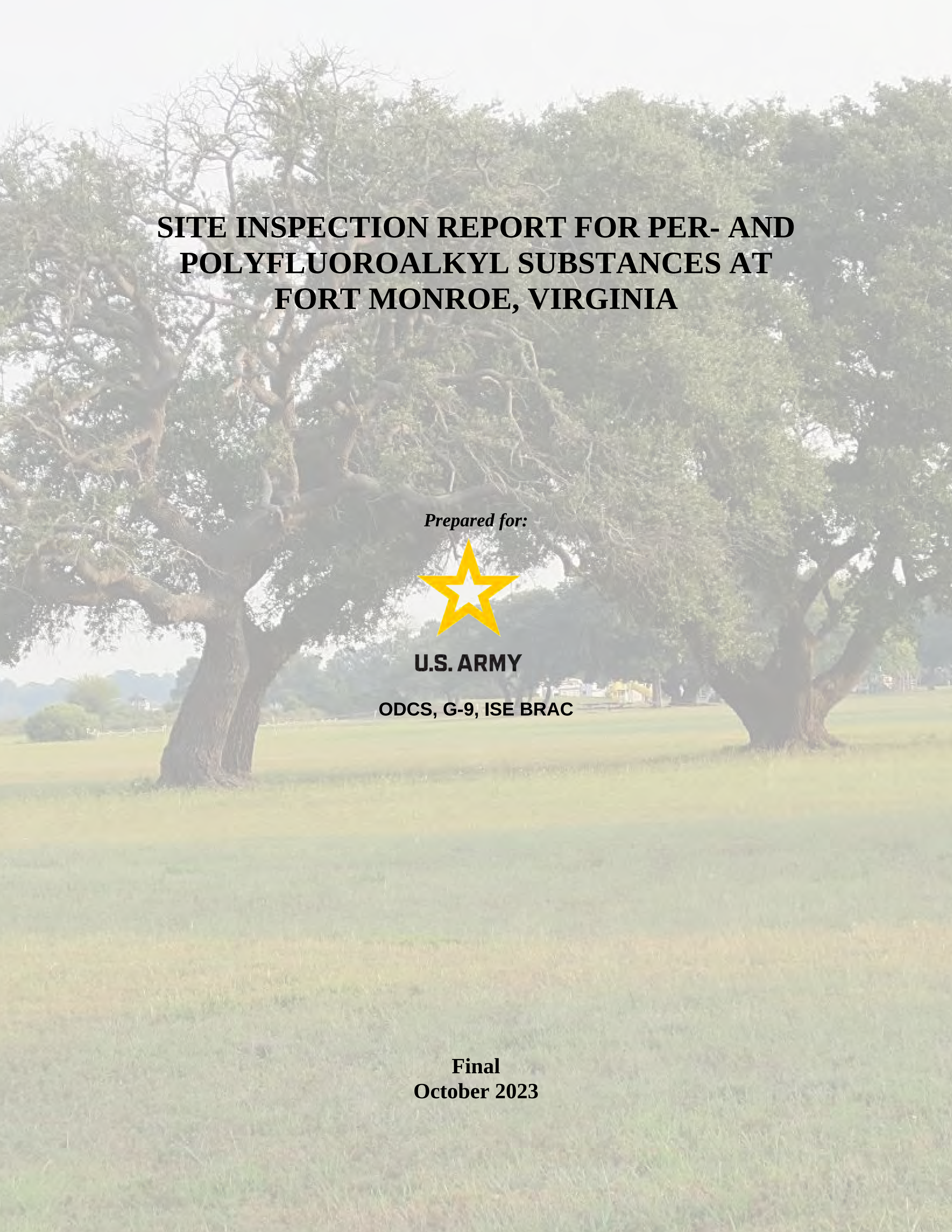

SITE INSPECTION REPORT FOR PER- AND POLYFLUOROALKYL SUBSTANCES AT FORT MONROE, VIRGINIA

Prepared for:

U.S. ARMY

ODCS, G-9, ISE BRAC

Final
October 2023

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LIST OF ACRONYMS AND ABBREVIATIONS

%R	Percent Recovery
AFFF	Aqueous Film-Forming Foam
amsl	Above Mean Sea Level
AOPI	Area of Potential Interest
Army	U.S. Army
BRAC	Base Realignment and Closure
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CoC	Chain-of-Custody
CSM	Conceptual Site Model
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DI	Deionized
DO	Dissolved Oxygen
DoD	U.S. Department of Defense
DPT	Direct-Push Technology
DQO	Data Quality Objective
DUA	Data Usability Assessment
ECOS	Environmental Conservation Online System
EDR	Environmental Data Resources, Inc.
EIS	Extracted Internal Standard
FMA	Fort Monroe Authority
FTA	Fire Training Area
GPS	Global Positioning System
HDPE	High-Density Polyethylene
HFPO-DA	Hexafluoropropylene Oxide Dimer Acid (aka GenX)
HQ	Hazard Quotient
ID	Identification
IDW	Investigation-Derived Waste
IPaC	Information for Planning and Consultation
ITRC	Interstate Technology & Regulatory Council
LC/MS/MS	Liquid Chromatography with Tandem Mass Spectrometry
LCS	Laboratory Control Sample
LOD	Limit of Detection
LUC	Land Use Control
MDEQ	Michigan Department of Environmental Quality
MEC	Munitions and Explosives of Concern
MOU	Memorandum of Understanding
MS	Matrix Spike
MSA	Metropolitan Statistical Area
MSD	Matrix Spike Duplicate
msl	Mean Sea Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHL	National Historic Landmark
NMFS	National Marine Fisheries Service
NNWW	Newport News Waterworks
NPL	National Priorities List
NPS	National Park Service

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

ORP	Oxidation-Reduction Potential
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PFAS	Per- and Polyfluoroalkyl Substances
PFBS	Perfluorobutane Sulfonate
PFHxS	Perfluorohexane Sulfonate
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
P.E.	Professional Engineer
P.G.	Professional Geologist
PMP	Project Management Professional
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
REM	Registered Environmental Manager
RPD	Relative Percent Difference
RSL	Regional Screening Level
SDG	Sample Delivery Group
SI	Site Inspection
SL	Screening Level
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound
T&E	Threatened and Endangered
TCLP	Toxicity Characteristic Leaching Procedure
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
UN	United Nations
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USATEC	U.S. Army Topographic Engineering Center
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance
VDEQ	Virginia Department of Environmental Quality
VOC	Volatile Organic Compound
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 four areas of potential interest (AOPIs) at Fort Monroe in Hampton, Virginia. 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 and groundwater samples were collected from the four AOPIs. 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), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) (also known as GenX) (DoD 2022a). 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 2022 Office of the Secretary of Defense (OSD) Memorandum (DoD 2022a). Since PFAS comprise a large grouping consisting of thousands of individual chemicals, PFOS, PFOA, PFBS, PFNA, 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 above the limit of detection (LOD). The updated CSMs detail site geological conditions; determine primary and secondary release mechanisms; identify potential human receptors; and demonstrate complete, potentially complete, and incomplete exposure pathways for current and reasonably anticipated future exposure scenarios.

One or more of the Target PFAS were detected in at least one medium at all four of the AOPIs. Target PFAS concentrations exceeded SLs in groundwater at all four AOPIs. PFOS, PFOA, PFNA, and PFHxS were detected in groundwater at concentrations that exceeded SLs. HFPO-DA was not detected at any AOPI. Figure ES-1 depicts the installation-wide map of AOPIs and PFAS groundwater results, including the distribution of SL exceedances and proximity to installation 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 Name	Exceedance of SLs		Recommendation
	Groundwater	Soil	
Marina	Yes	No	Further investigation recommended
Fire Training Pit	Yes	Yes	Further investigation recommended
Walker Airfield	Yes	Yes	Further investigation recommended
Fire Station (Building 24)	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 former Fort Monroe 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. §2700 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. Fort Monroe 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.

Based on results of the Fort Monroe PFAS PA (Leidos 2023), four areas of potential interest (AOPIs) were identified for investigation through multimedia sampling in an SI to determine whether a PFAS release occurred. Fort Monroe is located in Hampton, Virginia, as shown in Figure 1-1. The entirety of the former Fort Monroe is referred to as the "Fort," "site," "facility," or "installation" throughout this document. Any references to "offsite" refers to areas that are outside the original boundary of Fort Monroe.

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 findings from the PA in conjunction with soil and groundwater 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, this SI Report 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 2022 OSD Memorandum (DoD 2022a), 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 the Fort Monroe UFP-QAPP Addendum (Leidos 2022b). The field activities followed site-specific sampling and health and safety protocols, as identified in the Programmatic Accident Prevention Plan (Leidos 2022c) and the Fort Monroe Site Safety and Health Plan (Appendix A of the Fort Monroe UFP-QAPP Addendum).

1.2 FORT MONROE DESCRIPTION

Fort Monroe is a former Army facility that lies within the Hampton, Virginia corporate limits, south of the community of Phoebus, and is accessible only by two bridges (Highways 143 and 258) that lead to a single main entrance. In 2005, Fort Monroe was selected for closure pursuant to the BRAC process. Fort Monroe was decommissioned on September 15, 2011, and portions of Fort Monroe, including the old stone fort and the north beach area, were designated as a National Monument on November 1, 2011.

During the development of the PA, historical records, interviews, aerial photographic analysis, site reconnaissance, available documentation, and physical evidence were reviewed to determine where PFAS-containing materials may have previously been stored, used, or disposed of (40 CFR §300.420(b)). The evaluated areas include fire stations, fire training areas (FTAs), landfills, plating operations, wastewater treatment plants (WWTPs), pesticide facilities, vehicle maintenance shops, paint shops, and photographic processing facilities. The Fort Monroe PFAS PA recommended four AOPIs for further investigation in an SI due to known or potential historical PFAS-containing material use, storage, 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 Monroe

AOPI Name	Dates of Operation	Size (acres)
Marina	October 1981 (i.e., date of the Marina fire)	0.53
Fire Training Pit	1950s to 1980s	0.04
Walker Airfield	1951 to 2002	8.5
Fire Station (Building 24)	1881 to 2011	0.05

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 Monroe. 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 2022 OSD Memorandum (DoD 2022a) 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 Monroe 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. Task Team Activity Log Sheets
  - Appendix D. Boring Logs
  - Appendix E. Sampling and Well Development 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 Monroe, 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 Monroe is located at the southeastern tip of Virginia's lower peninsula, between Hampton Roads harbor to the southwest, the Chesapeake Bay to the east, and Mill Creek to the west (Figure 1-1). Fort Monroe lies within the Hampton, Virginia, corporate limits, south of the community of Phoebus, and is accessible only by two bridges (Highways 143 and 258) that lead to a single main entrance. Fort Monroe spans 565.5 acres, which include accreted lands. Approximately 108 acres of the Fort Monroe property are submerged (R&K Engineering and GRW Engineers 1996, as cited in SAIC 2000) and 85 acres of property are wetlands (Tiner et al. 1998). The remaining acres of Fort Monroe are classified as improved or semi-improved. The improved area has been modified for the military mission or heavily landscaped. Figure 2-1 depicts the Fort Monroe site features.

2.2 SITE OPERATIONAL HISTORY

Fort Monroe was garrisoned in 1824 and served as the headquarters for the Coast Artillery School from 1824 to 1907. By World War II, Fort Monroe served as headquarters for an array of batteries containing coastal artillery guns as the Fort was again assigned to the defense of the Chesapeake Bay and the Hampton Roads port of embarkation. The Fort also served as a staging area and training area for troops temporarily and permanently stationed in the Hampton Roads area. In addition, the Army controlled submarine barriers and underwater mine fields. After the war, Fort Monroe was designated the home installation for Headquarters, U.S. Continental Army Command, and Army Ground Forces began operations at Fort Monroe in October 1946. In 1946, the disarmament of Fort Monroe began, with the artillery pieces being removed and many of the fortifications being demolished to make way for new construction (Weinert and Arthur 1989).

The Secretary of the Interior designated Fort Monroe as a National Historic Landmark (NHL) in 1960. In 1972, a nomination form was submitted to provide documentation on the automatic placement of Fort Monroe on the National Register of Historic Places in 1966. All buildings on Fort Monroe are within the boundaries of the Fort Monroe NHL district.

On July 1, 1973, the U.S. Continental Army Command was deactivated, and Headquarters U.S. Army Training and Doctrine Command was organized and charged with the responsibility of training individuals of the active Army and Reserve components with the development of operational doctrine and the development and procurement of new weapons systems. In 2005, Fort Monroe was selected for closure pursuant to the BRAC process. Fort Monroe was decommissioned on September 15, 2011, and portions of Fort Monroe, including the old stone fort and the north beach area, were designated as a National Monument on November 1, 2011.

The Commonwealth of Virginia deeded 366.56 acres (250 acres in 1838, 80.36 acres in 1908, and 36.2 acres in 1936) to DoD. In addition, 190 acres were acquired through condemnation in 1906, 10.5 acres were acquired by deed in 1903, 1.29 acres were acquired by deed in 1904, and 1.95 acres were transferred from the U.S. Department of Transportation to the U.S. Coast Guard (USCG) in 1960 and 1981. Approximately 40 acres of Fort Monroe were accreted. Both the 1838 and 1936 deeds had reversionary clauses, which stated that the land was to be used "for the purpose of fortifications and national defense and no other." Whenever the United States ceases to use the land for those purposes, that portion of Fort Monroe reverts back to the Commonwealth of Virginia (USAEHA 1987).

2.3 DEMOGRAPHICS, PROPERTY TRANSFER, AND LAND USE

The Hampton Roads Metropolitan Statistical Area (MSA) covers the southeastern corner of Virginia adjacent to the Atlantic Ocean and the Chesapeake Bay. The James River and the Hampton Roads harbor divide the MSA into two sub-regions: the Peninsula and the Southside. The Peninsula is the northern sub-region and includes the cities of Hampton, Newport News, Poquoson, and Williamsburg; the counties of James City and York; and a portion of Gloucester County. The Southside includes the cities of Chesapeake, Norfolk, Portsmouth, Suffolk, and Virginia Beach, and a portion of Isle of Wight County. The land area covers 2,628 square miles. The MSA includes three major port facilities, two international airports, two rail lines, two major shipyards, and several military bases, including one of the world's largest naval bases (USAEC & Fort Monroe DPW 2005).

According to the U.S. Census Bureau 2010 data, the population of the city of Hampton was estimated at 137,436. This included 51.3 percent Black or African American, 41.2 percent White, 6.2 percent Hispanic, 2.4 percent Asian, 0.6 percent American Indian or Alaska Native, and 0.2 percent Native Hawaiian and other Pacific Islanders. In 2018, 15.4 percent of the population in Hampton was below the poverty level (U.S. Census Bureau 2020).

Currently, the Fort Monroe Authority (FMA) employs 25 people and the National Park Service (NPS) employs 3 people. In addition, approximately 160 families live at Fort Monroe. There are currently 174 residential units within the property, including single-family homes, duplexes, townhouses, and apartments (FMA 2021). In 2010, the Commonwealth of Virginia passed the Fort Monroe Authority Act establishing FMA as a political subdivision of the Commonwealth with responsibility for ensuring that the Fort adheres to the National Historic Preservation Act and meets the design standards for new development or building restoration or renovation at Fort Monroe in keeping with the Fort's status as an NHL. The Fort Monroe Land Use Master Plan (Sasaki 2013) is the officially adopted vision for the reuse of Fort Monroe.

Approximately 313 acres of Fort Monroe property reverted to the Commonwealth of Virginia by deed in June 2013. In April 2017, approximately 73 acres of Fort Monroe non-reversionary property were transferred to FMA under an Economic Development Conveyance authority. Environmental carve-outs located on reversionary and non-reversionary property were transferred in 2019 after CERCLA actions at the sites were completed. These carve-out properties, totaling approximately 48 acres, were able to be transferred to FMA (9 acres) and reverted to the Commonwealth of Virginia (39 acres) following completed CERCLA actions at these sites. The Chamberlin property reverted to the Commonwealth by deed in December 2021. At present, 131 acres of Fort Monroe property remain to be transferred; this acreage includes the North Beach Area of Fort Monroe. Approximately 121 acres of property at Fort Monroe were transferred from the Commonwealth to NPS in August 2015 (U.S. Army 2020). Although land use controls (LUCs) are not in place, a 2016 Memorandum of Understanding (MOU) was signed by the Virginia Department of Environmental Quality (VDEQ) and FMA to prohibit groundwater use at four sites at Fort Monroe (Building 204/205, Directorate of Engineering and Housing Compound, Post Engineers Shop Compound, and Area 200).

2.4 TOPOGRAPHY

Fort Monroe is situated on a large sand spit known as Old Point Comfort located on the lower Chesapeake Bay in the Coastal Plain physiographic province of Virginia. The topography of Fort Monroe is generally flat, with an average elevation of 8 feet above mean sea level (amsl). Approximately 108 acres of Fort Monroe are submerged within the Mill Creek tidal basin. Many areas of Fort Monroe contain dredge-fill material.

2.5 GEOLOGY

The Hampton area of Virginia occupies a low-lying terrace with typically less than approximately 20 feet of topographic relief. The area is dissected by swampy, sluggish tidal streams and bays, and marine erosion and deposition have created a wide sandy beach along the Chesapeake Bay from North End Point to the barrier spit (Old Point Comfort) occupied by Fort Monroe. Between 1845 and 1902, the Army extensively investigated the geology local to Fort Monroe during efforts to locate potable water supplies for the Fort (Cederstrom 1957). The sand spit on which the Fort is constructed is underlain by Quaternary sand deposited by the movement of marine currents. Deep drilling at Fort Monroe between 1896 and 1902 encountered 30 to 50 feet of Pleistocene-aged sand overlying 560 to 580 feet of interlayered sand and clay of the Miocene-Pliocene Chesapeake Group (formerly the Chesapeake Formation). A boring drilled by the Army at Fort Monroe in 1902 encountered granitic basement rock at a depth of 2,246 feet below ground surface (bgs) indicative of the depth to bedrock and the overall thickness of the sedimentary deposits underlying the Fort.

The native soils of Fort Monroe are combinations of sand, silt, and clay that are produced from water-transported parent material. A large portion of Fort Monroe is constructed with fill material, including debris materials from the Fort as well as sediment dredged from Mill Creek and the Chesapeake Bay, emplaced to expand the available land area in support of the military mission. In addition, most high-maintenance landscaping is conducted on topsoil fill imported from off-post sources. The erosion potential for non-fill soil types found on post is generally slight to moderate with the exception of sands, which have high erosion potential in areas lacking a vegetative cover. Runoff ranges from very slow to medium in these soil types. Most of the upper 1 to 1½ feet of the soils on Fort Monroe have been significantly disturbed (USAEC & Fort Monroe DPW 2005).

2.6 HYDROGEOLOGY

Fort Monroe is located in the North Atlantic Coastal Plain aquifer system. The North Atlantic Coastal Plain aquifer is a semi-consolidated sand and gravel aquifer. Groundwater in the Coastal Plain is recharged primarily by infiltration of precipitation and percolation to the water table. Most unconfined groundwater flows short distances to nearby streams, but small amounts flow down to recharge the deeper confined aquifers. Four aquifers are beneath Fort Monroe: the water table aquifer (10 to 20 feet below mean sea level [msl]), the Yorktown aquifer (40 to 50 feet below msl), the Eocene-upper Cretaceous aquifer (320 to 440 feet below msl), and the Lower Cretaceous aquifer (570 to 630 feet below msl).

