PRELIMINARY ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES AT FORT MONROE, HAMPTON, VIRGINIA

Prepared for:

U.S. ARMY

ODCS, G-9, ISE BRAC

Final
August 2023

PRELIMINARY ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES AT FORT MONROE, HAMPTON, VIRGINIA

Prepared for:
ODCS, G-9, BRAC ISE
600 Army Pentagon
Washington, DC 20310

Prepared by:

Leidos
1750 Presidents Street
Reston, Virginia 20190

Contract Number W912DR-18-D-0003
Delivery Order Number W912DR21F0140

Sarika Johnson, Rupa Price
PFAS Preliminary Assessment Team

Yasu Peterson, P.E., PMP
BRAC PFAS Project Manager

Rita Schmon-Stasik
QA Manager

Lisa Jones-Bateman, REM, PMP
Principal

Final
August 2023

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AFFF	Aqueous Film-Forming Foam
amsl	Above Mean Sea Level
AOPI	Area of Potential Interest
Army	U.S. Army
ATSDR	Agency for Toxic Substances and Disease Registry
BRAC	Base Realignment and Closure
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CFR	Code of Federal Regulations
COC	Chemical of Concern
COPC	Chemical of Potential Concern
COI	Constituent of Interest
CSM	Conceptual Site Model
DERP	Defense Environmental Restoration Program
DoD	U.S. Department of Defense
DPW	Directorate of Public Works
ECOS	Environmental Conservation Online System
ECP	Environmental Condition of Property
EDR	Environmental Data Resources, Inc.
FMA	Fort Monroe Authority
FTA	Fire Training Area
HFPO-DA	Hexafluoropropylene Oxide Dimer Acid (aka GenX)
HQ	Hazard Quotient
HRSD	Hampton Roads Sanitation District
IPaC	Information for Planning and Consultation
JP-4	Jet Propulsion Fuel No. 4
JP-5	Jet Propulsion Fuel No. 5
LBP	Leas-Based Paint
LHA	Lifetime Health Advisory
MOU	Memorandum of Understanding
MSA	Metropolitan Statistical Area
msl	Mean Sea Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHL	National Historic Landmark
NMFS	National Marine and Fisheries Service
NNWW	Newport News Waterworks
NPS	National Park Service
OSD	Office of the Secretary of Defense
OWS	Oil/Water Separator
PA	Preliminary Assessment
PAL	Project Action Limit
PFAS	Per- and Polyfluoroalkyl Substances
PFBS	Perfluorobutane Sulfonate
PFHpA	Perfluoroheptanoic Acid
PFHxS	Perfluorohexane Sulfonate
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

ppb	Parts per Billion
ppt	Parts per Trillion
PX	Post Exchange
RfD	Reference Dose
RI	Remedial Investigation
RSL	Regional Screening Level
SDS	Safety Data Sheet
SDWA	Safe Drinking Water Act
SI	Site Inspection
T&E	Threatened and Endangered
U.S.C.	United States Code
UCMR3	Third Unregulated Contaminant Monitoring Rule
UCMR5	Fifth Unregulated Contaminant Monitoring Rule
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USATEC	U.S. Army Topographic Engineering Center
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The objective of a Preliminary Assessment (PA) is to identify areas of potential interest (AOPIs) based on whether use, storage, disposal, or release of potential per and polyfluoroalkyl substances (PFAS)-containing materials, including aqueous film-forming foam (AFFF), occurred in accordance with the 2018 *Army Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018). A PA for PFAS-containing materials with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) and its ammonium salt ("GenX" chemicals) was completed for the Base Realignment and Closure (BRAC) property at the former Fort Monroe, to assess potential PFAS release areas and exposure pathways. The entire Fort Monroe, which is in Hampton, Virginia, was selected for closure under BRAC. The completion of this PA included the execution of the following tasks:

- Conducted a kickoff meeting with the BRAC Office and the U.S. Army Corps of Engineers (USACE) on June 9, 2021, to present all parties' preliminary knowledge of the former Fort Monroe to provide information to guide the PA and site visit.
- Reviewed available records (e.g., aerial photography, historical maps, technical reports, previous studies, investigations) from online sources (i.e., Internet-based searches), environmental investigations and/or regulatory programs (e.g., the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]), and internal Army documents from the Administrative Record. In addition, an Environmental Data Resources, Inc. (EDR) Report for the former Fort Monroe and any listed sites within and up to a 1-mile search distance was conducted.
- Conducted a 3-day site visit from September 13 to 15, 2021, to identify potential sources of PFAS and gather information for developing conceptual site models (CSMs) at AOPIs.
- Interviewed individuals with historical and present-day knowledge of operations on the BRAC property.
- Identified AOPIs and developed preliminary CSMs for pathways of potential PFAS in soil, groundwater, surface water, and sediment.

