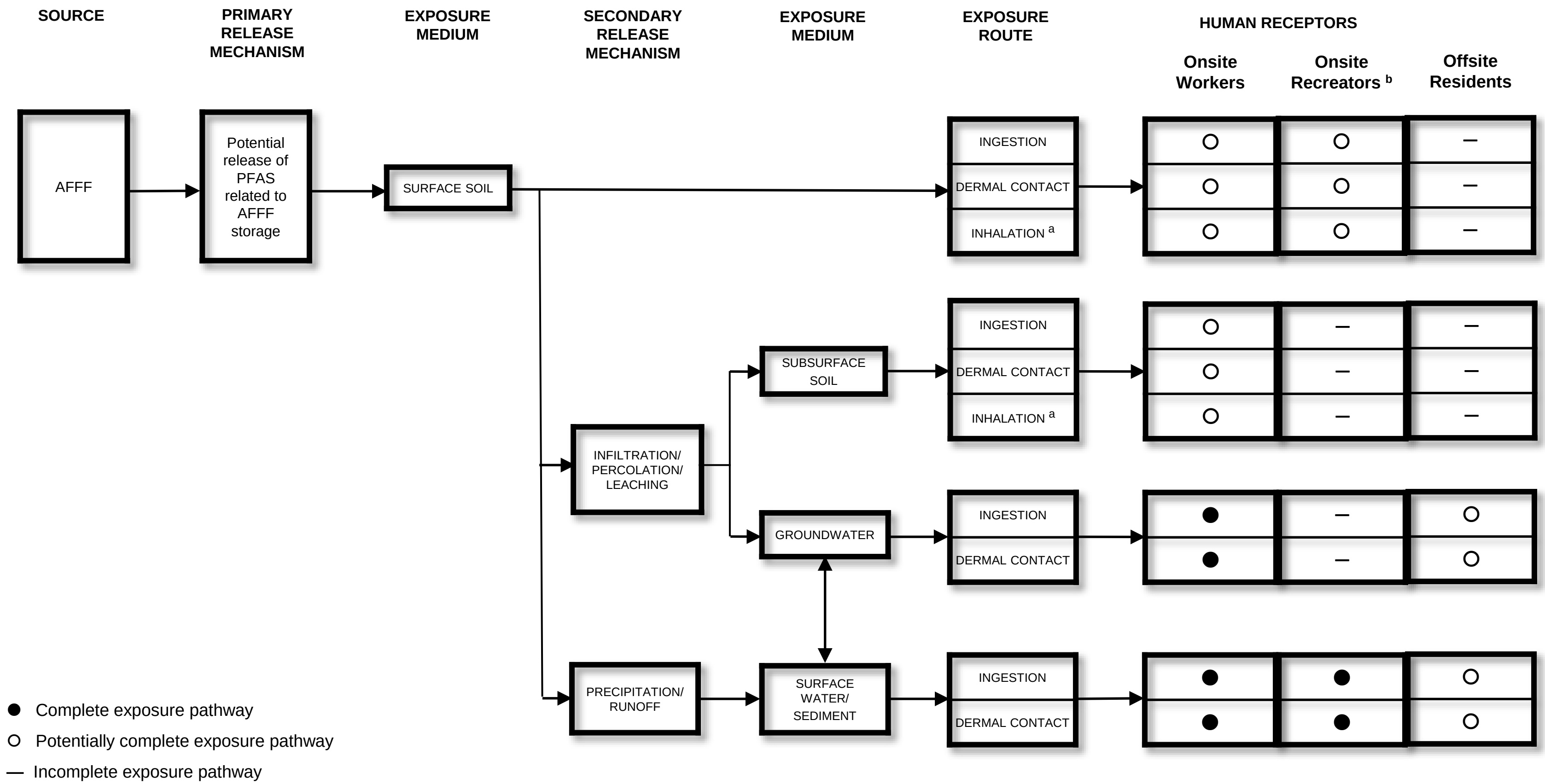
MATERIAL AND CHEMICAL STORAGE (BUILDING 493 AND STORAGE YARD) AOPI SAMPLE RESULTS
FORT PICKETT
BLACKSTONE, VIRGINIA

FIGURE 6-5 | DATE: 10/13/2023



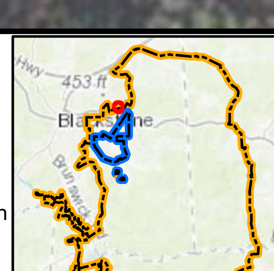
[a] Inhalation of PFAS is considered potentially complete because no toxicity information is available for the inhalation route.