The hydrogeologic setting at Fort Monroe consists of a sandy barrier island surrounded by saline coastal surface water of the Chesapeake Bay and Mill Creek. Shallow groundwater flow in this setting occurs from mainland aquifers discharging fresh groundwater to local surface water bodies, including streams and rivers, and from precipitation that infiltrates directly to the groundwater table beneath undeveloped portions of Fort Monroe. The barrier island comprises a dynamic shallow groundwater system with alternating inputs of freshwater from precipitation and mainland groundwater flow and saltwater from tidal pumping, overwash, and preferential subsurface flow of brackish groundwater. During periods of prolonged rainfall, the water table may temporarily rise to form a transitional ridge of fresh water in the elongated shape of the barrier island. Freshwater in the deeper aquifers flows seaward in the direction of prevailing hydraulic gradients and mixes with saltwater of the Chesapeake Bay at depth (Leidos 2021).

2.7 SURFACE WATER HYDROLOGY

Surface water at Fort Monroe includes the Moat, portions of the Mill Creek tidal basin, and the Chesapeake Bay shoreline. Fort Monroe has approximately 16,000 feet of shoreline facing Hampton Roads harbor (south) and the Chesapeake Bay (east) and approximately 17,000 feet of shoreline facing Mill Creek (west). The Moat is the only surface water body completely within the footprint of Fort Monroe and has a water surface area of approximately 19 acres. Seawater exchange between the Moat and Mill Creek is currently facilitated by passive tidal exchange through two 72-inch culvert pipes and controlled by sluice gates (USACE 2003). The sluice gates are located in Building 257 between the Moat and the outlet of the culvert pipes into Mill Creek.

Mill Creek is a tidal estuary with approximately 80 acres of salt marsh habitat (USACE 2003). The location of Mill Creek at the confluence of the James River estuary and the Chesapeake Bay is subject to the tidal range and tidal currents generated in the connected water bodies. Water exchange between Mill Creek and the Chesapeake Bay occurs by estuarine circulation, which is controlled by factors such as the inflow of water from small tributaries on the western and northern shore of Mill Creek, the semi-diurnal tidal cycle, rainfall and evaporation, the wind, and episodic events like storms. Additional sources of freshwater to Mill Creek include surface runoff from communities populating the Mill Creek shoreline to the west and north, and from Fort Monroe to the east. The salinity of the Chesapeake Bay in the vicinity of Hampton Roads harbor ranges from 16 to 23 parts per thousand. Other tributaries flowing into the Chesapeake Bay are predominantly brackish, and the primary mixing action in the Fort Monroe area is from tidal forces.

According to the Federal Emergency Management Agency, Fort Monroe is entirely within the 100-year flood zone.

2.8 WATER USAGE

Potable use of groundwater underlying the site is unlikely because it is in a shallow water-bearing zone and is high in salinity. Historical well drilling efforts at Fort Monroe to locate potable water supplies encountered saline water at shallow to moderate depths beneath Fort Monroe and were subsequently abandoned (Darton 1896, New York Times 1902). Although groundwater use restrictions are not in place, a 2016 MOU was signed by VDEQ and FMA to prohibit groundwater use and consumption at four sites at Fort Monroe (Building 204/205, Directorate of Engineering and Housing Compound, Post Engineers Shop Compound, and Area 200) (VDEQ and FMA 2016).

Drinking water for Fort Monroe historically has come from regional suppliers and several surface water sources. Fort Monroe’s primary drinking water source through 2003 was Big Bethel Water Treatment Plant. The water came from the upper and lower reservoirs, known together as Big Bethel Reservoir, fed by Brick Kiln Creek as the raw water source. Currently, drinking water at Fort Monroe is purchased from Newport News Waterworks (NNWW). The main source of drinking water supplied by NNWW is the Chickahominy River, which is approximately 40 miles northwest of Fort Monroe. When water is available, it is pumped from the river above Walkers Dam and transferred though pipes to NNWW reservoirs for storage and conveyed to one of two treatment plants at Lee Hall and Harwood’s Mill (FMA 2021).

According to Virginia Water Control Board groundwater data, only two water supply wells are within 4 miles of Fort Monroe. One of these wells is located at Fort Monroe. It is inactive and was never used for potable water because it is brackish. The other well is within 4 miles of Fort Monroe to the west. This well is owned by a private citizen and is closed. It was never used for drinking water because it is high in iron and sodium. Lastly, one well owned by Sentara Hampton General Hospital is located more than 5 miles away and possibly used for emergency drinking water on rare occasions, although it is not known to be serviceable. Groundwater in the Hampton area generally flows west to east toward the Chesapeake Bay and to surface water surrounding Fort Monroe on three sides, including the Mill Creek Estuary and the Chesapeake Bay (Weston 1990). The Environmental Data Resources, Inc. (EDR) report did not identify any public supply wells within 1 mile (EDR 2021).

2.9 ECOLOGICAL PROFILE

Tidal estuaries border Fort Monroe to the west (Mill Creek), west and south (Hampton Roads harbor), and east (Chesapeake Bay). Fort Monroe is largely developed and has approximately 85 acres of unmanaged vegetation; the majority of flora is introduced. Most of the vegetation cover is in landscaped areas, including turf that is mowed regularly. A total of 249 plant species, including 136 native species and 113 introduced species, have been identified at Fort Monroe (Galvez et al. 1998). A floral survey documented 2,071 individual trees or clusters of trees at Fort Monroe, comprising 92 tree species (Lingenfelser et al. 2003). One of the native tree species includes the live oak (*Quercus virginiana*), which is an evergreen tree species that can live to be centuries old. More than 130 southern live oaks grow within the interior of Fort Monroe, and several small, wooded areas in the northern portion of Fort Monroe contain live oaks (Lookingbill et al. 2018). Several exotic and invasive species are present at Fort Monroe that pose an ecological threat due to their invasive nature (Lingenfelser et al. 2003). Naturally occurring native plant communities include wetlands in Mill Creek. Invasive (*Phragmites* dominated) wetlands are also present in Mill Creek (Lingenfelser et al. 2003).

There are 108 acres of submerged land and 85 acres of wetlands (including tidal and non-tidal wetlands) throughout Fort Monroe. Of the wetland acreage, most is classified as emergent estuarine (65.4 acres). Melchor (1983) described Mill Creek as a tidal estuary with a surface area of 1.25 square miles, which includes approximately 80 acres of *Spartina alterniflora* salt marsh. Most of the salt marsh in Mill Creek is present along the shoreline of the northern portion of Fort Monroe. Common species in the area include groundsel bush (*Baccharis halmifolia*), marsh elder (*Iva frutescens*), giant cordgrass (*Spartina cynosuroides*), salt meadow hay (*Spartina patens*), and saltgrass (*Distichlis spicata*).

Although the area of Fort Monroe is relatively small, the beaches, wetlands, and small patches of forest provide a diverse array of habitats for numerous bird species, particularly in the tidal wetland areas in the northern portion of Fort Monroe (USACE 2010). Twenty-four mammal species, including muskrats, river otters, squirrels, opossums, raccoons, mice, chipmunks, rabbits, foxes, and other mammals, were identified as inhabiting or suspected to occur on Fort Monroe (Galvez et al. 1998). Eighty-nine bird species have been identified at Fort Monroe (Condon, McCloskey, and Lingenfelser 2010). Birds observed foraging in Mill Creek included waterfowl (e.g., ducks, gulls, geese, loons, grebes, and swans), wading birds (e.g., great blue heron and sanderling), and large birds of prey (e.g., hawks, owls, osprey, and bald eagles).

With its associated wetlands and mudflats exposed at low tide, Mill Creek provides habitat and a nursery for a number of fish and invertebrate species and foraging habitat for a variety of marsh and shorebirds (NRWG 2009). Nineteen species of fish and blue crab (*Callinectes sapidus*) were collected during fish seining as part of field surveys that Galvez et al. (1998) conducted in Mill Creek adjacent to Fort Monroe.

The U.S. Fish and Wildlife Service (USFWS) Environmental Conservation Online System (ECOS) Information for Planning and Consultation (IPaC) tool identified one federally listed threatened and endangered (T&E) species (northern long eared bat [*Myotis septentrionalis*]) as potentially occurring on or near Fort Monroe. The T&E candidate species, the monarch butterfly (*Danaus plexippus*), was also identified by IPaC as potentially occurring at Fort Monroe (USFWS 2023). Limited habitat is available for maternity roosts at Fort Monroe for the northern long eared bat (Leidos 2018, HRCP 2019) and the nearest maternity roost trees are more than 20 miles to the south in Chesapeake, Virginia (VDGIF 2023). Monarchs are present at Fort Monroe (Leidos 2018). Additional listed species that may occur at or near Fort Monroe include the red knot (*Calidrus canutus*), piping plover (*Charadrius melodus*), northeastern beach tiger beetle (*Cincindela dorsalis*), and nesting species of sea turtles. Although individual birds and sea turtles have been spotted at Fort Monroe, no known nests exist.

Federally listed marine T&E species under the protection of the National Marine Fisheries Service (NMFS) may be present in the surrounding waterbodies. These T&E species may include species such as Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), sea turtles, fin whale (*Balaenoptera physalus*), and North Atlantic right whale (*Eubalaena glacialis*) (HRCP 2019).

Thirty-two migratory birds of particular concern are identified by the IPaC tool as potentially occurring on or near Fort Monroe. These birds include species such as the American oystercatcher (*Haematopus* *palliatus*), bald eagle (*Haliaeetus leucocephalus*), brown pelican (*Pelecanus occidentalis*), gull-billed tern (*Gelochelidon nilotica*), and Lesser yellowlegs (*Tringa flavipes*) (USFWS 2023).

2.10 CLIMATE

The lower Virginia Peninsula has a continental-type climate with four well-defined seasons. It is located in the middle latitudes of North America, where the atmospheric flow is generally from west to east. The climate and temperatures are slightly moderated by the proximity to the Chesapeake Bay and the Atlantic Ocean. This results in mild winters and long, warm summers. High humidity occurs frequently along the coast, with the average relative humidity in the afternoon at 60 percent. Relative humidity at dawn is on average 80 percent. The area is characterized by frequent periods of ground fog in the late summer. The coldest period at Fort Monroe occurs in late January, with an average temperature of 39.4°F, as shown in Table 2-1. July is the warmest month, with a monthly average temperature of 78.5°F. The average annual precipitation is 47.9 inches. Precipitation is well-distributed throughout the year, although the heaviest rains occur in July, August, and September.

Table 2-1. High, Mean, and Low Temperatures

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max Temp (°F)	46.7	49.4	57.0	65.9	73.4	81.0	85.2	83.7	78.1	68.3	59.5	51.1	66.6
Mean Temp (°F)	39.4	41.6	48.8	57.2	65.9	73.9	78.5	77.2	71.6	60.7	51.5	43.6	59.2
Min Temp (°F)	32.0	33.8	40.6	48.5	58.3	66.8	71.8	70.7	65.1	53.0	43.5	36.0	51.7

Source: http://www.idcide.com/weather/va/hampton.htm.

Due to its coastal location, the Fort Monroe area is subject to hurricanes and other easterly storms throughout late summer and early fall that can cause high winds, high tides, high precipitation, and flooding. The area also is subject to occasional strong winter storms that travel along the eastern coastline and can bring severe storm surge conditions and, occasionally, snow. The wind is from the south from April through August and from the north from September through March. The average hourly wind speed experiences significant seasonal variation over the course of the year, with average hourly wind speeds ranging from 8.1 to 11.4 miles per hour (Weather Spark 2021).

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 Monroe 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

The 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 Fort Monroe sample locations were determined based on current site conditions (i.e., groundwater flow direction), presence of site media (e.g., surface soil may not be sampled at a given site), 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 Monroe was conducted in accordance with the Programmatic UFP-QAPP (Leidos 2022a) and Fort Monroe UFP-QAPP Addendum (Leidos 2022b). The field activities employed to execute the Programmatic UFP-QAPP and Fort Monroe UFP-QAPP Addendum, including any variances or deviations, are described below.

3.2 SAMPLE DESIGN AND RATIONALE

Four AOPIs were investigated during the Fort Monroe 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 Monroe UFP-QAPP Addendum (Leidos 2022b) are the basis for sample design at each AOPI. All samples were analyzed for the Target PFAS list of perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) (also known as GenX).

The general approach for determining the presence or absence of PFAS at an AOPI consisted of collecting two direct-push technology (DPT) grab groundwater samples and three soil samples from each of three soil borings installed within the AOPI. Variations to the general sampling approach included modifications to sample quantities at AOPIs based on size (i.e., additional samples collected at larger AOPIs), omitting surface soil samples in paved or gravel-covered areas, omitting subsurface soil samples due to shallow groundwater, and collecting groundwater from existing monitoring wells. Surface water and sediment samples were not proposed as part of this SI due to the potential for migration of offsite contamination associated with local municipalities into the surface water bodies onsite at Fort Monroe.

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

Where:

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

For existing monitoring wells, the sequential number of each sample (##) was replaced with the existing monitoring well identification (ID) (e.g., the site location ID for monitoring well MW-3 is FTM-MAR-MW-3).

Each sample that was collected received a unique sample number, related to the site ID above, using the following format: FMXXX## – 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 = DPT groundwater sample, MW = groundwater from an existing monitoring well, SS = surface soil, SB = subsurface soil)
- zz = the sequence number for the sample at the location.

For existing monitoring wells, the unique sample number used FMXXX where XXX is the abbreviation for the AOPI being sampled followed by the monitoring well ID (e.g., the sample ID for MW-5 is FMMAR-MW5).

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 FTM-YYyy.

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 January 9 through January 13, 2023. The locations and methods of sample collection under the SI are described in the following sections. Sampling procedures adhered to the Programmatic UFP-QAPP (Leidos 2022a) and Fort Monroe UFP-QAPP Addendum (Leidos 2022b), with relevant information summarized below.

Sampling activities at Fort Monroe included collecting surface and subsurface soil samples from soil borings, installing polyvinyl chloride (PVC) screens or DPT screen point samplers, and conducting one round of groundwater samples. Samples were analyzed for 26 PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) procedures compliant with DoD Quality Systems Manual (QSM) Version 5.4, Table B-15 (DoD 2021) to determine the presence or absence of Target PFAS. Forty samples were collected among the 4 AOPIs, including 3 existing monitoring well groundwater samples, 8 DPT grab groundwater samples, 10 surface soil samples, and 19 subsurface soil samples. No surface water or sediment samples were collected, as discussed in the AOPI-specific CSMs in Sections 6.2 through 6.5. A breakdown of samples collected at each AOPI is provided in Table 3-1. Prior to beginning sampling, site reconnaissance and utility clearance were performed. Sampling was completed at one AOPI before moving to the next AOPI when feasible. Any variances in sampling procedure, such as moving a location or sample point elimination, were discussed with the project team and communicated in daily field summary emails (Appendix A). Field procedures and any variances are discussed in the following sections. Photographs of SI field activities are provided in Appendix B.

Table 3-1. Fort Monroe AOPI SI Sample Collection

AOPI Name	Soil Samples	Groundwater Samples
Marina	3 SS / 5 SB	4
Fire Training Pit	3 SS / 6 SB	3
Walker Airfield	4 SS / 5 SB	2
Fire Station (Building 24)	0 SS / 3 SB	2
Total	**10 SS / 19 SB**	**11**

SS = Surface soil sample
SB = Subsurface soil sample

3.4 FIELD PROCEDURES

The following sections describe utility clearance, munitions and explosives of concern (MEC) avoidance, bulk source water sampling, soil boring installation and sampling, groundwater sampling, equipment calibration, and location surveys. 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 investigation 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.

3.4.1 Utility Clearance

Prior to initiating intrusive activities, the Field Manager coordinated underground utility clearances for the four AOPIs through the Caretaker's Office, Veolia, and Virginia811 "Call Before You Dig." Fort Monroe is owned by multiple proprietors, and all but one of the AOPIs are on property that has been transferred. The Marina and Fire Station AOPIs are on property that has been transferred to the Commonwealth of Virginia (property managed by FMA). Walker Airfield is located on property that has been transferred to NPS, and the area of the former Fire Training Pit is on Army-owned property that has not yet been transferred. As part of the utility clearance process, individual utility companies were consulted (as needed), and each area was visually inspected to verify that utilities had been marked. The Field Manager looked for signs of unidentified utilities, including overhead utilities, and completed a Subsurface Clearance Checklist prior to initiating drilling operations. Prior to conducting powered drilling within 25 feet of known or suspected subsurface utilities, the boreholes were excavated using a low-impact technique (hand auger) to a minimum of 5 feet bgs (or less if groundwater was encountered).

3.4.2 MEC Avoidance

A certified unexploded ordnance (UXO) Technician conducted a survey (visual and magnetometer) prior to all intrusive work to preclude disturbing subsurface MEC. MEC avoidance operations were conducted in accordance with the Department of Defense Explosives Safety Board (DDESB) Technical Paper 18, June 24, 2020, and Appendix A of the Fort Monroe Site Safety and Health Plan (Appendix A of the Fort Monroe UFP-QAPP Addendum [Leidos 2022b]).

3.4.3 Bulk Source Water Sampling

Prior to beginning work, two bulk source water samples (FM-SRC-01 and FM-SRC-02) were collected on September 7, 2022, for PFAS analysis to determine if the onsite source water was PFAS-free (i.e., PFAS not detected above the limit of detection [LOD]) and could be used for drilling and decontamination. Sample FM-SRC-01 was collected from a fire hydrant located at the end of Fenwick Road. Sample FM-SRC-02 was collected from a spigot located at the recreational vehicle campground. Source water was purged for a minimum of 1 minute prior to filling laboratory-supplied, Trizma®-preserved high-density polyethylene (HDPE) bottles. PFAS were detected at concentrations above the LOD in both the fire hydrant and spigot source water samples. Verified PFAS-free (i.e., PFAS not detected above the LOD) deionized (DI) water was brought onsite in an HDPE drum for implementation of the SI.

3.4.4 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 Monroe UFP-QAPP Addendum (Leidos 2022b). 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 or shallow groundwater. 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). All 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 were collected from the 0- to 1-foot bgs interval. Surface soil samples were not collected from soil borings located in mulch or asphalt unless native soil was identified below the material in sufficient volume for collection of an analytical sample. Surface soil sample depths did not exceed 1 foot bgs.

A maximum of two subsurface soil samples were collected from each soil boring. 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. A second subsurface soil sample was collected immediately above the water table to evaluate the potential for leaching. In the event groundwater was encountered at less than 5 feet bgs, only one subsurface soil sample was collected (immediately above the water table).

Soil borings were abandoned following sample collection by backfilling the borehole with bentonite chips. Bentonite chips were hydrated using the PFAS-free DI water. Surface restoration matched the surrounding surface (e.g., asphalt or grass).