In conducting the PA of the BRAC property at the former Fort Monroe, four AOPIs were identified where a potential for release of PFAS exists resulting from site operational history. AOPIs were identified at potential PFAS-release locations on the BRAC property only.

Based on the potential PFAS releases at the AOPIs, the potential for exposure to PFAS contamination in soil exists. In addition, a potential future on-post groundwater exposure pathway exists because no groundwater use restrictions are in place. Given the findings of this PA, the AOPIs presented warrant further evaluation in a Site Inspection (SI).

1. INTRODUCTION

The U.S. Army (Army) conducted this Preliminary Assessment (PA) to investigate the potential presence of per-and polyfluoroalkyl substances (PFAS) at the former Fort Monroe in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 United States Code [U.S.C.] §9601 et seq.); the Defense Environmental Restoration Program (DERP, 10 U.S.C. §2701 et seq.); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 Code of Federal Regulations [CFR] Part 300); and guidance documents developed by the U.S. Environmental Protection Agency (USEPA) and the Department of the Army. The former Fort Monroe is not on the National Priorities List, and the Army is responsible for compliance with CERCLA in accordance with Executive Order 12580, as amended.

The purpose of this PFAS PA is to identify locations that are areas of potential interest (AOPIs) on the former Fort Monroe based on the use, storage and/or disposal of potential PFAS-containing materials, in accordance with the 2018 *Army Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018). The PA was conducted in general accordance with 40 CFR §300.420(b) and the USEPA *Guidance for Performing Preliminary Assessments Under CERCLA* (USEPA 1991) and the *Army Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018). This report presents findings from research conducted to assess past use of PFAS-containing materials and identify areas where these materials were stored, handled, used, or disposed of at the former Fort Monroe.

The entire Fort Monroe property was evaluated for this PFAS PA, including Army-owned property as well as property that has been previously transferred. Fort Monroe is located in Hampton, Virginia, as shown in Figure 1-1.

1.1 PFAS BACKGROUND INFORMATION

PFAS are a group of synthetic compounds that have been manufactured and used extensively worldwide since the 1950s for a variety of purposes. PFAS are stable, man-made fluorinated organic chemicals that repel oil, grease, and water. Common industrial uses of PFAS include paints, varnishes, sealants, hydraulic fluid, surfactants, and firefighting foams. PFAS include both per- and polyfluorinated compounds. Perfluorinated compounds, such as perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA or GenX) are a subset of PFAS with completely fluorinated carbon chains, while polyfluorinated compounds have at least one carbon chain atom that is not fully fluorinated. These six PFAS together, and for the purposes of this PA, are referred to in this report as "Target PFAS."

Fort Monroe was evaluated for all potential use, storage, and/or disposal of PFAS-containing materials. A variety of PFAS-containing materials are used in relation to current and historical Army operations. However, the use, storage, and/or disposal of aqueous film-forming foam (AFFF) is the most common potential source of PFAS at U.S. Department of Defense (DoD) facilities. As such, this section is organized to summarize the AFFF-related sources first and all remaining potential PFAS-containing materials in the subsequent paragraph. AFFF is used as a firefighting agent to suppress petroleum hydrocarbon fires and vapors. Firefighting foams like AFFF were developed in the 1960s (ITRC 2020a), but AFFF did not see widespread DoD use until the early 1970s. Older fire training facilities often were unlined and not constructed to prevent infiltration of firefighting foams and combustion products leaching into the subsurface. Large quantities of AFFF may have been released into the environment as a result of fire training exercises, fire responses, fire suppression system activations, and tank and pipeline leaks/spills.

Other potential PFAS sources considered include Installation storage warehouses, some pesticide use, automobile maintenance shops, photographic processing facilities, laundry/waterproofing facilities, car washes, stormwater or sanitary sewer components, and biosolid application areas.