[b] No groundwater use restrictions; however, groundwater exposure pathways for recreators are incomplete because no onsite potable groundwater source exists.

Figure 6-6. Human Health CSM for Material and Chemical Storage (Building 493 and Storage Yard) AOPI

Legend

- Areas of Potential Interest (AOPI)
- BRAC Boundary
- Installation/VAARNG Property Boundary
- DPT Groundwater Sample/Soil Boring (3)
- Groundwater Flow Direction
- Surface Water Flow Direction



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BLACKSTONE ARMY AIRFIELD BURN PITS AOPI
SAMPLE LOCATIONS
FORT PICKETT
BLACKSTONE, VIRGINIA

FIGURE 6-7 | DATE: 9/14/2023

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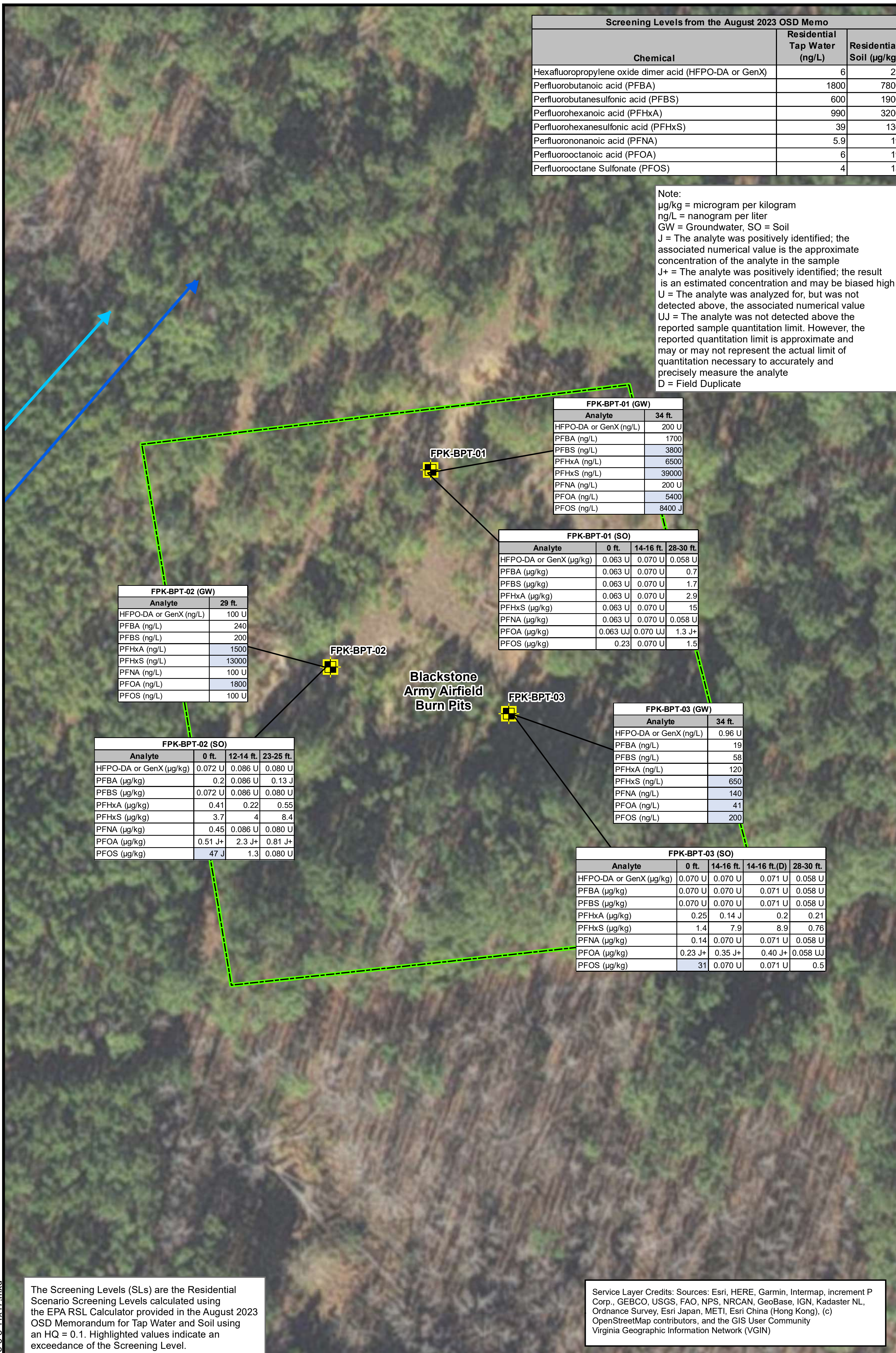