3.4.5 Groundwater Sampling

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

3.4.5.1 Existing Monitoring Well Sampling

Prior to commencing low-flow drawdown methods, existing monitoring wells were redeveloped by purging approximately three well volumes using a non-PFAS-containing peristaltic pump and new HDPE tubing. Groundwater was sampled by the low-flow sampling method using a peristaltic pump. 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 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 identification, date and time of sample collection, name of sampler, sample preservation, and type of analysis.

3.4.5.2 Grab Groundwater Sampling

Grab groundwater samples were collected from eight 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. Select locations used clean, new 1-inch PVC screen and riser in the open borehole instead of the SP22 stainless steel sampler.

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 until water was visibly clear and water quality measurements were recorded. 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 DI water. Surface restoration matched the surrounding surface (e.g., asphalt or grass).

3.4.6 Equipment Calibration

Equipment including a water quality instrument (YSI Multiparameter Instrument Model 556) and turbidity meter (HACH Model 2100Q) 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 forms 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 Monroe UFP-QAPP Addendum (Leidos 2022b). The following minor deviations from the planned sample quantities and locations in the Fort Monroe UFP-QAPP Addendum (Leidos 2022b) were observed during field activities and summarized for USACE in daily field notes:

- The quantities of samples varied from Table 17-1 of the Fort Monroe UFP-QAPP Addendum (Leidos 2022b), with the actual sample quantities shown in Table 3-1. The deviation in sample quantities is a result of actual field conditions, including pavement in place of surface soil and the presence of shallow groundwater at select locations. Surface soil samples and subsurface soil samples were collected as detailed on Worksheet #18 of the Fort Monroe UFP-QAPP Addendum (Leidos 2022b), which specified samples of pavement and saturated soils would not be collected.
    - Samples from one planned soil boring (FTM-FSA-04) and one planned collocated soil boring/DPT groundwater sample (FTM-FSA-03) were not collected at the Fire Station AOPI due to numerous occurrences of subsurface utilities.

- One planned surface soil sample was not collected (FMFSA02-SS01) due to mulch extending to approximately 10 inches below the ground surface.
- Seven planned subsurface soil samples were not collected. Samples FMMAR01-SB03, FMWAF01-SB03, FMWAF02-SB03, FMWAF04-SB03, FMFSA01-SB02, FMFSA03-SB02, and FMFSA03-SB03 were not collected due to shallow groundwater (i.e., less than 5 feet bgs). While this was a change from the planned sample quantities, it is not a deviation from the procedures in the Fort Monroe UFP-QAPP Addendum (Leidos 2022b), which specified that if groundwater was encountered at less than 5 feet bgs, only one subsurface soil sample would be collected (immediately above the water table).

- Two locations at the Fire Station AOPI (one in front of the building [FTM-FSA-02] and one behind [FTM-FSA-01]) were identified for potential sampling in coordination with the Caretaker's Office and Veolia and based on utility clearances. In conducting hand clearances at the two shifted locations, several refusals and encounters with difficult material (large debris including asphalt, concrete, and brick) occurred. As a result, soil and groundwater samples were collected from holes produced via hand auger where groundwater was attained as opposed to mobilizing the drill rig and attempting to find a secondary area clear of the debris.

3.5 DECONTAMINATION PROCEDURES

To ensure that chemical analysis results reflected the actual concentrations at sample locations, the non-dedicated, reusable equipment used in sampling activities was rigorously cleaned and decontaminated between sample locations in accordance with the Programmatic UFP-QAPP (Leidos 2022a) and Fort Monroe UFP-QAPP Addendum (Leidos 2022b). The non-disposable sampling equipment used to conduct sampling activities (e.g., drilling rods, 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 waste stream.

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

Decontamination of downhole drill rig equipment was completed prior to use, between locations, and after final use before departing the site. Non-dedicated tools and rods were bucket washed in an HDPE bucket with PFAS-free DI water/biodegradable detergent (e.g., Liquinox®) and rinsed with PFAS-free DI water at the staging area. Equipment was scrubbed using polyethylene or PVC brushes to remove particulates, then rinsed with the PFAS-free DI water.

3.6 DISPOSITION OF FIELD INVESTIGATION-DERIVED WASTE

The IDW generated during the SI at Fort Monroe included solids (e.g., soil, acetate liners, and groundwater sampling material) and liquids (e.g., development and purge water, decontamination rinse water). These materials were managed in accordance with the IDW Management Plan provided in Appendix D of the Fort Monroe UFP-QAPP Addendum (Leidos 2022b).

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 D of the Fort Monroe UFP-QAPP Addendum [Leidos 2022b]). Liquid and solid wastes were placed in United Nations (UN)-approved, 55-gallon drums for storage, transport, and disposal. Permanent labels for the drums included a unique container number, a description of the contents (i.e., soil or wastewater), the fill date, the source location, the generator's name (i.e., Fort Monroe), and a telephone number for the generator's point of contact (i.e., the Fort Monroe BRAC Environmental Coordinator). Each bucket or carboy used to temporarily store liquid IDW was marked "Nonpotable Water" or "Decontamination Waste" to comply with requirements of the IDW Management Plan included in Appendix D of the Fort Monroe UFP-QAPP Addendum (Leidos 2022b) and Occupational Safety and Health Administration (OSHA) hazard communication standards.

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. For drums containing liquid IDW (i.e., wastewater), a composite sample was collected using a peristaltic pump and new HDPE tubing and pumping directly into sample bottles. The certified waste hauler provided guidance to analyze for suspected contaminants based on site history and previous investigations. The sample was analyzed for PFAS, toxicity characteristic leaching procedure (TCLP) volatile organic compounds (VOCs), TCLP semivolatile organic compounds (SVOCs), TCLP metals, TCLP pesticides, TCLP herbicides, pH, and flashpoint.

No IDW from Fort Monroe was characterized as hazardous. The containerized waste was disposed of in accordance with applicable state and Federal Resource Conservation and Recovery Act (RCRA) regulations. The licensed and certified waste hauler (US Ecology) removed the drums containing IDW waste from Fort Monroe on May 9, 2023, for disposal at the US Ecology Michigan Disposal Waste Treatment Plant located at 49350 N I-94 Service Drive in Belleville, Michigan. The signed waste manifests and certificates of disposal are provided in Appendix F. Soiled personal protective equipment was bagged and disposed of as municipal waste.

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 Monroe SI field activities (40 CFR 300.420(c)(4)). Additional information on these procedures is presented in the Fort Monroe UFP-QAPP Addendum (Leidos 2022b).

Merit Laboratories, Inc., located in East Lansing, Michigan, was the analytical laboratory under contract for the analysis of PFAS during the Fort Monroe 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 above 2°C or below 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 number. The sample custodian labeled each container with its sample ID number, 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 Monroe SI conforms to the analytical requirements presented in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Monroe UFP-QAPP Addendum (Leidos 2022b) for the chemical analysis of field investigation samples. All samples were analyzed for PFAS 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 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 Monroe UFP-QAPP Addendum (Leidos 2022b).

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 (%R) 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 one 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 %R 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 Monroe field investigation. The requirements for field QC were established on Worksheet #20 of the Programmatic UFP-QAPP (Leidos 2022a) and Fort Monroe UFP-QAPP Addendum (Leidos 2022b).

Table 4-1. Frequency of Field QC Samples for Fort Monroe 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 (i.e., PFAS-free DI water)
Equipment Rinsate Blank	1 for every 10 or fewer investigative samples
Field Duplicate	1 for every 10 or fewer investigative samples
MS/MSD	1 for every 20 or fewer investigative samples
Reagent Blank	1 per drinking water sampling event; none required for this event

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 DoD Data Validation Guidelines Module 3 (DoD 2020) and the revised table for sample qualification in the presence of blank contamination (DoD 2022b).

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 in January 2023 at Fort Monroe. Samples and associated QC samples (e.g., field duplicates, equipment rinsate blanks, source water blanks, MSs, MSDs) were collected and analyzed for PFAS using methods specified in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Monroe UFP-QAPP Addendum (Leidos 2022b). Consistent with the data quality requirements established in the Programmatic UFP-QAPP (Leidos 2022a) and Fort Monroe UFP-QAPP Addendum (Leidos 2022b) 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 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.

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.

4.5.3 Sensitivity

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

4.5.4 Representativeness

Representativeness was satisfied by ensuring that the Programmatic UFP-QAPP (Leidos 2022a) and Fort Monroe UFP-QAPP Addendum (Leidos 2022b) protocols were followed, appropriate sampling techniques were used, established analytical procedures were implemented, and analytical holding times of the samples were not exceeded.

4.5.5 Comparability

Comparability was achieved by using consistent, documented, and UFP-QAPP-approved methods and meeting project accuracy and precision objectives.

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. All soil and groundwater samples proposed were collected with the exception of those that could not be collected due to reasons consistent with the sampling protocol in the Fort Monroe UFP-QAPP Addendum (e.g., soil boring locations impacted by subsurface utilities; pavement, asphalt, or gravel at the ground surface; or shallow groundwater). Analytical completeness was 100 percent.

4.5.7 Data Usability Assessment

Data that have been qualified as estimated (i.e., J, J+, J-, UJ) during validation indicate accuracy, precision, or sensitivity QC measurements may have exceeded criteria, but the results are considered valid. No data were recommended for exclusion during validation (qualified X) or subsequently rejected (qualified R) by the project decision team.

5. SITE INSPECTION SCREENING LEVELS

Detected concentrations of the Target PFAS in samples collected during this SI are compared to residential scenario SLs calculated using the USEPA RSL calculator for soil and the tap water criteria for groundwater and a target hazard quotient (HQ) of 0.1, as published in the 2022 OSD Memorandum (DoD 2022a. This SI uses the SLs and a target HQ of 0.1 to evaluate the Target PFAS concentrations. These SLs (Table 5-1) are used in this SI Report to evaluate the data and determine if further investigation is warranted at each AOPI.

Table 5-1. Screening Levels from the 2022 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
PFBS	601	1,900
PFHxS	39	130
PFNA	6	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 a CSM for each AOPI at Fort Monroe 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 six Target PFAS outlined in the 2022 OSD Memorandum (DoD 2022a): PFOS, PFOA, PFBS, PFNA, 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 PA were further refined for each AOPI where Target PFAS were detected above the LOD in soil or groundwater. 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 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 below SLs for soil or groundwater, or if SLs have been exceeded along the migration pathway. For example, if Target PFAS are not detected in soil but are detected at concentrations exceeding 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 above the LODs.

Although LUCs are not in place, a 2016 MOU was signed by VDEQ and FMA to prohibit groundwater use and consumption at four sites at Fort Monroe (Building 204/205, Directorate of Engineering and Housing Compound, Post Engineers Shop Compound, and Area 200) (VDEQ and FMA 2016). The MOU was put in place to address contaminants other than PFAS, including VOCs, metals, polynuclear aromatic hydrocarbons, and pesticides. Due to its overlap with Building 204/205, the use and consumption of groundwater at the Marina AOPI is prohibited.

6.2 MARINA AOPI

The following subsections describe the background, sampling results, CSM, and recommendation for the Marina AOPI.

6.2.1 AOPI Background

The Marina AOPI is located at the southwestern tip of Fort Monroe west of McNair Drive and south of the boat docking area. The Marina is located on property that has been transferred to the Commonwealth of Virginia (property managed by FMA). The 2016 MOU prohibits groundwater use at the Building 204/205 site, which overlaps with the Marina AOPI.

On October 1, 1981, a fire at the Marina destroyed the Old Point Yacht Club piers, two buildings, four automobiles, and seven boats. In addition to Hampton and Fort Monroe fire units, the Norfolk Fire Department responded to the fire and three Navy tugboats and three USCG cutters directed firehoses on the blaze (Graves 1989). Based on interviews with fire department personnel, aqueous-film forming foam (AFFF) was used by the Hampton Fire Department until the mid-2000s. Based on the time frame, respondents, and magnitude of the fire, AFFF was likely released at the Marina as part of the fire response.

6.2.2 SI Sampling and Results

Soil and groundwater samples were collected from the Marina AOPI at the following locations (Figure 6-1):

- Eight soil samples and one QC duplicate were collected from three soil borings (FTM-MAR-01, FTM-MAR-02, and FTM-MAR-03) within the suspected release area. The second subsurface soil sample was not able to be collected at FTM-MAR-01 due to the presence of shallow groundwater at less than 5 feet bgs.
- Groundwater samples were collected at three existing monitoring wells (FTM-MAR-MW-3, FTM-MAR-MW-4, and FTM-MAR-MW-5) associated with the Marina AOPI to evaluate Target PFAS concentrations within the suspected release area. In addition, one DPT grab groundwater sample was collected at FTM-MAR-01 where groundwater was encountered at less than 5 feet bgs.

The Target PFAS analytical results for soil and groundwater at the Marina AOPI are summarized below and presented in Table 6-1 and Figure 6-2.

6.2.2.1 Soil

PFOS was detected in surface soil (estimated concentrations) and subsurface soil below the SL at all three locations (FTM-MAR-01, FTM-MAR-02, and FTM-MAR-03).

PFOA was detected (estimated concentration) below the SL in subsurface soil collected at location FTM-MAR-03. PFNA was detected (estimated concentrations) below the SL at locations FTM-MAR-01 and FTM-MAR-02. PFBS, PFHxS, and HFPO-DA were not detected above the LODs in any soil samples collected at the Marina AOPI.

6.2.2.2 Groundwater

PFOS, PFOA, and PFNA were detected above the SLs in groundwater collected at the Marina AOPI. PFOS concentrations exceeded the SL of 4 ng/L within the suspected release area at locations FTM-MAR-01 (7.6 ng/L), FTM-MAR-MW-3 (8.9 ng/L), FTM-MAR-MW-4 (27 ng/L), and FTM-MAR-MW-5 (79 ng/L).

PFOA concentrations exceeded the SL of 6 ng/L at FTM-MAR-MW-3 (10 ng/L) and FTM-MAR-MW-5 (11 ng/L). PFOA was detected in all other groundwater samples at concentrations below the SL.

PFNA concentrations exceeded the SL of 6 ng/L at FTM-MAR-MW-5 (32 ng/L). PFNA was detected below the SL in all other groundwater samples collected at the AOPI.

PFBS and PFHxS were detected below their respective SLs in all groundwater samples collected at the Marina AOPI. HFPO-DA was not detected above the LOD in any groundwater samples.

6.2.3 CSM

The Marina AOPI is approximately 0.53 acres. The area is highly developed with concrete streets and lots. Few grassy areas exist with structures north and southeast of the AOPI. The ground surface elevation at the Marina AOPI is approximately 0 to 5 feet amsl. In general, stormwater runoff enters storm drains and gutters within the paved streets and lots that discharge to the Phoebus Channel. Infiltration likely exceeds surface runoff during precipitation events on the sandy beach portion of the Marina.

The Building 204/205 Area is underlain by fill material and tan, poorly sorted, fine- to coarse-grained sands with pebbles and shell fragments, which is generally consistent with a beach environment. Shallow groundwater has been encountered at approximately 3 to 6 feet bgs. It is likely that the Building 204/205 Area experiences flow direction reversals during key events (e.g., abnormally high tides, wind directions), but the overall flow direction is toward the bay (east to west) (Versar and Leidos 2017).

Due to the fire response activities that were conducted with the potential use of AFFF, the surface soil at the AOPI is the source medium for potential PFAS contamination. The primary release mechanism is the potential release of PFAS to surface soils related to the emergency response operations. The secondary contaminant migration and fate and transport considerations include downward contaminant migration from surface soil to subsurface soil, groundwater (through leaching and percolation), and surface water and sediment via runoff in precipitation (i.e., rainfall or snow melt). Due to the geological and hydrological conditions at the AOPI, such as the shallow depth to groundwater (less than 5 feet bgs) and tidal influences, the potential exists for connectivity between groundwater and nearby surface water. Surface water bodies at the former Fort Monroe are tidally influenced and receive surface water runoff and overland flow from the mainland. Such influences could result in PFAS concentrations in surface water and sediment in Mill Creek that are attributable to offsite sources not associated with Fort Monroe.

Based on the mixed land use at the former Fort Monroe, the human receptors considered in the CSM are onsite workers with the potential to work at the AOPI, onsite residents living within the former Fort Monroe boundaries, and offsite residents living in the vicinity of the former Fort Monroe property (i.e., off-post). Current land use at this AOPI is recreational; however, onsite residents are evaluated for the potential migration (i.e., groundwater and surface water) to residents living within the former Fort Monroe boundaries.

The onsite soil exposure pathways are potentially complete because Target PFAS were detected below the SLs in soil and above the SLs in groundwater. Although Target PFAS were detected above the SLs in groundwater, the 2016 MOU (VDEQ and FMA 2016) prohibits the use and consumption of groundwater at the Marina, and the groundwater is not suitable for consumption due to the shallow water-bearing zone and high salinity. Onsite drinking water is obtained from NNWW. Thus, the onsite groundwater exposure pathways for ingestion are incomplete. The dermal exposure pathway is considered potentially complete for onsite workers because contact with shallow groundwater during intrusive activities is possible. The offsite groundwater exposure pathways are incomplete as offsite drinking water is obtained from NNWW, and there is no migration potential of groundwater to offsite drinking water sources because no active wells are within 4 miles.

Surface water and sediment samples were not collected at the Marina AOPI because no surface water bodies or surface drainage features are present. However, the surface water and sediment exposure pathways for onsite and offsite receptors were evaluated because of the proximity of the Marina AOPI to Mill Creek and the potential for connectivity between groundwater at the AOPI with the nearby surface water feature. The surface water and sediment ingestion exposure pathways for onsite receptors are incomplete because surface water is not used as a drinking water source and is not suitable as a potential drinking water source due to its brackish properties. The dermal exposure pathway for onsite receptors is potentially complete due to the possibility of dermal contact with surface water or sediment impacted by groundwater from the AOPI. The nearest offsite (i.e., off-post) receptors reside across Mill Creek. As a result, exposure routes to surface water or sediment directly impacted by groundwater at the AOPI do not exist for offsite receptors, making the offsite exposure pathways incomplete. As noted above, Mill Creek has the potential for impacts from offsite sources of PFAS. Figure 6-3 presents the CSM for the Marina AOPI.

6.2.4 Recommendation

Detected concentrations of Target PFAS in groundwater exceed the SLs; therefore, further investigation is recommended.