Many PFAS are highly soluble in water and have low volatility due to their ionic nature. The specific gravity/relative density for PFOS and PFOA is 1.8 (ITRC 2020b). Long-chain perfluorinated compounds have low vapor pressure and are expected to persist in aquatic environments. These compounds do not readily degrade by most natural processes. They are thermally, chemically, and biologically stable, and are resistant to biodegradation, atmospheric photooxidation, direct photolysis, and hydrolysis. The structure of these compounds increases their resistance to degradation; the carbon-fluorine bond is one of the strongest in nature, and the fluorine atoms shield the carbon backbone.

When PFAS are released to the environment, they can readily migrate into soil, groundwater, surface water, and sediment. Once in the environment, the compounds are persistent and may continue to migrate through airborne transport, surface water, groundwater, and/or biologic uptake. The amount of PFAS entering the environment depends on the type and amount of the PFAS material that may have been released, where and when it was used, the type of soil, and other factors. If private or public wells are located nearby, they potentially could be affected by PFAS. Similarly, surface water features may be impacted and may convey PFAS to downgradient receptors.

Of the thousands of PFAS, some are considered precursor compounds (typically polyfluoroalkyl substances). Precursor compounds can abiotically or biotically transform into PFOS and PFOA. PFOS and PFOA are referred to as terminal PFAS, meaning no further degradation products will form from them (ITRC 2020c).

1.2 PURPOSE AND OBJECTIVES

The purpose of a PA under the NCP is to 1) eliminate from further consideration those sites that pose no threat to public health or the environment; 2) determine if there is any potential need for removal action; 3) set priorities for Site Inspections (SIs); and 4) gather existing data to facilitate evaluation for the release pursuant to the Hazard Ranking System, if warranted (40 CFR §300.420(b)(1)).

The primary objective of the PA is to identify locations at Fort Monroe where there was use, storage, or disposal of PFAS-containing materials resulting in a potential release of PFAS to the environment and conduct an initial assessment of possible migration pathways of potential contamination. This PA also includes development of a preliminary conceptual site model (CSM) for AOPIs related to PFAS.

1.3 PFAS REGULATORY OVERVIEW AND SCREENING CRITERIA

In May 2016, USEPA issued lifetime health advisories (LHAs) for PFOA and PFOS under the Safe Drinking Water Act (SDWA). To provide Americans, including the most sensitive populations, with a margin of protection from a lifetime of exposure to PFOS and PFOA in drinking water, USEPA established a health advisory level for PFOS and PFOA (individually or combined) of 70 ng/L (USEPA 2016).

In October 2019, the Office of the Secretary of Defense (OSD) issued guidance on investigating PFOS, PFOA, and PFBS at DoD restoration sites. The OSD guidance provided risk screening levels for PFOS, PFOA, and PFBS in (groundwater) tap water and soil, based on the USEPA regional screening level (RSL) calculator for residential and industrial reuse and using the oral reference dose of 2E-05 mg/kg-day. These screening levels are used during a SI to determine if further investigation in a Remedial Investigation (RI) is warranted.

In April 2021, USEPA issued an updated toxicity assessment for PFBS. USEPA developed chronic (0.0003 mg/kg-day) and subchronic (0.001 mg/kg-day) oral reference doses (RfDs) for PFBS as part of USEPA's toxicity assessment. The RSL for PFBS was previously calculated using the RfD of 0.02 mg/kg day. New toxicity values resulted in revisions to the RSLs for PFBS in May 2021 (USEPA 2021).

In September 2021, OSD issued a revision to *Investigating Per- and Polyfluoroalkyl Substances within the DoD Cleanup Program* (DoD 2021). The revised memorandum accounts for the updated PFBS screening

levels attributable to USEPA's reassessment of PFBS toxicity in 2021. Based on USEPA's research, the RSLs for PFOS and PFOA are calculated using an RfD of 2E-05 mg/kg-day. The RSL for PFBS is calculated using an RfD of 3E-04 mg/kg-day. When multiple PFAS are encountered at a site, a 0.1 factor is applied to the screening level when it is based on noncarcinogenic endpoints.