Screening Levels from the August 2023 OSD Memo		
Chemical	Residential Tap Water (ng/L)	Residential Soil (µg/kg)
Hexafluoropropylene oxide dimer acid (HFPO-DA or GenX)	6	23
Perfluorobutanoic acid (PFBA)	1800	7800
Perfluorobutanesulfonic acid (PFBS)	600	1900
Perfluorohexanoic acid (PFHxA)	990	3200
Perfluorohexanesulfonic acid (PFHxS)	39	130
Perfluorononanoic acid (PFNA)	5.9	19
Perfluorooctanoic acid (PFOA)	6	19
Perfluorooctane Sulfonate (PFOS)	4	13

Note:
µg/kg = microgram per kilogram
ng/L = nanogram per liter
GW = Groundwater, SO = Soil
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample
J+ = The analyte was positively identified; the result is an estimated concentration and may be biased high
U = The analyte was analyzed for, but was not detected above, the associated numerical value
UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte
D = Field Duplicate

FPK-BPT-01 (GW)	
Analyte	34 ft.
HFPO-DA or GenX (ng/L)	200 U
PFBA (ng/L)	1700
PFBS (ng/L)	3800
PFHxA (ng/L)	6500
PFHxS (ng/L)	39000
PFNA (ng/L)	200 U
PFOA (ng/L)	5400
PFOS (ng/L)	8400 J

FPK-BPT-01 (SO)			
Analyte	0 ft.	14-16 ft.	28-30 ft.
HFPO-DA or GenX (µg/kg)	0.063 U	0.070 U	0.058 U
PFBA (µg/kg)	0.063 U	0.070 U	0.7
PFBS (µg/kg)	0.063 U	0.070 U	1.7
PFHxA (µg/kg)	0.063 U	0.070 U	2.9
PFHxS (µg/kg)	0.063 U	0.070 U	15
PFNA (µg/kg)	0.063 U	0.070 U	0.058 U
PFOA (µg/kg)	0.063 UJ	0.070 UJ	1.3 J+
PFOS (µg/kg)	0.23	0.070 U	1.5

FPK-BPT-02 (GW)	
Analyte	29 ft.
HFPO-DA or GenX (ng/L)	100 U
PFBA (ng/L)	240
PFBS (ng/L)	200
PFHxA (ng/L)	1500
PFHxS (ng/L)	13000
PFNA (ng/L)	100 U
PFOA (ng/L)	1800
PFOS (ng/L)	100 U

FPK-BPT-02 (SO)			
Analyte	0 ft.	12-14 ft.	23-25 ft.
HFPO-DA or GenX (µg/kg)	0.072 U	0.086 U	0.080 U
PFBA (µg/kg)	0.2	0.086 U	0.13 J
PFBS (µg/kg)	0.072 U	0.086 U	0.080 U
PFHxA (µg/kg)	0.41	0.22	0.55
PFHxS (µg/kg)	3.7	4	8.4
PFNA (µg/kg)	0.45	0.086 U	0.080 U
PFOA (µg/kg)	0.51 J+	2.3 J+	0.81 J+
PFOS (µg/kg)	47 J	1.3	0.080 U

FPK-BPT-03 (GW)	
Analyte	34 ft.
HFPO-DA or GenX (ng/L)	0.96 U
PFBA (ng/L)	19
PFBS (ng/L)	58
PFHxA (ng/L)	120
PFHxS (ng/L)	650
PFNA (ng/L)	140
PFOA (ng/L)	41
PFOS (ng/L)	200

FPK-BPT-03 (SO)				
Analyte	0 ft.	14-16 ft.	14-16 ft.(D)	28-30 ft.
HFPO-DA or GenX (µg/kg)	0.070 U	0.070 U	0.071 U	0.058 U
PFBA (µg/kg)	0.070 U	0.070 U	0.071 U	0.058 U
PFBS (µg/kg)	0.070 U	0.070 U	0.071 U	0.058 U
PFHxA (µg/kg)	0.25	0.14 J	0.2	0.21
PFHxS (µg/kg)	1.4	7.9	8.9	0.76
PFNA (µg/kg)	0.14	0.070 U	0.071 U	0.058 U
PFOA (µg/kg)	0.23 J+	0.35 J+	0.40 J+	0.058 UJ
PFOS (µg/kg)	31	0.070 U	0.071 U	0.5

The Screening Levels (SLs) are the Residential Scenario Screening Levels calculated using the EPA RSL Calculator provided in the August 2023 OSD Memorandum for Tap Water and Soil using an HQ = 0.1. Highlighted values indicate an exceedance of the Screening Level.