Table 6-1. Target PFAS Results and Screening for the Marina AOPI

Location ID	Sample ID	Sample Type	Depth (ft)	Sample Date	HFPO-DA or GenX	PFBS	PFHxS	PFNA	PFOA	PFOS
Soil				**Units**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
				Screening Levels	**23**	**1,900**	**130**	**19**	**19**	**13**
FTM-MAR-01	FMMAR01-SS01	SURF	0.00-1.00	01/12/2023	0.027 U	0.027 U	0.027 U	**0.030 J**	0.027 U	**0.076 J**
	FMMAR01-SB02	BORE	2.00-4.00	01/12/2023	0.034 U	0.034 U	0.034 U	0.034 U	0.034 U	**0.083**
FTM-MAR-02	FMMAR02-SS01	SURF	0.00-1.00	01/12/2023	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	**0.037 J**
	FMMAR02-SB02	BORE	1.00-3.00	01/12/2023	0.030 U	0.030 U	0.030 U	**0.045 J**	0.030 U	**0.14**
	FMMAR02-SB03	BORE	3.00-5.00	01/12/2023	0.032 U	0.032 U	0.032 U	**0.033 J**	0.032 U	**0.18**
	FMMAR02-SB03-FD	BORE	3.00-5.00 (D)	01/12/2023	0.030 U	0.030 U	0.030 U	**0.036 J**	0.030 U	**0.22**
FTM-MAR-03	FMMAR03-SS01	SURF	0.00-1.00	01/12/2023	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	**0.065**
	FMMAR03-SB02	BORE	2.00-4.00	01/12/2023	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	**0.11**
	FMMAR03-SB03	BORE	4.00-6.00	01/12/2023	0.036 U	0.036 U	0.036 U	0.036 U	**0.043 J**	**0.21**
Groundwater				**Units**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
				Screening Levels	**6**	**601**	**39**	**6**	**6**	**4**
FTM-MAR-01	FMMAR01-GW01	PNCH	4.50-4.50	01/12/2023	0.86 U	**5.7**	**2.4**	**2.9**	**4**	**7.6**
FTM-MAR-MW-3	FMMAR-MW3	WELL	9.00-9.00	01/13/2023	0.86 U	**12**	**5.1**	**1.9**	**10**	**8.9**
FTM-MAR-MW-4	FMMAR-MW4	WELL	10.00-10.00	01/13/2023	0.88 U	**50**	**3.7**	**2.1**	**4.1**	**27**
	FMMAR-MW4-FD	WELL	10.00-10.00 (D)	01/13/2023	0.88 U	**49**	**3.5**	**2.1**	**4**	**25**
FTM-MAR-MW-5	FMMAR-MW5	WELL	8.00-8.00	01/13/2023	0.89 U	**62**	**4.7**	**32**	**11**	**79**

The SLs are the Residential Scenario SLs calculated using the USEPA RSL Calculator provided in the July 2022 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 FIRE TRAINING PIT AOPI

The following subsections describe the background, sampling results, CSM, and recommendation for the Fire Training Pit AOPI.

6.3.1 AOPI Background

The Fire Training Pit AOPI is located in the northern portion of Fort Monroe to the east of Fenwick Road. The Fire Training Pit is located on Army-owned property that has not yet been transferred. The location of the Fire Training Pit is consistent with an aerial photograph from 1982 that described a pit that appeared to contain a dark liquid in the same area.

Based on historical documents and an interview with the former Fire Chief conducted for a U.S. Army BRAC non-PFAS SI Report, it was determined that wood containing creosote and lead-based paint was ignited using jet propulsion fuels (JP-4 and JP-5) and waste oil. The pit was banked with rocks and concrete and had a dirt bottom (SAIC 2008, USAEHA 1983). According to personnel interviews conducted during the Fort Monroe PFAS PA (Leidos 2023), fire training exercises were conducted three to four times per month (less frequently during colder months) from the 1950s to the 1980s. The former Deputy Fire Chief indicated that AFFF was likely used during fire training exercises at the Fire Training Pit. This is supported by the time frame during which the fire training activities occurred.

The Fire Training Pit was previously investigated during a non-PFAS SI (SAIC 2008) and Supplemental SI (SAIC 2011). Chemical concentrations in soil and groundwater were compared to chemical of concern screening criteria, and based on the results, no further action was recommended.

6.3.2 SI Sampling and Results

Soil and groundwater samples were collected from the Fire Training Pit AOPI at the following locations (Figure 6-4):

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

The Target PFAS analytical results for soil and groundwater collected at the Fire Training Pit AOPI are summarized below and presented in Table 6-2 and Figure 6-5.

6.3.2.1 Soil

PFOS, PFOA, PFNA, and PFHxS were detected in soil samples collected at the Fire Training Pit AOPI. PFOS was detected at a concentration of 17 µg/kg in the deepest soil sample interval collected within the suspected release area at location FTM-FTP-01, which exceeds the 13 µg/kg SL. PFOS was detected below the SL in all other soil samples collected at the AOPI.

PFOA and PFHxS were detected at concentrations below their respective SLs in surface soil and subsurface soil at locations FTM-FTP-01 and FTM-FTP-02. PFNA was detected below the SL in surface soil and subsurface soil collected at locations FTM-FTP-02 and FTM-FTP-03. HFPO-DA was not detected above the LOD.

6.3.2.2 Groundwater

PFOS, PFOA, PFNA, and PFHxS were detected at concentrations above their respective SLs at the Fire Training Pit AOPI.

PFOS was detected at concentrations that exceeded the SL of 4 ng/L at all three groundwater sampling locations within the suspected release area: 3,200 ng/L (FTM-FTP-01); 610 ng/L (FTM-FTP-02); and 400 ng/L (FTM-FTP-03). The highest concentration of PFOS at FTM (3,200 ng/L) was detected at the FTP in sample FMFTP01-GW01.

PFOA was detected at concentrations that exceeded the SL of 6 ng/L at all three groundwater sampling locations within the suspected release area: 34 ng/L (FTM-FTP-01), 9.3 ng/L (FTM-FTP-02), and 11 ng/L (FTM-FTP-03). In addition, PFHxS was detected at concentrations above the SL of 6 ng/L all three groundwater sampling locations at the AOPI: 830 ng/L (FTM-FTP-01), 71 ng/L (FTM-FTP-02), and 130 ng/L (FTM-FTP-03).

PFNA was detected at a concentration of 13 ng/L at location FTM-FTP-03 (FMFTP03-GW01), which exceeds the SL of 6 ng/L. PFNA was also detected below the SL at FTM-FTP-02. PFBS was detected below the SL in all groundwater samples collected at the FTP. HFPO-DA was not detected above the LOD.

6.3.3 CSM

The Fire Training Pit AOPI is approximately 0.04 acres. The area is primarily an open grassy expanse with a concrete pad abutting the western boundary surrounded by a grassy area that is depressed on the northern side. The ground surface elevation at the Fire Training Pit AOPI is approximately 5 feet amsl. In general, infiltration likely exceeds surface runoff during precipitation events at the Fire Training Pit AOPI. The current land use is recreational.

The Fire Training Pit is underlain by silty sands and clayey sands, and groundwater was encountered at approximately 5 feet bgs.

Due to the fire training activities that were conducted from the 1950s to the 1980s, with the potential use of AFFF starting in the 1970s, the surface soil at the AOPI is the source medium for potential PFAS contamination. The primary release mechanism is the potential release of PFAS to surface soils related to historical operations at the Fire Training Pit AOPI. The secondary contaminant migration and fate and transport considerations include downward contaminant migration from surface soil to subsurface soil and groundwater through leaching and percolation. Surface water and sediment are not present at the Fire Training Pit AOPI.

Based on the mixed land use at the former Fort Monroe, the human receptors considered in the CSM are onsite workers with the potential to work at the AOPI, onsite recreators within the former Fort Monroe boundaries, and offsite residents living in the vicinity of the former Fort Monroe property (i.e., off-post).

The onsite subsurface soil exposure pathways are complete because Target PFAS were detected above the SLs in subsurface soil at the FTP AOPI. The onsite surface soil exposure pathways are potentially complete since Target PFAS were detected below the SLs in surface soil and above the SLs in subsurface soil and groundwater.

Although Target PFAS were detected above the SLs in groundwater, the groundwater is not suitable for consumption due to the shallow water-bearing zone and high salinity. Onsite drinking water is obtained from NNWW. Thus, the onsite groundwater exposure pathways for ingestion are incomplete. The dermal exposure pathway is considered potentially complete for onsite workers because contact with shallow groundwater during intrusive activities is possible. The offsite groundwater exposure pathways are incomplete as offsite drinking water is obtained from NNWW, and there is no migration potential of groundwater to offsite drinking water sources because no active wells are within 4 miles. Figure 6-6 presents the CSM for the Fire Training Pit AOPI.

6.3.4 Recommendation

Detected concentrations of Target PFAS in soil and groundwater samples collected at the Fire Training Pit exceed the SLs; therefore, further investigation is recommended.

Table 6-2. Target PFAS Results and Screening for the Fire Training Pit AOPI

Location ID	Sample ID	Sample Type	Depth (ft)	Sample Date	HFPO-DA or GenX	PFBS	PFHxS	PFNA	PFOA	PFOS
Soil				**Units**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
				Screening Levels	**23**	**1,900**	**130**	**19**	**19**	**13**
FTM-FTP-01	FMFTP01-SS01	SURF	0.00-1.00	01/09/2023	0.032 U	0.032 U	**0.43**	0.032 U	**0.039 J**	**0.72**
	FMFTP01-SB02	BORE	1.00-3.00	01/09/2023	0.037 U	0.037 U	**0.54**	0.037 U	**0.065 J**	**1.1**
	FMFTP01-SB03	BORE	3.00-5.00	01/09/2023	0.030 U	0.030 U	**0.26**	0.030 U	0.030 U	**17**
FTM-FTP-02	FMFTP02-SS01	SURF	0.00-1.00	01/09/2023	0.038 U	0.038 U	**0.58**	**0.19**	**0.20**	**9.5**
	FMFTP02-SB02	BORE	1.00-3.00	01/09/2023	0.040 U	0.040 U	**0.15**	**0.065 J**	**0.085**	**1.4**
	FMFTP02-SB02-FD	BORE	1.00-3.00 (D)	01/09/2023	0.030 U	0.030 U	**0.13**	**0.060**	**0.069**	**1.2**
	FMFTP02-SB03	BORE	3.00-5.00	01/09/2023	0.032 U	0.032 U	0.032 U	0.032 U	0.032 U	**1.2**
FTM-FTP-03	FMFTP03-SS01	SURF	0.00-1.00	01/09/2023	0.032 U	0.032 U	0.032 U	**0.043 J**	0.032 U	**0.57**
	FMFTP03-SB02	BORE	1.00-3.00	01/09/2023	0.033 U	0.033 U	0.033 U	**0.034 J**	0.033 U	**0.16**
	FMFTP03-SB03	BORE	3.00-5.00	01/09/2023	0.033 U	0.033 U	0.033 U	**0.079**	0.033 U	**0.42**
Groundwater				**Units**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
				Screening Levels	**6**	**601**	**39**	**6**	**6**	**4**
FTM-FTP-01	FMFTP01-GW01	PNCH	6.00-6.00	01/10/2023	0.88 U	**19**	**830**	8.5 UJ	**34**	**3,200**
FTM-FTP-02	FMFTP02-GW01	PNCH	6.00-6.00	01/10/2023	0.88 U	**5.2**	**71**	**4.6**	**9.3**	**610**
FTM-FTP-03	FMFTP03-GW01	PNCH	5.80-5.80	01/10/2023	0.89 U	**6.3**	**130**	**13**	**11**	**400**

The SLs are the Residential Scenario SLs calculated using the USEPA RSL Calculator provided in the July 2022 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.
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.

6.4 WALKER AIRFIELD AOPI

The following subsections describe the background, sampling results, CSM, and recommendation for the Walker Airfield AOPI.

6.4.1 AOPI Background

The Walker Airfield AOPI is located in the central portion of Fort Monroe on the western side of Fenwick Road. Walker Airfield is located on property that has been transferred to NPS. The airfield was used only for helicopters following the late 1960s when fixed wing airplanes were discontinued (SAIC 2008). According to personnel interviews, fire training exercises were conducted at the airfield in the vicinity of the fire hydrant, and fire training exercises included the use of AFFF. Approximately 10 5-gallon cans of AFFF were stored in former Building 206. Building 206 was razed in the 1990s, and the building footprint is currently a maintained (mowed) grass-covered area.

6.4.2 SI Sampling and Results

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

- Nine soil samples and two QC duplicates were collected from four soil borings (FTM-WAF-01, FTM-WAF-02, FTM-WAF-03, and FTM-WAF-04) within the suspected release area. One surface soil and one subsurface soil sample were collected from outside the former bay doors of Building 206 at FTM-WAF-01. Borings FTM-WAF-02 and FTM-WAF-04 were located near the fire hydrant where fire training activities historically occurred; one surface soil and one subsurface soil sample were collected from each location. A second subsurface soil sample was not collected at FTM-WAF-01, FTM-WAF-02, and FTM-WAF-04 because shallow groundwater was encountered (i.e., less than 5 feet bgs). One surface soil sample and two subsurface soil samples were collected from beneath Building 206 at FTM-WAF-03.
- Two groundwater samples were collected from within the suspected release area (FTM-WAF-01 and FTM-WAF-02).

The Target PFAS analytical results for soil and groundwater samples collected at the Walker Airfield AOPI are summarized below and presented in Table 6-3 and Figure 6-8. Sediment and surface water are not present at this AOPI.

6.4.2.1 Soil

PFOS was detected at a concentration of 23 µg/kg in subsurface soil collected at FTM-WAF-01 outside the former bay doors of Building 206, which exceeds the 13 µg/kg SL. PFOS was detected below the SL at FTM-WAF-02, FTM-WAF-03, and FTM-WAF-04.

PFOA, PFNA, and PFHxS were detected below their respective SLs at each of the four soil borings. In addition, PFBS was detected below the SL in subsurface soil collected at FTM-WAF-01. HFPO-DA was not detected at concentrations above the LOD in soil.

6.4.2.2 Groundwater

PFOS, PFOA, and PFNA were detected above the SLs in both groundwater samples collected within the suspected release area at the Walker Airfield AOPI. In addition, PFHxS exceeded the SL in the sample collected near the fire hydrant (FMWAF02-GW01).

PFOS (65 ng/L), PFOA (15 ng/L), and PFNA (6.7 ng/L) were detected at concentrations above their SLs of 4 ng/L, 6 ng/L, and 6 ng/L, respectively, in the groundwater sample collected from outside the former bay doors at FTM-WAF-02. PFHxS and PFBS were detected below the SLs at FTM-WAF-01.

Detected concentrations of PFOS, PFOA, PFNA, and PFHxS exceeded their respective SLs in groundwater collected at FTM-WAF-02 near the fire hydrant. PFOS was detected at a concentration of 430 ng/L, which exceeds the SL of 4 ng/L. PFOA was detected at a concentration of 14 ng/L, PFNA was detected at a concentration of 16 ng/L, and PFHxS was detected at a concentration of 55 ng/L, exceeding their SLs of 6 ng/L, 6 ng/L, and 39 ng/L, respectively. In addition, PFBS was detected below the SL at FTM-WAF-02. HFPO-DA was not detected above the LOD in the groundwater sample collected at the Walker Airfield AOPI.

6.4.3 CSM

Walker Airfield is 8.5 acres and consists of an asphalt runway, fire hydrant, grassy area, and several concrete pads. Building 247 is still present but is unoccupied. The ground surface elevation at the Walker Airfield AOPI is approximately 5 feet amsl. In general, infiltration likely exceeds surface runoff during precipitation events at the Walker Airfield AOPI. However, stormwater runoff from the airfield and paved streets and lots enter storm drains that discharge to Mill Creek (U.S. Army 2006). The current land use is recreational.

Soil and groundwater conditions are similar to the Fire Training Pit AOPI due to their proximity and similarities in their CSMs. The Fire Training Pit is underlain by silty sands and clayey sands, and groundwater was encountered at approximately 4 to 5 feet bgs.

Due to the fire training activities that were conducted using AFFF and storage of AFFF in Building 206, the surface soil at the Walker Airfield AOPI is the source medium for potential PFAS contamination. The primary release mechanism is the potential release of PFAS to surface soils related to historical operations at the AOPI. The secondary contaminant migration and fate and transport considerations include downward contaminant migration from surface soil to subsurface soil and groundwater through leaching and percolation. Surface water and sediment are not present at the Walker Airfield AOPI.

Based on the mixed land use at the former Fort Monroe, the human receptors considered in the CSM are onsite workers with the potential to work at the AOPI, onsite recreators within the former Fort Monroe boundaries, and offsite residents living in the vicinity of the former Fort Monroe property (i.e., off-post).

The onsite subsurface soil exposure pathways are complete because Target PFAS were detected above the SLs in subsurface soil at the Walker Airfield AOPI. The onsite surface soil exposure pathways are potentially complete, since Target PFAS were detected below the SLs in surface soil and above the SLs in subsurface soil and groundwater.

Although Target PFAS were detected above the SLs in groundwater, the groundwater is not suitable for consumption due to the shallow water-bearing zone and high salinity. Onsite drinking water is obtained from NNWW. Thus, the onsite groundwater exposure pathways for ingestion are incomplete. The dermal exposure pathway is considered potentially complete for onsite workers because contact with shallow groundwater during intrusive activities is possible. The offsite groundwater exposure pathways are incomplete as offsite drinking water is obtained from NNWW, and there is no migration potential of groundwater to offsite drinking water sources because no active wells are within 4 miles. Figure 6-9 presents the CSM for the Walker Airfield AOPI.

6.4.4 Recommendation

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

Table 6-3. Target PFAS Results and Screening for the Walker Airfield AOPI

Location ID	Sample ID	Sample Type	Depth (ft)	Sample Date	HFPO-DA or GenX	PFBS	PFHxS	PFNA	PFOA	PFOS
Soil				**Units**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
				Screening Levels	**23**	**1,900**	**130**	**19**	**19**	**13**
FTM-WAF-01	FMWAF01-SS01	SURF	0.00-1.00	01/10/2023	0.031 U	0.031 U	**0.16**	**0.058 J**	**0.060 J**	**1.5**
	FMWAF01-SS01-FD	SURF	0.00-1.00 (D)	01/10/2023	0.033 U	0.033 U	**0.11**	**0.046 J**	**0.045 J**	**2.2**
	FMWAF01-SB02	BORE	2.50-4.50	01/10/2023	0.031 U	**0.56**	**5.0**	**0.034 J**	**0.20**	**23**
FTM-WAF-02	FMWAF02-SS01	SURF	0.00-1.00	01/10/2023	0.046 U	0.046 U	**0.075 J**	**0.20**	**0.16**	**4.3**
	FMWAF02-SB02	BORE	2.00-4.00	01/10/2023	0.028 U	0.028 U	0.028 U	**0.042 J**	0.028 U	**0.68**
FTM-WAF-03	FMWAF03-SS01	SURF	0.00-1.00	01/10/2023	0.043 U	0.043 U	**0.068 J**	**0.17**	**0.16**	**3.0**
	FMWAF03-SB02	BORE	1.00-3.00	01/10/2023	0.037 U	0.037 U	**0.10**	**0.065 J**	**0.23**	**1.8**
	FMWAF03-SB03	BORE	3.00-5.00	01/10/2023	0.031 U	0.031 U	0.031 U	0.031 U	**0.037 J**	**0.29**
FTM-WAF-04	FMWAF04-SS01	SURF	0.00-1.00	01/10/2023	0.032 U	0.032 U	**0.092**	**0.22**	**0.11**	**7.9**
	FMWAF04-SB02	BORE	2.00-4.00	01/10/2023	0.028 U	0.028 U	0.028 U	**0.035 J**	**0.038 J**	**1.2**
	FMWAF04-SB02-FD	BORE	2.00-4.00 (D)	01/10/2023	0.027 U	0.027 U	0.027 U	**0.031 J**	**0.031 J**	**1.3**
Groundwater				**Units**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
				Screening Levels	**6**	**601**	**39**	**6**	**6**	**4**
FTM-WAF-01	FMWAF01-GW01	PNCH	5.00-5.00	01/10/2023	0.88 U	**3.7**	**19**	**6.7**	**15**	**65**
FTM-WAF-02	FMWAF02-GW01	PNCH	3.50-3.50	01/10/2023	0.89 U	**6.7**	**55**	**16**	**14**	**430**

The SLs are the Residential Scenario SLs calculated using the USEPA RSL Calculator provided in the July 2022 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.