In May 2022, based on continued evaluation of Target PFAS by the Agency for Toxic Substances and Disease Registry (ATSDR) and the USEPA Office of Water, USEPA provided new screening levels for PFOA, PFOS, PFNA, PFHxS, and HFPO-DA.

In July 2022, OSD issued a policy memorandum adopting these new screening levels to be used during the SI phase to determine whether further investigation in an RI is warranted. The screening levels for Target PFAS are listed in Table 1-1. This revised guidance is in effect as of July 2022 and is applicable to investigating PFOS, PFOA, PFBS, PFNA, PFHxS, and HFPO-DA at DoD restoration sites, including Base Realignment and Closure (BRAC) sites (DoD 2022). Currently, no legally enforceable Federal standards exist for PFAS in groundwater, surface water, soil, or sediment.

Table 1-1. Project Action Limits 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 (GenX)	6	23
PFBS	601	1,900
PFHxS	39	130
PFNA	6	19
PFOA	6	19
PFOS	4	13

Note: The residential tap water PALs are used to evaluate groundwater and surface water data. The residential soil PALs are used to evaluate soil and sediment data.

The Army's strategy is to continue to assess and investigate potential releases and implement necessary response actions in accordance with CERCLA to ensure that no human health-based exposures are above the CERCLA risk-based values in drinking water. Therefore, sites where human exposure to contaminated drinking water exists will be addressed first and as quickly as possible to eliminate the exposure and then will be subsequently prioritized and sequenced to conduct the investigations and response actions necessary to characterize and, if necessary, remediate the source of PFAS contamination (U.S. Army 2018).

1.4 PA METHODOLOGY

The PA for Fort Monroe included a site visit, aerial photographic analysis, records review, and interviews that were conducted in accordance with the methods detailed in the Programmatic PA Work Plan (Leidos 2021a). The Programmatic PA Work Plan outlines the approach and methodology for conducting the PFAS PA. As detailed in the Work Plan, the PA activities focused on ascertaining and documenting the following information regarding PFAS history and use, storage, or disposal at Fort Monroe:

- On-post fire training activities
- Use of PFAS-based AFFF in fire suppression systems or other systems
- AFFF stored, used, and/or disposed of at buildings and crash sites
- Activities or use of materials that are likely to contain PFAS, such as metal plating operations
- Wastewater treatment plants (WWTPs) and landfills that may have received PFAS-containing materials
- Studies conducted to assess environmental impacts at the facility
- Potential PFAS use at parcels post transfer
- Potential off-post sources that may impact Fort Monroe.

The data gathered during PA activities are summarized in Section 3.

1.5 REPORT ORGANIZATION

The contents of this PA Report are summarized below:

- ***Section 2. Site Background***—This section presents site-specific information related to site operational history and discusses the environmental setting. Demographics, land use, topography, geology, hydrogeology, hydrology, groundwater, potable wells, ecological receptors, and climate are described.
- ***Section 3. PA Analysis***—This section provides observations and results from the PA site visit, aerial photography analysis, records review, and interviews.
- ***Section 4. Summary of PA Data***—This section provides an overview of the data collected during the PA for the different potential PFAS sources.
- ***Sections 5. Summary of PA Results***—This section synthesizes all of the data gathered from the PA activities and determines whether each area evaluated during the PA is an AOPI or was not retained as an AOPI.
- ***Section 6. Conclusions***—This section presents conclusions of the PA.
- ***Section 7. References—***This section lists the references that were used in the preparation of this report.
- ***Appendices***—Appendices A through F include data from field activities or related assessments:
  - Appendix A. Final Fort Monroe Kickoff Meeting Minutes
  - Appendix B. Documents/Sources Reviewed During PA
  - Appendix C. Aerial Photographs
  - Appendix D. Site Visit Photographs
  - Appendix E. Questionnaire Responses and Interview Notes
  - Appendix F. Environmental Data Resources, Inc. (EDR) Report.

2. SITE BACKGROUND

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's land connection, adjacent to the community of Chesapeake Heights, is fenced with no ready access. 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 1823 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 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 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. Figure 2-2 illustrates the planned Fort Monroe land uses.

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). Fort Monroe transferred property and property recipients are shown in Figure 2-3. Although land use controls are not in place, a 2016 Memorandum of Understanding was signed by the Virginia Department of Environmental Quality 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); these sites are depicted in Figure 2-3.

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 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 2021b).