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Virginia Geographic Information Network (VGIN)

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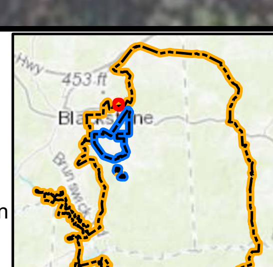
Legend

Areas of Potential Interest (AOPI)
BRAC Boundary
Installation/VAARNG Property Boundary
DPT Groundwater Sample/Soil Boring (3)
Groundwater Flow Direction
Surface Water Flow Direction



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VA STATE PLANE SOUTH (NAD83)

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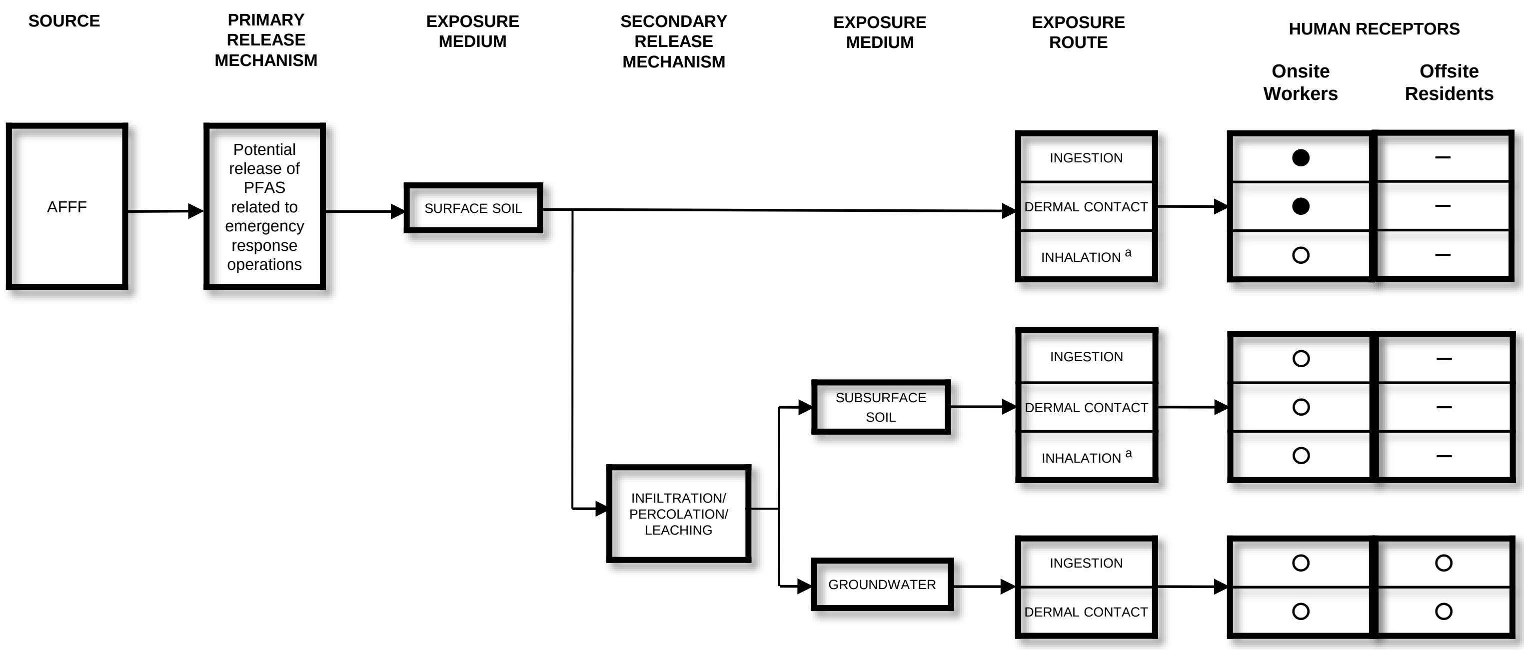
BLACKSTONE ARMY AIRFIELD BURN PITS AOPI
SAMPLE RESULTS
FORT PICKETT
BLACKSTONE, VIRGINIA

FIGURE 6-8 | DATE: 12/5/2023



● Complete exposure pathway

○ Potentially complete exposure pathway

— Incomplete exposure pathway

[a] Inhalation of PFAS is considered potentially complete because no toxicity information is available for the inhalation route.

Figure 6-9. Human Health CSM for Blackstone Army Airfield Burn Pits AOPI