6.5 FIRE STATION (BUILDING 24) AOPI

The following subsections describe the background, sampling results, CSM, and recommendation for the Fire Station (Building 24) AOPI.

6.5.1 AOPI Background

The Fire Station (Building 24) AOPI is located in the southern portion of Fort Monroe to the north of Ruckman Road and situated between Ingalls Road and the Moat. The Fire Station is located on property that has been transferred to the Commonwealth of Virginia (property managed by FMA) and is currently being used as a cafe.

Building 24 was constructed in 1881 and operated as a fire station until 2011. According to the Former Deputy Fire Chief, two 5-gallon cans of AFFF were historically stored on the two fire trucks parked at the station, which were washed down on the Fire Station ramp.

6.5.2 SI Sampling and Results

Soil and groundwater samples were collected from the Fire Station AOPI at the following locations (Figure 6-10):

- Three soil samples were collected from two soil borings (FTM-FSA-01 and FTM-FSA-02). One subsurface soil sample was collected near the rear door of the building at FTM-FSA-01. A second subsurface soil sample was not collected due to shallow groundwater (i.e., less than 5 feet bgs). At FTM-FSA-02, near the driveway, two subsurface soil samples were collected. Surface soil was not collected at FTM-FSA-02 due to mulch extending to approximately 10 inches below the surface.
- Two groundwater samples and one QC duplicate were collected at the AOPI (FTM-FSA-01 and FTM-FSA-02).

The Target PFAS analytical results for soil and groundwater samples collected at the Fire Station AOPI are summarized below and presented in Table 6-4 and Figure 6-11. Surface water and sediment are not present at this AOPI.

6.5.2.1 Soil

PFOS was detected at a concentration of 26 µg/kg in subsurface soil collected at the rear of the Fire Station (FTM-FSA-01) and at a concentration of 16 µg/kg in shallow subsurface soil near the driveway (FTM-FSA-02), both exceeding the 13 µg/kg SL. PFOS was also detected below the SL in deeper subsurface soil (FMFSA02-SB03) near the driveway.

PFOA, PFNA, and PFHxS were detected below their respective SLs at both soil borings. PFBS and HFPO-DA were not detected above the LOD in soil.

6.5.2.2 Groundwater

PFOS, PFOA, PFNA, and PFHxS were detected above the SLs in groundwater collected at FTM-FSA-01. PFOS was detected at a concentration of 1,800 ng/L, exceeding the SL of 4 ng/L. PFOA was detected at a concentration of 99 ng/L and PFNA was detected at a concentration of 37 ng/L, both exceeding their SLs of 6 ng/L. PHFxS was detected at 600 ng/L, which exceeds the SL of 39 ng/L. In addition, PFBS was detected below the SL at FTM-FSA-01.

Target PFAS were also detected in groundwater collected near the driveway (FTM-FSA-02) at the Fire Station AOPI. PFOS (170 ng/L), PFOA (17 ng/L), and PFHxS (60 ng/L) exceeded their SLs of 4 ng/L, 6 ng/L, and 39 ng/L, respectively. PFBS and PFNA were detected below their SLs at FTM-FSA-02. HFPO-DA was not detected above the LOD in groundwater samples collected at the Fire Station AOPI.

6.5.3 CSM

The Fire Station is approximately 0.05 acres. The area is highly developed with streets, and the building is surrounded by asphalt and concrete parking lots. Well-maintained landscaped areas are present on either side of the Fire Station driveway. The ground surface elevation at the Fire Station AOPI is approximately 5 feet amsl. The current land use at the Fire Station is mixed with a focus on retail and dining. The Fire Station is currently the location of the Firehouse Coffee 1881 coffee shop.

Although the surface soil has been re-worked during construction of the Fire Station, soil and groundwater conditions are similar to the Fire Training Pit AOPI, which is underlain by silty sands and clayey sands. Groundwater was encountered at approximately 5 to 6.5 feet bgs. In general, stormwater runoff enters storm drains and gutters within the paved streets and lots, which discharge to the Moat. The connectivity of the Moat to Mill Creek through passive tidal exchange (Section 2.7) leads to the potential for the surface water and sediment in the Moat to be impacted by offsite sources of PFAS not associated with Fort Monroe.

Due to the use of Building 24 as a fire station during the active timeframe of AFFF use and accounts indicating that fire trucks equipped with AFFF were washed in the driveway of the fire station, the surface soil at the AOPI is the source medium for potential PFAS contamination. The primary release mechanism is the potential release of PFAS to surface soils related to historical operations at the Fire Station AOPI. The secondary contaminant migration and fate and transport considerations include downward contaminant migration from surface soil to subsurface soil and groundwater through leaching and percolation and to surface water and sediment via runoff in precipitation (i.e., rainfall or snow melt).

Based on the mixed land use at the former Fort Monroe, the human receptors considered in the CSM are onsite workers with the potential to work at the AOPI, onsite residents living within the former Fort Monroe boundaries, and offsite residents living in the vicinity of the former Fort Monroe property (i.e., off-post). An on-AOPI residential pathway does not currently exist. However, onsite residents are evaluated for the potential migration (i.e., groundwater and surface water) to residents living within the former Fort Monroe boundaries.

The onsite subsurface soil exposure pathways are complete because Target PFAS were detected above the SLs in subsurface soil at the FTP AOPI. The onsite surface soil exposure pathways are potentially complete since Target PFAS were detected below the SLs in surface soil and above the SLs in subsurface soil and groundwater.

Although Target PFAS were detected above the SLs in groundwater, the groundwater is not suitable for consumption due to the shallow water-bearing zone and high salinity. Onsite drinking water is obtained from NNWW. Thus, the onsite groundwater exposure pathways for ingestion are incomplete. The dermal exposure pathway is considered potentially complete for onsite workers because contact with shallow groundwater during intrusive activities is possible. The offsite groundwater exposure pathways are incomplete as offsite drinking water is obtained from NNWW, and there is no migration potential of groundwater to offsite drinking water sources because no active wells are within 4 miles. Surface water and sediment samples were not collected at the Fire Station AOPI because no surface water bodies or surface drainage features are present. However, the surface water and sediment exposure pathways were evaluated because of the potential for runoff into the Moat and the potential for connectivity between the Moat and shallow groundwater at the AOPI. The surface water and sediment exposure pathways for onsite receptors are incomplete because surface water is not used as a drinking water source, and physical conditions make contact with the Moat media extremely unlikely. Although the Moat is tidally connected to Mill Creek, the nearest offsite (i.e., off-post) receptors reside across Mill Creek. As a result, exposure routes to surface water or sediment directly impacted by runoff or shallow groundwater at the Fire Station AOPI do not exist for offsite receptors, making the offsite exposure pathways incomplete. As noted above, Mill Creek has the potential for impacts from offsite sources of PFAS. Figure 6-12 presents the CSM for the Fire Station (Building 24) AOPI.

6.5.4 Recommendation

Target PFAS were detected above the SLs in soil and groundwater at the Fire Station (Building 24) AOPI; therefore, further investigation is recommended.

Table 6-4. Target PFAS Results and Screening for the Fire Station (Building 24) AOPI

Location ID	Sample ID	Sample Type	Depth (ft)	Sample Date	HFPO-DA or GenX	PFBS	PFHxS	PFNA	PFOA	PFOS
Soil				**Units**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
				Screening Levels	**23**	**1,900**	**130**	**19**	**19**	**13**
FTM-FSA-01	FMFSA01-SB01	BORE	4.00-5.00	01/12/2023	0.038 U	0.038 U	**0.78**	**0.29**	**0.19**	**26**
FTM-FSA-02	FMFSA02-SB02	BORE	3.00-4.00	01/12/2023	0.036 U	0.036 U	**0.27**	**0.33**	**0.29**	**16**
	FMFSA02-SB03	BORE	6.00-6.50	01/12/2023	0.027 U	0.027 U	**0.18**	**0.19**	**0.25**	**6.8**
Groundwater				**Units**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**	**ng/L**
				Screening Levels	**6**	**601**	**39**	**6**	**6**	**4**
FTM-FSA-01	FMFSA01-GW01	PNCH	5.50-5.50	01/12/2023	0.92 U	**27**	**600**	**37**	**99**	**1,800**
FTM-FSA-02	FMFSA02-GW01	PNCH	5.50-5.50	01/12/2023	0.89 U	**9.9**	**60**	**3.1**	**17**	**170**
	FMFSA02-GW01-FD	PNCH	5.50-5.50 (D)	01/12/2023	0.91 U	**10**	**57**	**4**	**19**	**190**

The SLs are the Residential Scenario SLs calculated using the USEPA RSL Calculator provided in the July 2022 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.
U = The analyte was analyzed for, but not detected above the reported sample quantitation limit.

7. CONCLUSIONS AND RECOMMENDATIONS

An SI is conducted when the PA determines an AOPI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes soil and groundwater 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)). The SI Report used the findings from the PA in conjunction with soil and groundwater 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 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 AOPIs were sampled during the SI at Fort Monroe to further evaluate PFAS-related releases and identify the presence or absence of Target PFAS.

Target PFAS were detected and exceeded SLs at all four AOPIs in soil and/or groundwater: the Marina, Fire Training Pit, Walker Airfield, and Fire Station (Building 24). HFPO-DA was not detected in any samples.

Target PFAS were detected in groundwater collected from all 11 groundwater sample locations. PFOS, PFOA, PFNA, and/or PFHxS concentrations exceeded the SLs in all of the groundwater samples. PFOS concentrations exceeded the SL in four subsurface soil samples collected from three AOPIs. Surface water and sediment samples were not collected at any of the AOPIs.

The CSMs were updated for each AOPI where Target PFAS were detected. 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. There are multiple land uses at and immediately adjacent to each AOPI. The CSMs present exposure pathways for conservative onsite and offsite receptors.

The soil exposure pathway for onsite workers is complete at three AOPIs where Target PFAS were detected in soil above the SLs and potentially complete at one AOPI where Target PFAS were detected below the SLs in soil. SL exceedances do not indicate an unacceptable risk without further remedial investigation, only that the pathway is complete. The onsite groundwater ingestion exposure pathway is considered incomplete at all AOPIs because groundwater is not currently used and is unlikely to be used for drinking water at Fort Monroe due to a shallow water-bearing zone and high salinity. The dermal exposure pathway is considered potentially complete for onsite workers at all AOPIs because contact with shallow groundwater during intrusive activities is possible. The groundwater exposure pathway for offsite residents is incomplete for all AOPIs as there are no active water supply wells within at least 4 miles. The exposure pathway for surface water and sediment are incomplete for all but the Marina AOPI where dermal exposure for onsite residents is potentially complete due to accessibility to Mill Creek and the possible connectivity between nearby groundwater from the AOPI where Target PFAS were greater than the SLs. The surface water bodies at Fort Monroe are tidally influenced and receive surface water runoff and overland flow from the mainland. Such influences could result in PFAS concentrations in surface water and sediment in the Chesapeake Bay that are attributable to offsite sources not associated with Fort Monroe as a source.

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. The following four AOPIs are recommended for further investigation or evaluation:

- Marina
- Fire Training Pit
- Walker Airfield
- Fire Station (Building 24).

Table 7-1. Summary of Target PFAS Detected and Recommendations

AOPI	Detection of HFPO-DA, PFBS, PFHxS, PFNA, PFOS, and/or PFOA		Recommendation and Rationale
	Groundwater	Soil	
Marina	Exceeds SL	Detected	SLs exceeded in groundwater; further investigation is recommended
Fire Training Pit	Exceeds SL	Exceeds SL	SLs exceeded in soil and groundwater; further investigation is recommended
Walker Airfield	Exceeds SL	Exceeds SL	SLs exceeded in soil and groundwater; further investigation is recommended
Fire Station (Building 24)	Exceeds SL	Exceeds SL	SLs exceeded in soil and groundwater; further investigation is recommended

8. REFERENCES

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

Cederstrom, D.J. 1957. *Geology and Groundwater Resources of the York-James Peninsula, Virginia: U.S. Geological Survey Water-Supply Paper 1361*. 237 p.

Condon, A., J. McCloskey, and S. Lingenfelser. 2010. *Bird Surveys of Fort Monroe, 2009-2010*. U.S. Fish and Wildlife Service, Gloucester, Virginia. July.

Darton, N.H. 1896. *Artesian-well prospects in the Atlantic Coastal Plain region: U.S. Geological Survey Bulletin 138*.

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*. May.

DoD. 2021. *Quality Systems Manual for Environmental Laboratories*. Prepared by the U.S. Department of Defense and U.S. Department of Energy. Version 5.4.

DoD. 2022a. *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program*. July 6.

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

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

FMA (Fort Monroe Authority). 2021. Available online at: https://fortmonroe.org/.

Galvez, J.I., T.W. Black, G.L. Swihart, and C.B. Black. 1998. *Biological diversity survey of the flora and fauna of Fort Monroe and Bethel Reservoir.* U.S. Fish and Wildlife Service. Office of Fishery Assistance. Gloucester, Virginia.

Graves, R. 1989. *Dangers Live in Firefighters' Memories*. May 11. Available online at: https://www.dailypress.com/news/dp-xpm-19890511-1989-05-11-8905080285-story.html.

HRCP (Hampton Roads Connector Partners). 2019. *Appendix – I Federal Species. I-64 Hampton Roads Bridge-Tunnel Expansion Project*. Revision 1. December.

ITRC (Interstate Technology & Regulatory Council). 2022. Fate and Transport of Per- and Polyfluroalkyl Substances (PFAS). July. Available online at: https://pfas-1.itrcweb.org/wp-content/uploads/2022/09/FT_PFAS_Fact_Sheet_083122_508.pdf.

Leidos. 2018. *Wetland Delineation and Threatened and Endangered Species Habitat Survey, Fort Monroe, Hampton, Virginia*. May.

Leidos. 2021. *Risk Assessment Technical Memorandum, Dog Beach Landfill, Fort Monroe, Hampton, Virginia.* February.

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. *Per- And Polyfluoroalkyl Substances Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum at Fort Monroe, Virginia*. Final. Prepared for the U.S. Army Corps of Engineers, Baltimore District. December.

Leidos. 2022c. *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. 2023. *Preliminary Assessment of Per- and Polyfluoroalkyl Substances at Fort Monroe, Hampton, Virginia.* Final. August.

Lingenfelser, S., E. Crawfort, M. Drummond, and J. McCloskey. 2003. *Floral Survey at Fort Monroe, Virginia*. Prepared for Department of Army Headquarters Fort Monroe, U.S. Fish and Wildlife Services, Virginia Field Office.

Lookingbill, T., K. Engelhardt, C. Geraghty, N. Hatchel, D. Kitchen. 2018. *Fort Monroe National Monument: Natural resource condition assessment*. Natural Resource Report NPS/FOMR/NRR—2018/1604. National Park Service, Fort Collins, Colorado.

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

Melchor, J. 1983. *Beach Restoration and Erosion Protection: Fort Monroe Military Reservation, Hampton, Virginia*. U.S. Army Corps of Engineers Planning Division, Norfolk District, Norfolk, Virginia.

New York Times. 1902. *"Struck Salt Water at a Depth of 2,246 feet,"* July 20, 1902.

NNWW (Newport News Waterworks). 2022. Reservoirs & Drought. Accessed January 26, 2022. Available online at: https://www.nnva.gov/386/Reservoirs-Drought.

NRWG (Natural Resource Working Group). 2009. *Fort Monroe NRWG Report.* Presented to the FMFADA. September 24.

SAIC (Science Applications International Corporation). 2000. *Integrated Natural Resources Management Plan Fort Monroe and Big Bethel Reservoir.* Prepared for the Department of the Army Headquarters Fort Monroe, Hampton, Virginia.

SAIC. 2008. *U.S. Army BRAC 2005 Site Inspection Report, Fort Monroe, Hampton, Virginia*. Final. December.

SAIC. 2011. *Supplemental Site Inspection Report, Fort Monroe, Hampton, Virginia.* Final. October.

Sasaki (Sasaki Associates). 2013. *Final Fort Monroe Authority Master Plan 2013 for Fort Monroe.* October 23. Available online at: http://www.fmauthority.com/public-meetings/master-plan/.

Tiner, R.W., D. Foulis, G.S. Smith, and J. Swords. 1998. *Wetlands Inventory Report for Fort Monroe and Bethel Reservoir, York County, Virginia. U.S. Fish and Wildlife Service National Wetlands Inventory Program.* Washington, DC.

U.S. Army. 2006. *Oil and Hazardous Substance Spill Prevention, Control, and Countermeasure Plan, Fort Monroe, Virginia.* January.

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. *Conveyance Progress Report, Fort Monroe, Virginia*. October.

U.S. Census Bureau. 2020. Available online at: https://www.census.gov/quickfacts/fact/table/hamptoncity virginiacounty/RHI225219#RHI225219.

USACE (U.S. Army Corps of Engineers). 2003. *Environmental Baseline Survey of Army Property for the Residential Communities Initiative at Fort Monroe, Virginia*. July.

USACE. 2010. *Environmental Impact Statement for BRAC 2005 Disposal and Reuse of Fort Monroe, Virginia*. Final. May.

USAEC (U.S. Army Environmental Center) & Fort Monroe. 2005. *USAEC and Fort Monroe Department of Public Works (DPW).* Draft U.S. Army BRAC 2005 Environmental Condition of Property Report, Fort Monroe, Hampton, Virginia. August.

USAEHA (U.S. Army Environmental Hygiene Agency). 1983. *Air Pollution Status and Evaluation Survey No. 43-21-0418-84, Fort Monroe, Virginia*. November.

USAEHA. 1987. *Environmental Operations Review No. 43-21-1374-88, Fort Monroe.* August.

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). 2023. *Environmental Conservation Online System for Information for Planning and Consultation (IPaC) website*. Accessed February 21, 2023. Available online at: https://ecos.fws.gov/ipac/.

VDEQ and FMA (Virginia Department of Environmental Quality and the Fort Monroe Authority). 2016. *Memorandum of Understanding Between VDEQ and the FMA, Coordination for Prohibiting Groundwater Use and Fishing at Fort Monroe*. September and October.

VDGIF (Virginia Department of Game and Inland Fisheries). 2023. *Northern long-eared bat Winter Habitat and Roost Tree Application*. Available online at: https://dgif-virginia.maps.arcgis.com/apps/webappviewer/index.html?id=32ea4ee4935942c092e41 ddcd19e5ec5. Accessed February 21.