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 the Fort 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 the Fort and were subsequently abandoned (Darton 1896, New York Times 1902). Although groundwater use restrictions are not in place, a 2016 Memorandum of Understanding was signed by the Virginia Department of Environmental Quality and FMA to prohibit groundwater use and consumption at four sites at Fort Monroe (depicted in Figure 2-3).

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 to 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 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).

Fort Monroe has 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 smooth cordgrass (*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 (*Myotis septentrionalis*) (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, there are no known nests.

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. PA ANALYSIS

The primary components of the PA are records reviews, analysis of aerial photographs, a site visit, and interviews. The following sections summarize the methods used and activities conducted for the Fort Monroe PA. The reference to "on-post" refers to property that has been or still is owned by the Army. Any references to off-post refers to areas that have never been owned by the Army.

3.1 RECORDS REVIEW

Prior to the records review, site visit, and interviews, a kickoff meeting was held between BRAC, the U.S. Army Corps of Engineers (USACE), and Leidos on June 9, 2021. The purpose of the kickoff meeting was to present all parties' preliminary knowledge of Fort Monroe to inform the PFAS PA and site visit. The final kickoff meeting minutes are presented in Appendix A.

Preliminary research was conducted prior to the site visit to determine if any of the following activities were conducted, which may indicate whether there was use, storage, or disposal of PFAS-containing materials during operations at Fort Monroe:

- On-post fire training
- Used PFAS-based AFFF in fire suppression systems or other systems
- AFFF used, stored, or disposed of at buildings and crash sites
- Activities or materials used that are likely to include PFAS-containing materials
- Studies conducted to assess the environmental impacts of PFAS-containing materials
- Review of potential off-post sources.

The records review included a combination of Internet-based searches and reviews of aerial photography, historical maps, technical reports, previous studies, and investigations available online. In addition, an EDR search of state and Federal environmental databases for Fort Monroe and any listed sites within a 1-mile search distance was conducted (EDR 2021).

The records review evaluated available environmental investigations conducted under CERCLA. Internal Army documents were also reviewed, including inspection reports, regulatory correspondence, Fort Monroe maps, and a Community Environmental Response Facilitation Act (CERFA) report. Table 3-1 lists the documents reviewed that are relevant to the evaluation of AOPIs in this PA. A complete list of documents reviewed is included in Appendix B.

Table 3-1. Summary of Relevant Records Reviewed

Document Title	Author	Date	Relevance
Air Pollution Status and Evaluation Survey No. 43-21-0418-84	USAEHA	1983	Fire training
Environmental Operations Review No. 43-21-1374-88	USAEHA	1987	Fire training, photographic processing, pesticide management
Property Report for Fort Monroe	USATHAMA	1990	Information on hazardous substances identification and storage
Preliminary Assessment Report for Fort Monroe	Weston	1990 and 1992	Information on hazardous substances identification and storage
Environmental Baseline Survey of Army Property for the Residential Communities Initiative	U.S. Army	2003	Fort Monroe background and historical activities
Environmental Condition of Property	SAIC	2006	Fort Monroe background, historical activities, and identification of SI sites
Oil and Hazardous Substance Spill Prevention, Control, and Countermeasure Plan	U.S. Army	2006	Spill history and procedures
Phase 2 Storm Water Management Plan	U.S. Army	2010	Storm water discharge

Table 3-1. Summary of Relevant Records Reviewed (Continued)

Document Title	Author	Date	Relevance
Site Inspection (SI) Report and Supplemental SI Report	SAIC	2008 and 2011	SI and Supplemental SI sampling results
Fort Monroe Land Use Master Plan	Sasaki	2013	Land use
Fort Monroe Conveyance Report	U.S. Army	2020	Property transfers

Information gathered during the records reviews helped identify data gaps and enabled elimination of several areas based on their historical use. Data gaps associated with facility operations; PFAS-containing material use, storage, or disposal; and current exposure receptors at Fort Monroe contributed to a conservative approach for identifying AOPIs. However, areas with little potential to result in a PFAS release, such as residential buildings, hospitals, cafeterias, and recreational areas, were eliminated from further evaluation early on in the PA process.

Areas identified to have potentially used, stored, or disposed of, or had recorded the potential for a release of PFAS-containing materials, including AFFF, were further evaluated.

3.2 AERIAL PHOTOGRAPHIC ANALYSIS

The PA included review of previous historical aerial photographic analyses, which included U.S. Army Topographic Engineering Center (USATEC) aerial photographs (dating back to 1918), USEPA aerial photographs (dating back to 1954), and an additional 12 aerial photographs (dated 1961 to 2016) provided by EDR (EDR 2021). The EDR aerial photographs are presented in Appendix C. The aerial photographs were analyzed to identify potential activities or developments that may suggest the potential use, storage, or disposal of PFAS-containing materials, including AFFF (e.g., evidence of fire training activities, such as fire pits or burn scars); however, no conclusions on the use, storage, or disposal of PFAS-containing materials were drawn from the aerial photograph review. The aerial photographic analysis is summarized as follows:

- **1942 and 1945 –** A former incinerator is identified in the area in the southern portion of Dog Beach Landfill; an Incinerator Disposal Field is identified north of the former incinerator. A building is present as well as an open burning area/ash disposal area associated with the adjacent incinerator.
- **1947 and 1948 –** The building in the Incinerator Disposal Field is no longer present.
- **1953 –** The Incinerator Disposal Field has expanded in size; two trenches are present, each with mounded soil appearing along each trench.
- **1954 –** The 1954 aerial photograph shows the location of the former Area 200 landfill near Griffith Street and a dump site where construction-type rubble has been deposited. Walker Airfield is present in the 1954 aerial photograph. In the Incinerator Disposal Field, a single trench remains along with mounded soil.
- **1959 –** The 1959 aerial photograph shows a dike built along the northwestern side of the peninsula, beginning at the southern end of the airfield and extending northeast to Dog Beach Landfill. The parking aprons at the airfield are being refinished and the runway has been extended onto the area where probable concrete rubble had been dumped. A pile of rubble is in the Dog Beach Landfill area and a stained area is adjacent to the railroad spur.
- **1961 and 1963** – Most of the staining adjacent to the railroad spur is no longer visible. Dog Beach Landfill has increased in size and is spreading into the wetlands area. The road in the middle of the peninsula leading to the northern perimeter of the site has been elevated. Near the northern end of this road, a pit has been excavated. Three possible horizontal tanks are located adjacent to a loop road at the airfield.

- **1968 –** A parking lot has been built on the previously stained area. The pit, which was located in the waste disposal area, is no longer visible. The possible tanks previously located adjacent to the loop road at the airfield are no longer visible.
- **1969 through 1982 –** Sand from the beach is being piled along the eastern side of the road that runs parallel to Dog Beach Landfill. No recent activity has occurred in the landfill, and the area is now covered with vegetation.
- **1983** – The aerial photographs show four new symmetrical shaped areas of disturbed ground. Adjacent to one of the areas of disturbed ground is a pit that appears to contain a dark-colored liquid, which is believed to be the former fire training pit.
- **1990 through 2016** – Building 206 is no longer present at Walker Airfield. There are no other visible changes at Fort Monroe.

3.3 PA SITE VISIT

Prior to the site visit, Leidos corresponded with FMA and NPS personnel to coordinate site visit dates, gain access to the facility, and identify potential interviewees. The Fort Monroe PA site visit was conducted from September 13 to 15, 2021. The PA site visit included a site walk and visual inspection of all readily accessible areas at Fort Monroe to identify potential sources of PFAS and gather information for developing CSMs at AOPIs. In addition, the Hampton Fire Department was visited, and interviews were conducted with fire department personnel regarding historical fires and historical fire response procedures. Appendix D contains photographs from the PA site visit.

3.4 SUMMARY OF INTERVIEWS

Prior to the site visit, interviews were conducted with FMA and NPS; in addition, FMA completed a PA questionnaire focused on the current use of the property (included in Appendix E). The primary goal of the interviews/questionnaire was to identify whether PFAS-containing materials and/or AFFF are used on-post; however, no current uses were identified.

In addition, telephone interviews with former Army personnel were conducted prior to and during the site visit; former Army personnel indicated that AFFF was used on-post in the past. Table 3-2 summarizes the interviews conducted and the pertinent information provided.