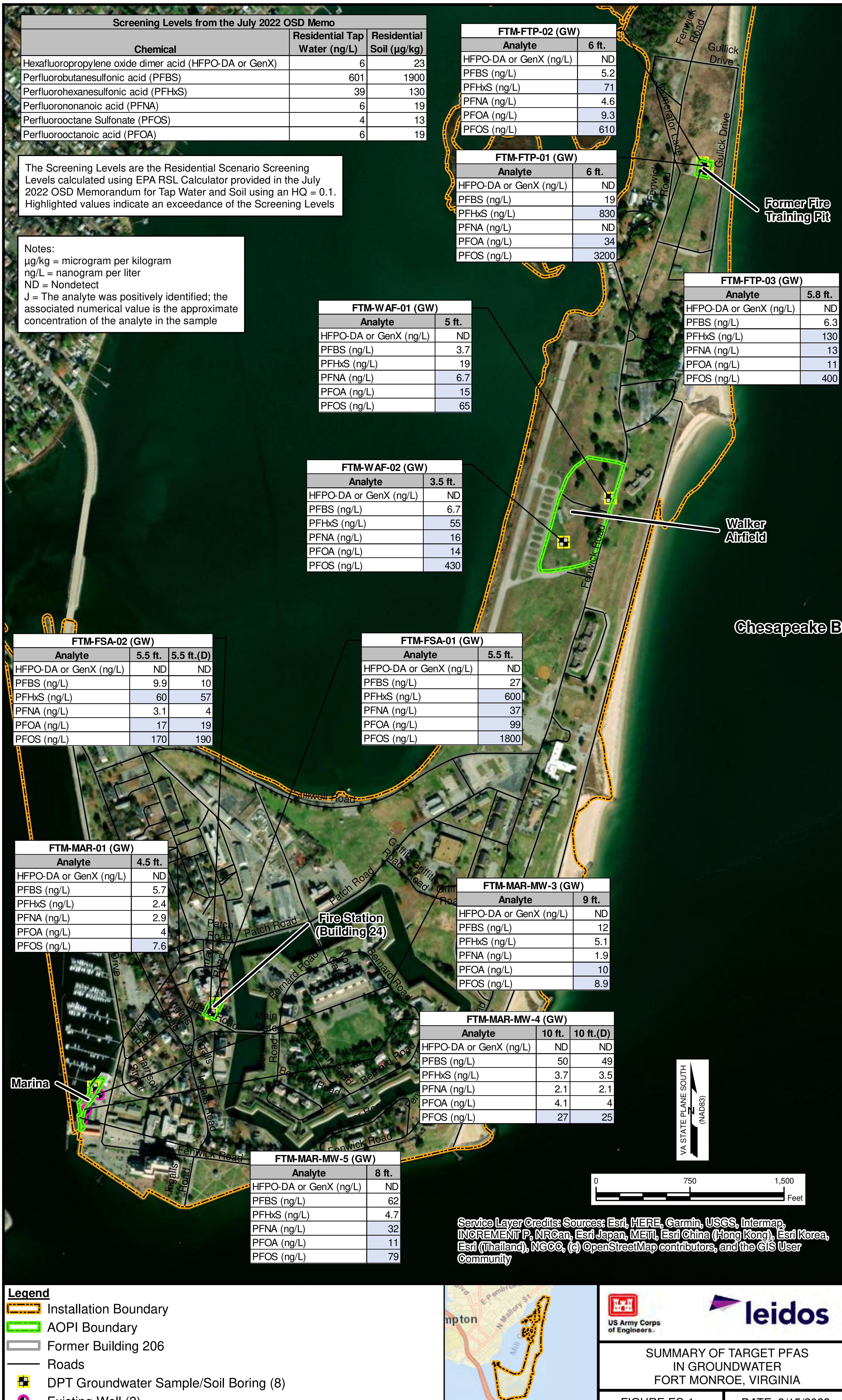
Versar and Leidos. 2017. *Final Remedial Investigation Report Remedial Investigation of Fort Monroe Building 204/205 Area, Hampton, Virginia*. January.

Weather Spark. 2021. Available online at: https://weatherspark.com/y/21666/Average-Weather-in-Hampton-Virginia-United-States-Year-Round.

Weinert and Arthur. 1989. *Defender of the Chesapeake: The Story of Fort Monroe*. White Mane Publishing Company. Shippensburg, Pennsylvania.

Weston (Roy F. Weston, Inc.). 1990. *Preliminary Assessment Report for Fort Monroe*. September.

FIGURES



Screening Levels from the July 2022 OSD Memo		
Chemical	Residential Tap Water (ng/L)	Residential Soil (µg/kg)
Hexafluoropropylene oxide dimer acid (HFPO-DA or GenX)	6	23
Perfluorobutanesulfonic acid (PFBS)	601	1900
Perfluorohexanesulfonic acid (PFHxS)	39	130
Perfluorononanoic acid (PFNA)	6	19
Perfluorooctane Sulfonate (PFOS)	4	13
Perfluorooctanoic acid (PFOA)	6	19

The Screening Levels are the Residential Scenario Screening Levels calculated using EPA RSL Calculator provided in the July 2022 OSD Memorandum for Tap Water and Soil using an HQ = 0.1. Highlighted values indicate an exceedance of the Screening Levels

Notes:
µg/kg = microgram per kilogram
ng/L = nanogram per liter
ND = Nondetect
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample

FTM-FTP-02 (GW)

Analyte	6 ft.
HFPO-DA or GenX (ng/L)	ND
PFBS (ng/L)	5.2
PFHxS (ng/L)	71
PFNA (ng/L)	4.6
PFOA (ng/L)	9.3
PFOS (ng/L)	610

FTM-FTP-01 (GW)

Analyte	6 ft.
HFPO-DA or GenX (ng/L)	ND
PFBS (ng/L)	19
PFHxS (ng/L)	830
PFNA (ng/L)	ND
PFOA (ng/L)	34
PFOS (ng/L)	3200

FTM-FTP-03 (GW)

Analyte	5.8 ft.
HFPO-DA or GenX (ng/L)	ND
PFBS (ng/L)	6.3
PFHxS (ng/L)	130
PFNA (ng/L)	13
PFOA (ng/L)	11
PFOS (ng/L)	400

FTM-WAF-01 (GW)

Analyte	5 ft.
HFPO-DA or GenX (ng/L)	ND
PFBS (ng/L)	3.7
PFHxS (ng/L)	19
PFNA (ng/L)	6.7
PFOA (ng/L)	15
PFOS (ng/L)	65

FTM-WAF-02 (GW)

Analyte	3.5 ft.
HFPO-DA or GenX (ng/L)	ND
PFBS (ng/L)	6.7
PFHxS (ng/L)	55
PFNA (ng/L)	16
PFOA (ng/L)	14
PFOS (ng/L)	430

FTM-FSA-02 (GW)

Analyte	5.5 ft.	5.5 ft.(D)
HFPO-DA or GenX (ng/L)	ND	ND
PFBS (ng/L)	9.9	10
PFHxS (ng/L)	60	57
PFNA (ng/L)	3.1	4
PFOA (ng/L)	17	19
PFOS (ng/L)	170	190

FTM-FSA-01 (GW)

Analyte	5.5 ft.
HFPO-DA or GenX (ng/L)	ND
PFBS (ng/L)	27
PFHxS (ng/L)	600
PFNA (ng/L)	37
PFOA (ng/L)	99
PFOS (ng/L)	1800

FTM-MAR-01 (GW)

Analyte	4.5 ft.
HFPO-DA or GenX (ng/L)	ND
PFBS (ng/L)	5.7
PFHxS (ng/L)	2.4
PFNA (ng/L)	2.9
PFOA (ng/L)	4
PFOS (ng/L)	7.6

FTM-MAR-MW-3 (GW)

Analyte	9 ft.
HFPO-DA or GenX (ng/L)	ND
PFBS (ng/L)	12
PFHxS (ng/L)	5.1
PFNA (ng/L)	1.9
PFOA (ng/L)	10
PFOS (ng/L)	8.9

FTM-MAR-MW-4 (GW)

Analyte	10 ft.	10 ft.(D)
HFPO-DA or GenX (ng/L)	ND	ND
PFBS (ng/L)	50	49
PFHxS (ng/L)	3.7	3.5
PFNA (ng/L)	2.1	2.1
PFOA (ng/L)	4.1	4
PFOS (ng/L)	27	25

FTM-MAR-MW-5 (GW)

Analyte	8 ft.
HFPO-DA or GenX (ng/L)	ND
PFBS (ng/L)	62
PFHxS (ng/L)	4.7
PFNA (ng/L)	32
PFOA (ng/L)	11
PFOS (ng/L)	79

SUMMARY OF TARGET PFAS
IN GROUNDWATER
FORT MONROE, VIRGINIA

FIGURE ES-1 | DATE: 9/15/2023

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INSTALLATION LOCATION
FORT MONROE, VIRGINIA

FIGURE 1-1 DATE: 5/8/2023

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PROJECT: \GIS_Data\BRAC_PFAS\Fort Monroe\SI\Figure 1-2 FortMonroe_AOPIs.mxd

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SITE FEATURES
FORT MONROE, VIRGINIA

FIGURE: 2-1 | DATE: 5/8/2023

PROJECT: \GIS_Data\BRAC PFAS\Fort Monroe\Figure 2-1 FortMonroe_Site.mxd

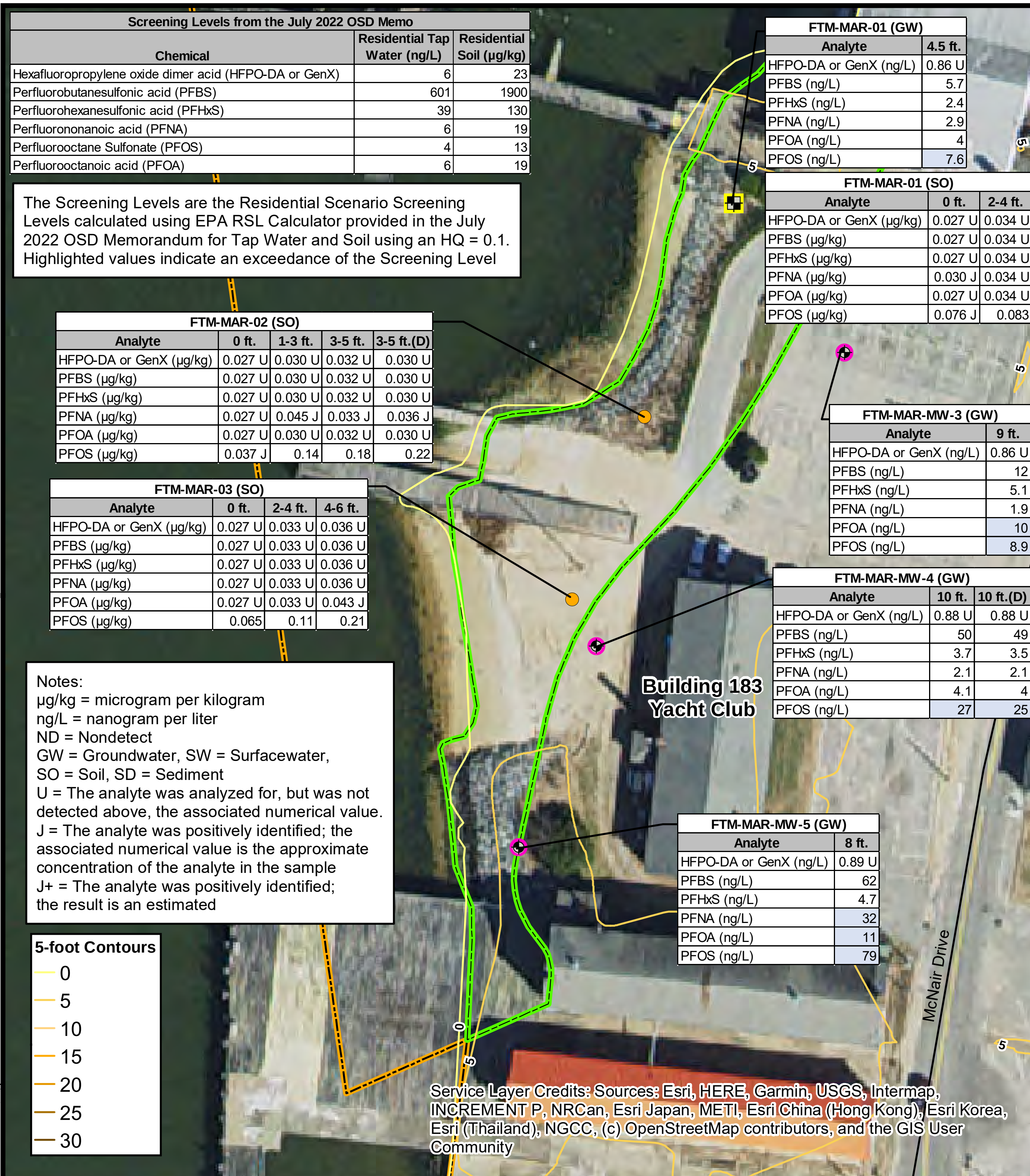
MARINA AOPI SAMPLE LOCATIONS
FORT MONROE, VIRGINIA

FIGURE: 6-1 DATE: 5/18/2023

PROJECT: \GIS Data\BRAC PFAS\Fort Monroe\SI\Figure 6-1 FortMonroe Marina Locations.mxd

Chemical	Residential Tap Water (ng/L)	Residential Soil (µg/kg)
Screening Levels from the July 2022 OSD Memo		
Hexafluoropropylene oxide dimer acid (HFPO-DA or GenX)	6	23
Perfluorobutanesulfonic acid (PFBS)	601	1900
Perfluorohexanesulfonic acid (PFHxS)	39	130
Perfluorononanoic acid (PFNA)	6	19
Perfluorooctane Sulfonate (PFOS)	4	13
Perfluorooctanoic acid (PFOA)	6	19

The Screening Levels are the Residential Scenario Screening Levels calculated using EPA RSL Calculator provided in the July 2022 OSD Memorandum for Tap Water and Soil using an HQ = 0.1. Highlighted values indicate an exceedance of the Screening Level



FTM-MAR-01 (GW)

Analyte	4.5 ft.
HFPO-DA or GenX (ng/L)	0.86 U
PFBS (ng/L)	5.7
PFHxS (ng/L)	2.4
PFNA (ng/L)	2.9
PFOA (ng/L)	4
PFOS (ng/L)	7.6

FTM-MAR-01 (SO)

Analyte	0 ft.	2-4 ft.
HFPO-DA or GenX (µg/kg)	0.027 U	0.034 U
PFBS (µg/kg)	0.027 U	0.034 U
PFHxS (µg/kg)	0.027 U	0.034 U
PFNA (µg/kg)	0.030 J	0.034 U
PFOA (µg/kg)	0.027 U	0.034 U
PFOS (µg/kg)	0.076 J	0.083

FTM-MAR-02 (SO)

Analyte	0 ft.	1-3 ft.	3-5 ft.	3-5 ft.(D)
HFPO-DA or GenX (µg/kg)	0.027 U	0.030 U	0.032 U	0.030 U
PFBS (µg/kg)	0.027 U	0.030 U	0.032 U	0.030 U
PFHxS (µg/kg)	0.027 U	0.030 U	0.032 U	0.030 U
PFNA (µg/kg)	0.027 U	0.045 J	0.033 J	0.036 J
PFOA (µg/kg)	0.027 U	0.030 U	0.032 U	0.030 U
PFOS (µg/kg)	0.037 J	0.14	0.18	0.22

FTM-MAR-MW-3 (GW)

Analyte	9 ft.
HFPO-DA or GenX (ng/L)	0.86 U
PFBS (ng/L)	12
PFHxS (ng/L)	5.1
PFNA (ng/L)	1.9
PFOA (ng/L)	10
PFOS (ng/L)	8.9

FTM-MAR-03 (SO)

Analyte	0 ft.	2-4 ft.	4-6 ft.
HFPO-DA or GenX (µg/kg)	0.027 U	0.033 U	0.036 U
PFBS (µg/kg)	0.027 U	0.033 U	0.036 U
PFHxS (µg/kg)	0.027 U	0.033 U	0.036 U
PFNA (µg/kg)	0.027 U	0.033 U	0.036 U
PFOA (µg/kg)	0.027 U	0.033 U	0.043 J
PFOS (µg/kg)	0.065	0.11	0.21

FTM-MAR-MW-4 (GW)

Analyte	10 ft.	10 ft.(D)
HFPO-DA or GenX (ng/L)	0.88 U	0.88 U
PFBS (ng/L)	50	49
PFHxS (ng/L)	3.7	3.5
PFNA (ng/L)	2.1	2.1
PFOA (ng/L)	4.1	4
PFOS (ng/L)	27	25

Notes:
µg/kg = microgram per kilogram
ng/L = nanogram per liter
ND = Nondetect
GW = Groundwater, SW = Surfacewater,
SO = Soil, SD = Sediment
U = The analyte was analyzed for, but was not detected above, the associated numerical value.
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

FTM-MAR-MW-5 (GW)

Analyte	8 ft.
HFPO-DA or GenX (ng/L)	0.89 U
PFBS (ng/L)	62
PFHxS (ng/L)	4.7
PFNA (ng/L)	32
PFOA (ng/L)	11
PFOS (ng/L)	79

5-foot Contours
0
5
10
15
20
25
30

Legend
Installation Boundary
AOPI Boundary
Roads
Soil Boring (2)
DPT Groundwater Sample/Soil Boring (1)
Existing Well (3)

0 60 120 Feet

VA STATE PLANE SOUTH (NAD83)

US Army Corps of Engineers
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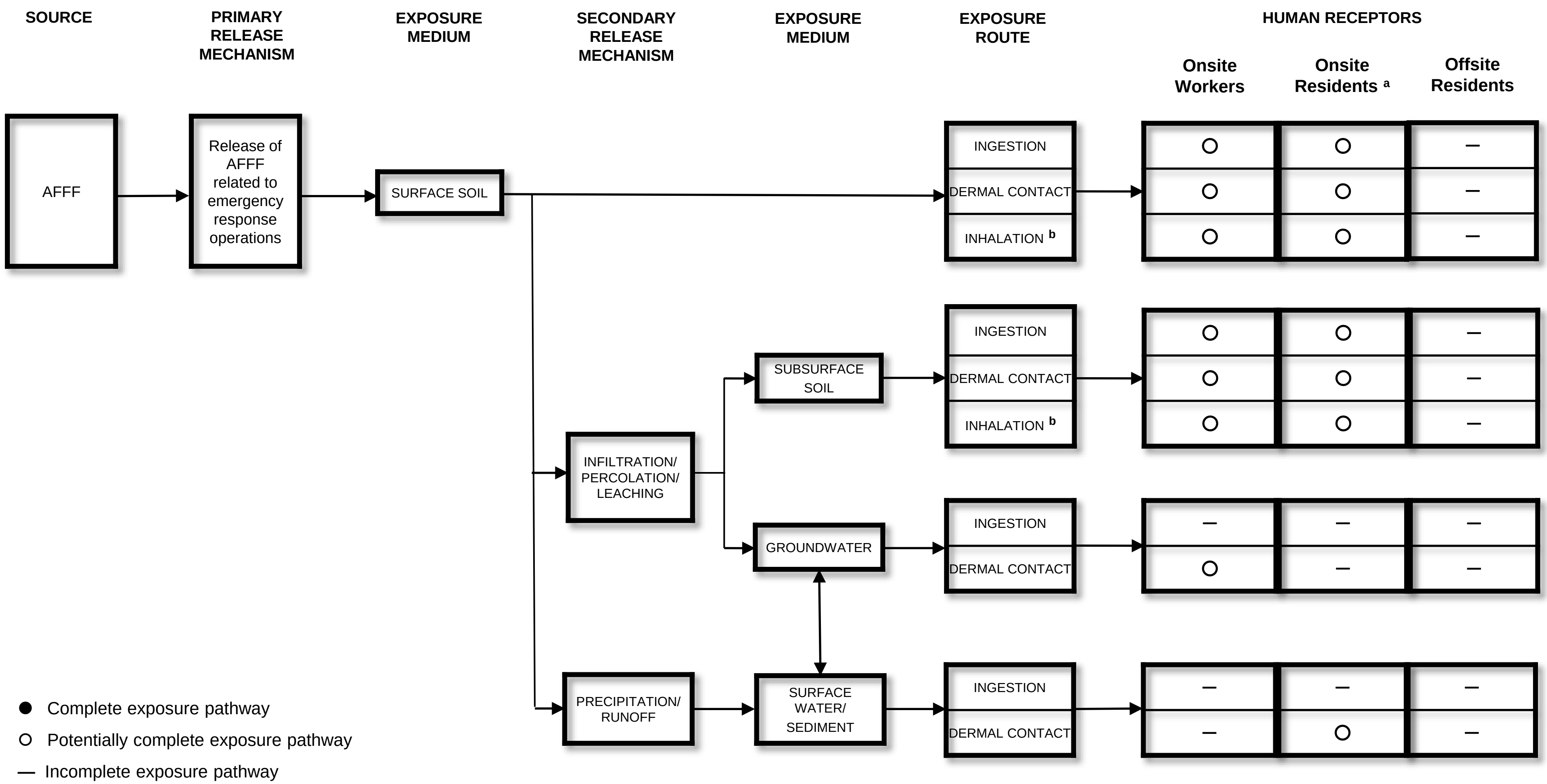
MARINA AOPI
SAMPLE RESULTS
FORT MONROE, VIRGINIA

FIGURE: 6-2 | DATE: 7/18/2023

PROJECT: \GIS_Data\BRAC PFAS\Fort Monroe\Figure 2 Site Features.mxd



[a] Current land use at this AOPI is recreational; however, onsite residents are evaluated for the potential migration (i.e., groundwater and surface water) to residents on the former Fort Monroe.

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

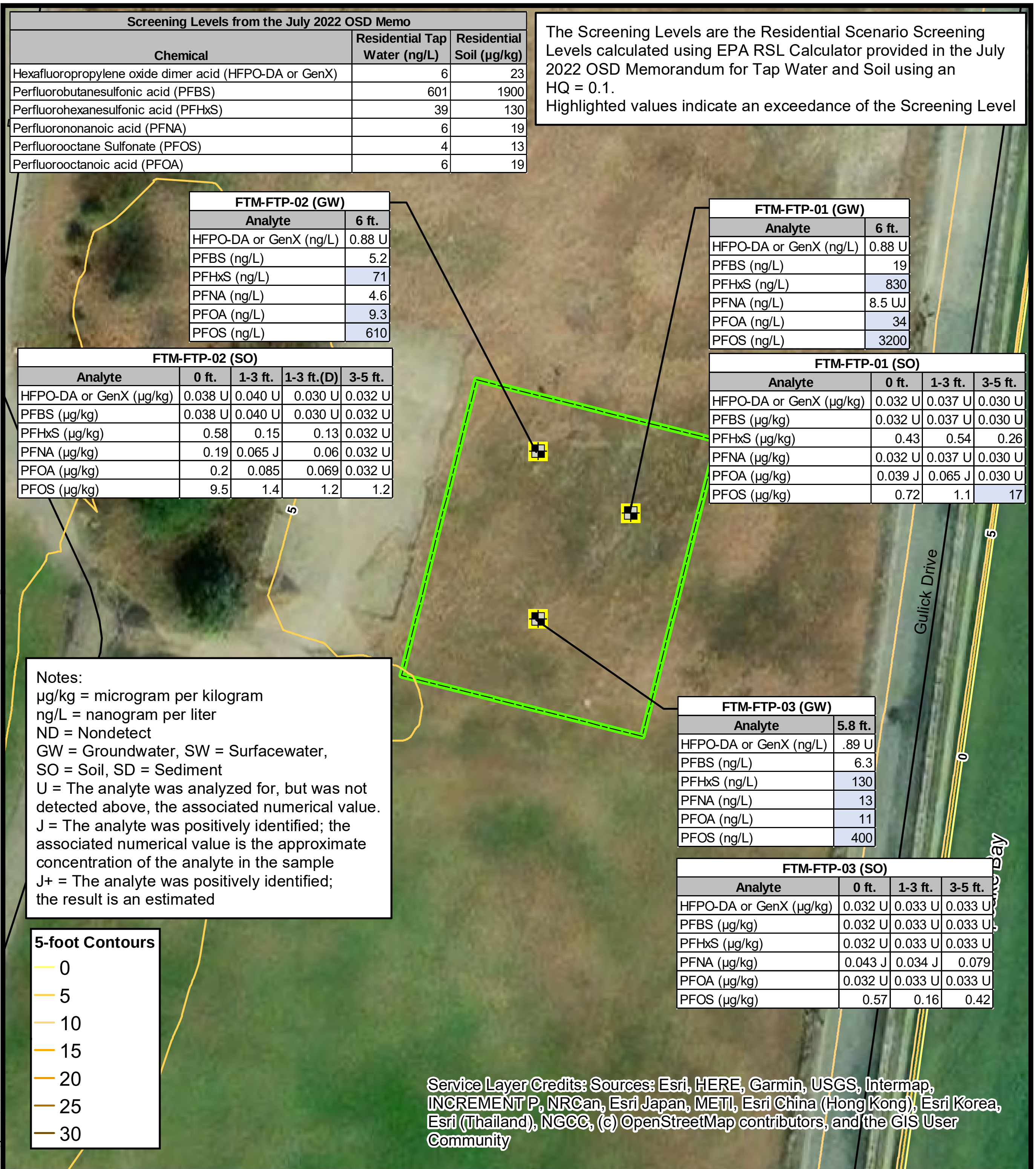
Figure 6-3. Human Health CSM for Marina AOPI

FIRE TRAINING PIT AOPI
SAMPLE LOCATIONS
FORT MONROE, VIRGINIA

FIGURE: 6-4 | DATE: 5/18/2023

Screening Levels from the July 2022 OSD Memo		
Chemical	Residential Tap Water (ng/L)	Residential Soil (µg/kg)
Hexafluoropropylene oxide dimer acid (HFPO-DA or GenX)	6	23
Perfluorobutanesulfonic acid (PFBS)	601	1900
Perfluorohexanesulfonic acid (PFHxS)	39	130
Perfluorononanoic acid (PFNA)	6	19
Perfluorooctane Sulfonate (PFOS)	4	13
Perfluorooctanoic acid (PFOA)	6	19

The Screening Levels are the Residential Scenario Screening Levels calculated using EPA RSL Calculator provided in the July 2022 OSD Memorandum for Tap Water and Soil using an HQ = 0.1.
Highlighted values indicate an exceedance of the Screening Level



FTM-FTP-02 (GW)	
Analyte	6 ft.
HFPO-DA or GenX (ng/L)	0.88 U
PFBS (ng/L)	5.2
PFHxS (ng/L)	71
PFNA (ng/L)	4.6
PFOA (ng/L)	9.3
PFOS (ng/L)	610

FTM-FTP-01 (GW)	
Analyte	6 ft.
HFPO-DA or GenX (ng/L)	0.88 U
PFBS (ng/L)	19
PFHxS (ng/L)	830
PFNA (ng/L)	8.5 UJ
PFOA (ng/L)	34
PFOS (ng/L)	3200

FTM-FTP-02 (SO)				
Analyte	0 ft.	1-3 ft.	1-3 ft.(D)	3-5 ft.
HFPO-DA or GenX (µg/kg)	0.038 U	0.040 U	0.030 U	0.032 U
PFBS (µg/kg)	0.038 U	0.040 U	0.030 U	0.032 U
PFHxS (µg/kg)	0.58	0.15	0.13	0.032 U
PFNA (µg/kg)	0.19	0.065 J	0.06	0.032 U
PFOA (µg/kg)	0.2	0.085	0.069	0.032 U
PFOS (µg/kg)	9.5	1.4	1.2	1.2

FTM-FTP-01 (SO)			
Analyte	0 ft.	1-3 ft.	3-5 ft.
HFPO-DA or GenX (µg/kg)	0.032 U	0.037 U	0.030 U
PFBS (µg/kg)	0.032 U	0.037 U	0.030 U
PFHxS (µg/kg)	0.43	0.54	0.26
PFNA (µg/kg)	0.032 U	0.037 U	0.030 U
PFOA (µg/kg)	0.039 J	0.065 J	0.030 U
PFOS (µg/kg)	0.72	1.1	17

FTM-FTP-03 (GW)	
Analyte	5.8 ft.
HFPO-DA or GenX (ng/L)	.89 U
PFBS (ng/L)	6.3
PFHxS (ng/L)	130
PFNA (ng/L)	13
PFOA (ng/L)	11
PFOS (ng/L)	400

FTM-FTP-03 (SO)			
Analyte	0 ft.	1-3 ft.	3-5 ft.
HFPO-DA or GenX (µg/kg)	0.032 U	0.033 U	0.033 U
PFBS (µg/kg)	0.032 U	0.033 U	0.033 U
PFHxS (µg/kg)	0.032 U	0.033 U	0.033 U
PFNA (µg/kg)	0.043 J	0.034 J	0.079
PFOA (µg/kg)	0.032 U	0.033 U	0.033 U
PFOS (µg/kg)	0.57	0.16	0.42

Notes:
µg/kg = microgram per kilogram
ng/L = nanogram per liter
ND = Nondetect
GW = Groundwater, SW = Surfacewater,
SO = Soil, SD = Sediment
U = The analyte was analyzed for, but was not detected above, the associated numerical value.
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

5-foot Contours
- 0
- 5
- 10
- 15
- 20
- 25
- 30

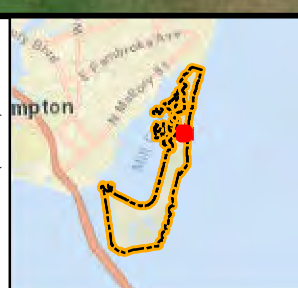
PROJECT: \Fort Monroe\Data Figures\Figure 6-5 FortMonroe_FTP

Legend
- Installation Boundary
- AOPI Boundary
- DPT Groundwater Sample/Soil Boring (3)

0 60 120 Feet

VA STATE PLANE SOUTH (NAD83)

N



US Army Corps of Engineers

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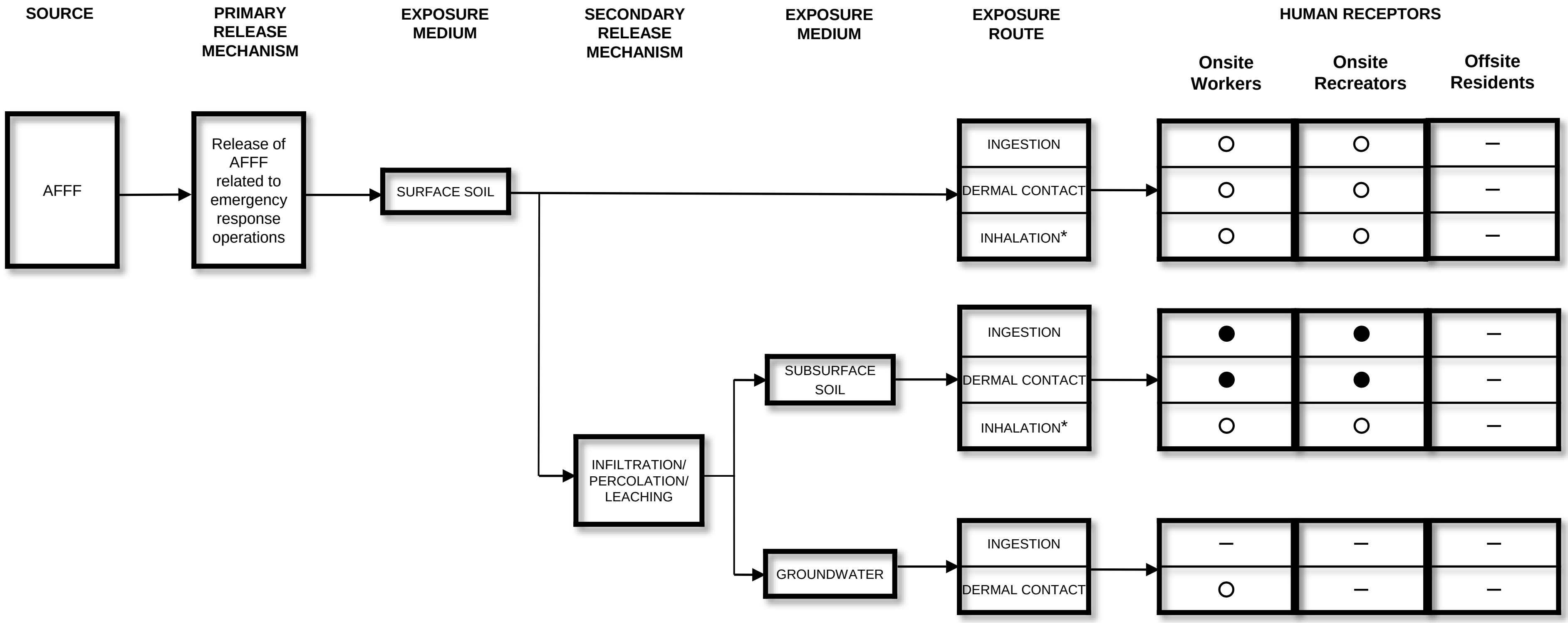
FIRE TRAINING PIT AOPI
SAMPLE RESULTS
FORT MONROE, VIRGINIA

FIGURE: 6-5 DATE: 10/27/2023



● Complete exposure pathway

○ Potentially complete exposure pathway

— Incomplete exposure pathway

* Inhalation of PFAS is considered potentially complete because no toxicity information is available for the inhalation route

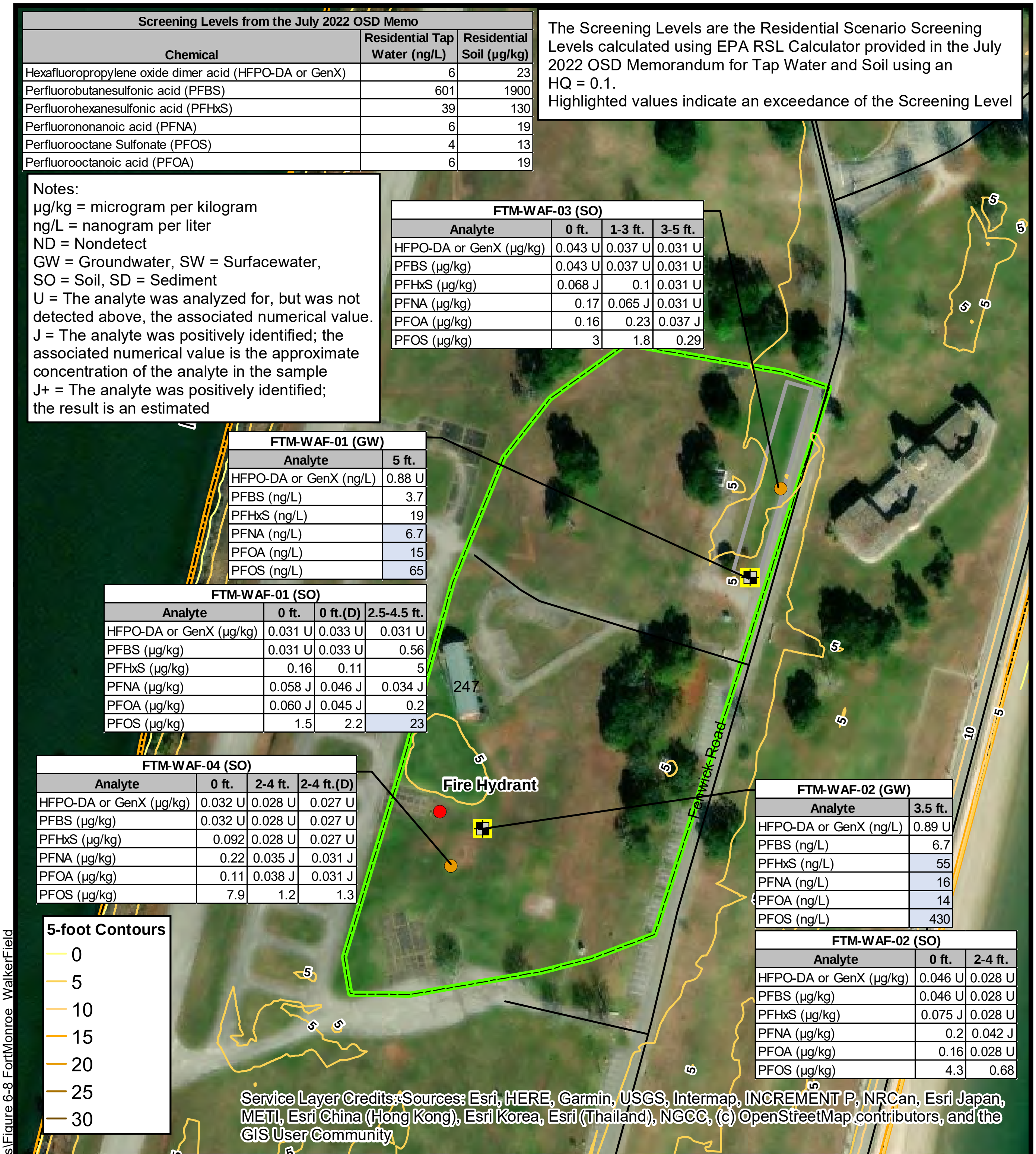
Figure 6-6. Human Health CSM for Fire Training Pit AOPI

Mill Creek
Fenwick Road
FTM-WAF-03
FTM-WAF-01
FTM-WAF-04
FTM-WAF-02
Fire Hydrant
247
5-foot Contours
0
5
10
15
20
25
30
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Legend
Installation Boundary
AOPI Boundary
Former Building 206
Roads
Fire Hydrant
Soil Boring (2)
DPT Groundwater Sample/Soil Boring (2)
VA STATE PLANE SOUTH
N
(NAD83)
0
230
460
Feet
US Army Corps of Engineers
leidos
WALKER AIRFIELD AOPI
SAMPLE LOCATIONS
FORT MONROE, VIRGINIA
FIGURE: 6-7
DATE: 5/18/2023
PROJECT: \GIS_Data\BRAC PFAS\Fort Monroe\SI\Figure 6-7 FortMonroe_Walkerfield Locations.mxd

Screening Levels from the July 2022 OSD Memo		
Chemical	Residential Tap Water (ng/L)	Residential Soil (µg/kg)
Hexafluoropropylene oxide dimer acid (HFPO-DA or GenX)	6	23
Perfluorobutanesulfonic acid (PFBS)	601	1900
Perfluorohexanesulfonic acid (PFHxS)	39	130
Perfluorononanoic acid (PFNA)	6	19
Perfluorooctane Sulfonate (PFOS)	4	13
Perfluorooctanoic acid (PFOA)	6	19

The Screening Levels are the Residential Scenario Screening Levels calculated using EPA RSL Calculator provided in the July 2022 OSD Memorandum for Tap Water and Soil using an HQ = 0.1.
Highlighted values indicate an exceedance of the Screening Level

Notes:
µg/kg = microgram per kilogram
ng/L = nanogram per liter
ND = Nondetect
GW = Groundwater, SW = Surfacewater,
SO = Soil, SD = Sediment
U = The analyte was analyzed for, but was not detected above, the associated numerical value.
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



FTM-WAF-03 (SO)			
Analyte	0 ft.	1-3 ft.	3-5 ft.
HFPO-DA or GenX (µg/kg)	0.043 U	0.037 U	0.031 U
PFBS (µg/kg)	0.043 U	0.037 U	0.031 U
PFHxS (µg/kg)	0.068 J	0.1	0.031 U
PFNA (µg/kg)	0.17	0.065 J	0.031 U
PFOA (µg/kg)	0.16	0.23	0.037 J
PFOS (µg/kg)	3	1.8	0.29

FTM-WAF-01 (GW)	
Analyte	5 ft.
HFPO-DA or GenX (ng/L)	0.88 U
PFBS (ng/L)	3.7
PFHxS (ng/L)	19
PFNA (ng/L)	6.7
PFOA (ng/L)	15
PFOS (ng/L)	65

FTM-WAF-01 (SO)			
Analyte	0 ft.	0 ft.(D)	2.5-4.5 ft.
HFPO-DA or GenX (µg/kg)	0.031 U	0.033 U	0.031 U
PFBS (µg/kg)	0.031 U	0.033 U	0.56
PFHxS (µg/kg)	0.16	0.11	5
PFNA (µg/kg)	0.058 J	0.046 J	0.034 J
PFOA (µg/kg)	0.060 J	0.045 J	0.2
PFOS (µg/kg)	1.5	2.2	23

FTM-WAF-04 (SO)			
Analyte	0 ft.	2-4 ft.	2-4 ft.(D)
HFPO-DA or GenX (µg/kg)	0.032 U	0.028 U	0.027 U
PFBS (µg/kg)	0.032 U	0.028 U	0.027 U
PFHxS (µg/kg)	0.092	0.028 U	0.027 U
PFNA (µg/kg)	0.22	0.035 J	0.031 J
PFOA (µg/kg)	0.11	0.038 J	0.031 J
PFOS (µg/kg)	7.9	1.2	1.3

FTM-WAF-02 (GW)	
Analyte	3.5 ft.
HFPO-DA or GenX (ng/L)	0.89 U
PFBS (ng/L)	6.7
PFHxS (ng/L)	55
PFNA (ng/L)	16
PFOA (ng/L)	14
PFOS (ng/L)	430

FTM-WAF-02 (SO)		
Analyte	0 ft.	2-4 ft.
HFPO-DA or GenX (µg/kg)	0.046 U	0.028 U
PFBS (µg/kg)	0.046 U	0.028 U
PFHxS (µg/kg)	0.075 J	0.028 U
PFNA (µg/kg)	0.2	0.042 J
PFOA (µg/kg)	0.16	0.028 U
PFOS (µg/kg)	4.3	0.68

5-foot Contours
0
5
10
15
20
25
30

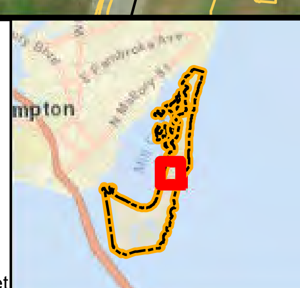
PROJECT: \Fort Monroe\Data Figures\Figure 6-8 FortMonroe_WalkerField

Legend
Installation Boundary
AOPI Boundary
Former Building 206
Roads
Fire Hydrant
Soil Boring (2)
DPT Groundwater Sample/Soil Boring (2)

0 230 460 Feet

VA STATE PLANE SOUTH (NAD83)

N



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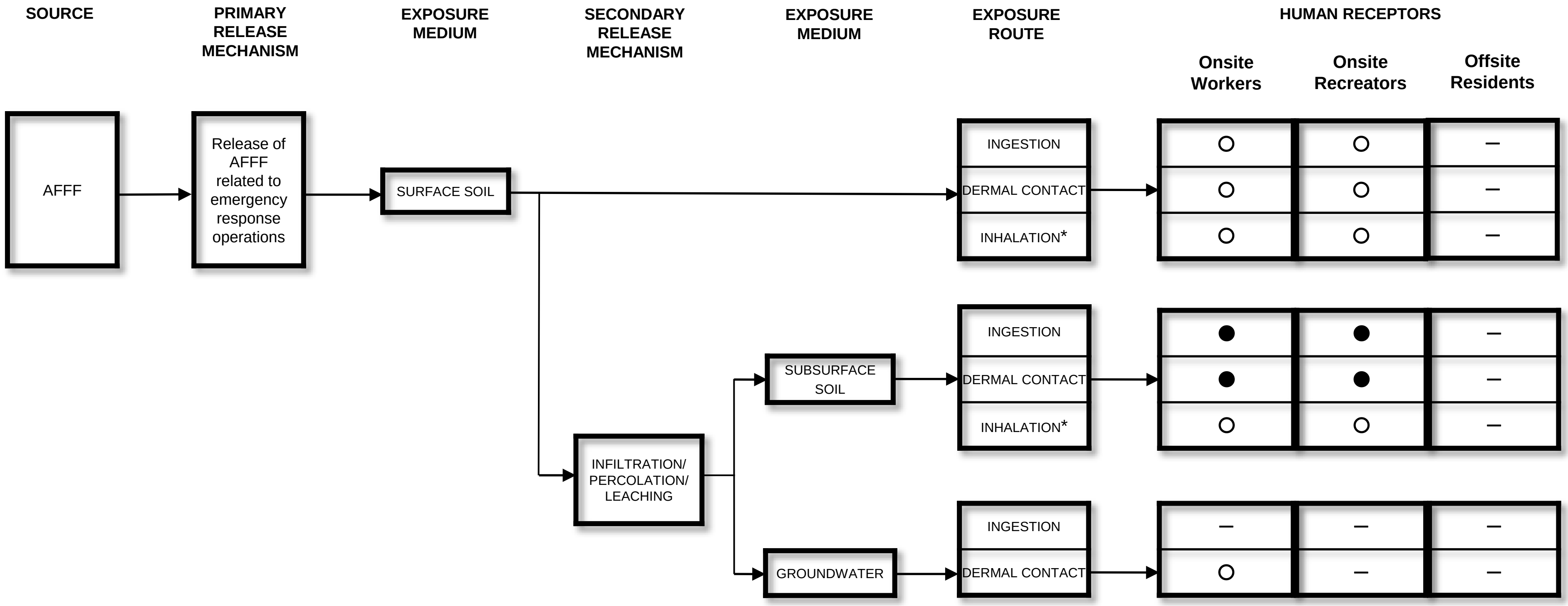
WALKER AIRFIELD AOPI
SAMPLE RESULTS
FORT MONROE, VIRGINIA

FIGURE: 6-8
DATE: 10/27/2023



● Complete exposure pathway

○ Potentially complete exposure pathway

— Incomplete exposure pathway

* Inhalation of PFAS is considered potentially complete because no toxicity information is available for the inhalation route

Figure 6-9. Human Health CSM for Walker Airfield AOPI


150
82
149
Murray Road
FTM-FSA-01
148
0
5
24
Murray Road
Ingalls Road
182
101
FTM-FSA-02
77
Ingalls Road
St Marys Church
Ruckman Road
Ruckman Road
5-foot Contours
0
5
10
15
20
25
30
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
123
171
PROJECT: \GIS_Data\BRAC PFAS\Fort Monroe\SI\Figure 6-10 FortMonroe_FireStation Locations.mxd
Legend
Installation Boundary
AOPI Boundary
Roads
DPT Groundwater Sample/Soil Boring (2)
0
60
120
Feet
VA STATE PLANE SOUTH
(NAD83)
N
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FIRE STATION (BUILDING 24) AOPI
SAMPLE LOCATIONS
FORT MONROE, VIRGINIA
FIGURE: 6-10
DATE: 5/18/2023

Screening Levels from the July 2022 OSD Memo		
Chemical	Residential Tap Water (ng/L)	Residential Soil (µg/kg)
Hexafluoropropylene oxide dimer acid (HFPO-DA or GenX)	6	23
Perfluorobutanesulfonic acid (PFBS)	601	1900
Perfluorohexanesulfonic acid (PFHxS)	39	130
Perfluorononanoic acid (PFNA)	6	19
Perfluorooctane Sulfonate (PFOS)	4	13
Perfluorooctanoic acid (PFOA)	6	19

The Screening Levels are the Residential Scenario Screening Levels calculated using EPA RSL Calculator provided in the July 2022 OSD Memorandum for Tap Water and Soil using an HQ = 0.1. Highlighted values indicate an exceedance of the Screening Level

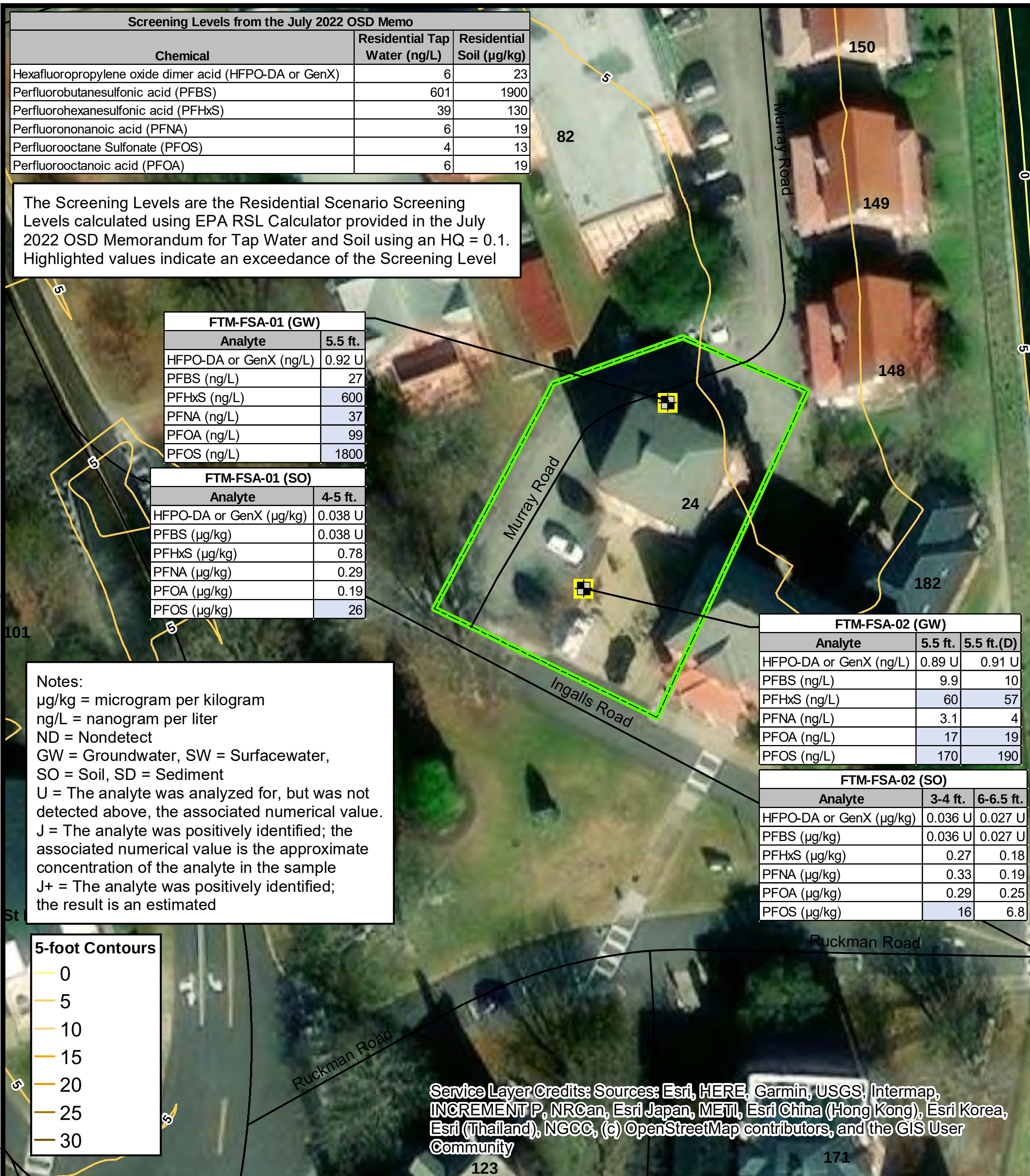
FTM-FSA-01 (GW)	
Analyte	5.5 ft.
HFPO-DA or GenX (ng/L)	0.92 U
PFBS (ng/L)	27
PFHxS (ng/L)	600
PFNA (ng/L)	37
PFOA (ng/L)	99
PFOS (ng/L)	1800

FTM-FSA-01 (SO)	
Analyte	4-5 ft.
HFPO-DA or GenX (µg/kg)	0.038 U
PFBS (µg/kg)	0.038 U
PFHxS (µg/kg)	0.78
PFNA (µg/kg)	0.29
PFOA (µg/kg)	0.19
PFOS (µg/kg)	26

FTM-FSA-02 (GW)		
Analyte	5.5 ft.	5.5 ft.(D)
HFPO-DA or GenX (ng/L)	0.89 U	0.91 U
PFBS (ng/L)	9.9	10
PFHxS (ng/L)	60	57
PFNA (ng/L)	3.1	4
PFOA (ng/L)	17	19
PFOS (ng/L)	170	190

FTM-FSA-02 (SO)		
Analyte	3-4 ft.	6-6.5 ft.
HFPO-DA or GenX (µg/kg)	0.036 U	0.027 U
PFBS (µg/kg)	0.036 U	0.027 U
PFHxS (µg/kg)	0.27	0.18
PFNA (µg/kg)	0.33	0.19
PFOA (µg/kg)	0.29	0.25
PFOS (µg/kg)	16	6.8

Notes:
µg/kg = microgram per kilogram
ng/L = nanogram per liter
ND = Nondetect
GW = Groundwater, SW = Surfacewater,
SO = Soil, SD = Sediment
U = The analyte was analyzed for, but was not detected above, the associated numerical value.
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

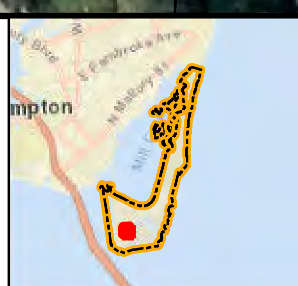


5-foot Contours
0
5
10
15
20
25
30

Legend
Installation Boundary
AOPI Boundary
Roads
DPT Groundwater Sample/Soil Boring (2)

0 60 120 Feet

VA STATE PLANE SOUTH (NAD83)



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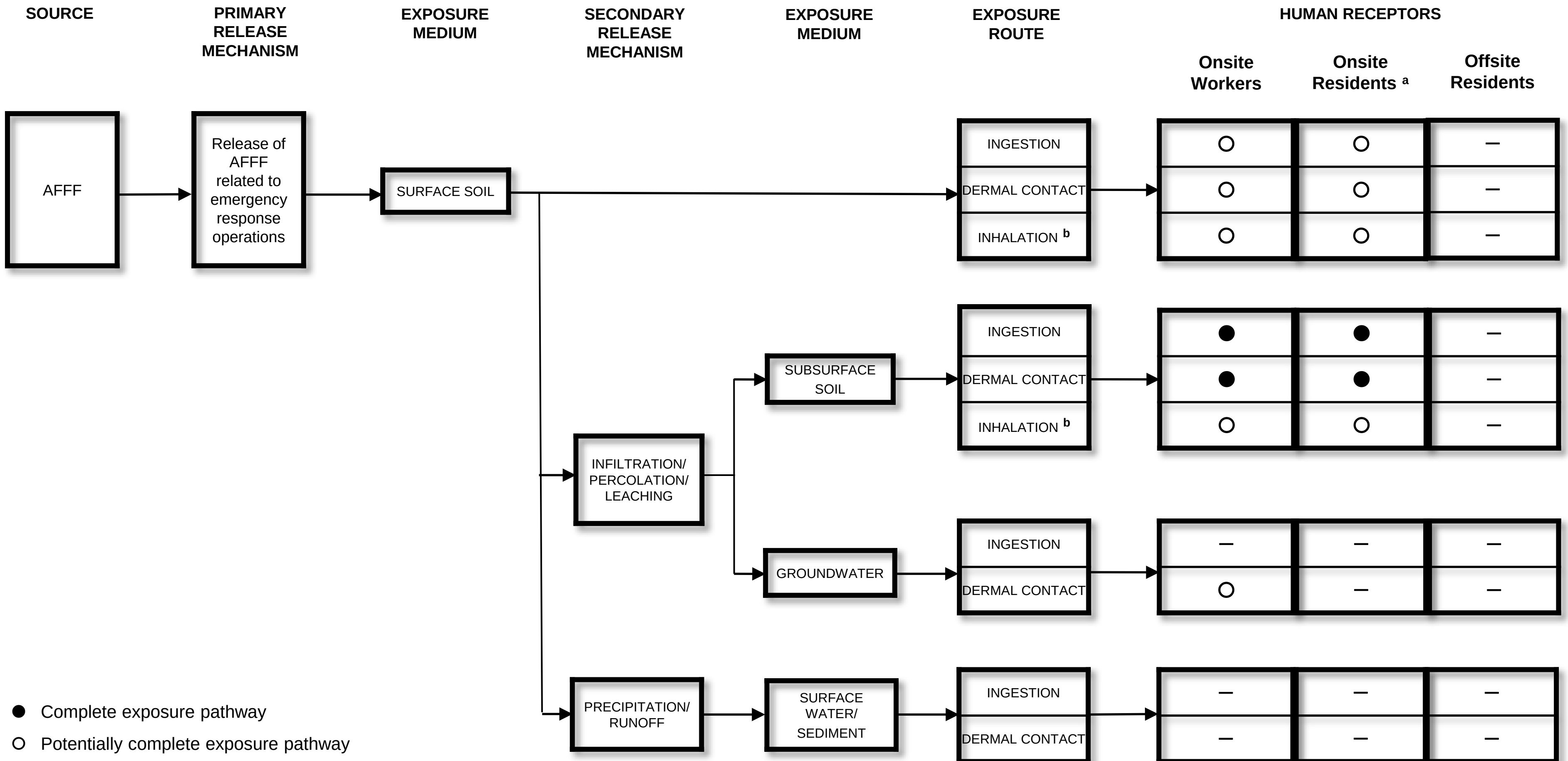
FIRE STATION (BUILDING 24)
AOPI SAMPLE RESULTS
FORT MONROE, VIRGINIA

FIGURE: 6-11 DATE: 10/27/2023

PROJECT: \Fort Monroe\Data Figures\Figure 6-11 FortMonroe_FireStation



● Complete exposure pathway

○ Potentially complete exposure pathway

— Incomplete exposure pathway

[a] Current land use at this AOPI is recreational; however, onsite residents are evaluated as a conservative assessment for the potential migration (i.e., groundwater and surface water) to residents on the former Fort Monroe.

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

Figure 6-12. Human Health CSM for Fire Station (Building 24) AOPI