Table 3-2. Interviews Conducted for PA

Title (Years of Experience at Facility)	Date	Information Provided
Former Post Engineers Manager/Inspector (1972 to 2010)	August 31, 2021	Individual was at Fort Monroe for 38 years. He provided the following information: • AFFF may have been used during the 1981 fire at the Marina. • A large fire occurred on the land inside the Moat (near Quarter 1) during his time at Fort Monroe. Individual does not believe that AFFF was used to extinguish the fire.
Former Deputy Fire Chief (1977 to 2000)	August 31, 2021	Individual was at Fort Monroe for 23 years. He provided the following information: • AFFF was stored in 5-gallon cans at the Airfield in a building that has been demolished. Approximately 10 cans were found. • AFFF was used routinely during fire training at the Airfield and at the Fire Training Pit until 1980, and infrequently thereafter. • There were no buildings with AFFF in the fire suppression system. • Two fire trucks were parked at the Fire Station and two cans of AFFF were stored on each fire truck. The fire trucks were washed down on the Fire Station ramp.

Table 3-2. Interviews Conducted for PA (Continued)

Title (Years of Experience at Facility)	Date	Information Provided
Former Employee/Engineer (1981 to 2015)	September 15, 2021	Individual was at Fort Monroe for 34 years. He provided the following information: • The former Fire Training Pit was used for practice fires and fire extinguishing. Individual was not aware of AFFF use during fire training activities. • Individual was not aware of AFFF use to extinguish the fires at Fort Monroe. Water was used to extinguish the fire on the land inside the Moat. Firefighters drew water from the Moat to extinguish the fire.
Former DPW Employee (1973 to 2011)	September 15, 2021	Individual was at Fort Monroe for 38 years. He provided the following information: • Not aware if AFFF was used during fire training activities. • Building 38 was used for simulated smoke exercises. Fire extinguishers were stored in the building. • Building 247 was used for equipment storage (originally used for air control). The building flooded during Hurricane Isabel.
Former Environmental Division Chief (2002 to 2010)	September 15, 2021	Individual was at Fort Monroe for 8 years. He provided the following information via email: • At the former Fire Training Pit, diesel was added to a wood pile to start the fires and then the fires were extinguished; however, he was not aware of how the fires were extinguished. • The former Fire Training Pit was not used from 2002 to 2010 and he was not aware of any other major fires at Fort Monroe during that time. • Portable halon fire extinguishers were stored at the airfield (near the building off the runway); however, he did not recall them being used.

4. SUMMARY OF PA DATA

4.1 PREVIOUS PFAS INVESTIGATIONS

In 2012, USEPA published the Third Unregulated Contaminant Monitoring Rule (UCMR3), which required nationwide public water systems (i.e., waterworks) to sample for a list of 30 unregulated contaminants, including 6 chemicals of concern relevant to this PA (i.e., PFOS, PFOA, PFBS, PFNA, perfluoroheptanoic acid [PFHpA], and PFHxS). The purveyor to Fort Monroe, NNWW, participated in the UCMR3 evaluation by sampling the six PFAS from 2013 to 2014; the PFAS were not detected (NNWW 2022). State-wide public water system sampling data did not reveal significant occurrences of PFOA, PFOS, or other PFAS in Virginia; PFAS were detected in two Virginia waterworks, but the source or an impact on drinking water supplies was not identified during follow-up sampling (VDH 2021a). USEPA published the Fifth Unregulated Contaminant Monitoring Rule (UCMR5) in 2021, which expanded the list to 29 PFAS for additional sampling between 2023 and 2025. The UCMR5 sampling includes more sensitive analytical limits for PFAS detection. As part of the UCMR5 sampling, NNWW water is proposed for sampling in 2023 (USEPA 2023).

The Virginia Department of Health Office of Drinking Water, in conjunction with the Virginia PFAS work group, designed a sample study to prioritize sites for measuring PFAS concentrations in drinking water and major sources of water and generate statewide occurrence data, subject to the limitations in 2020 Acts of Assembly Chapter 611 (HB586). Samples were collected from late May through July 2021. Of the 50 waterworks and major sources of water identified in the Virginia PFAS Sample Study Design, 45 agreed to participate in the study, and they provided 63 samples (some waterworks have more than 1 treatment facility or water source). PFAS were detected in 15 of the 63 sample locations. Samples from Newport News [2] contained PFAS above the practical quantitation limit (VDH 2021b). All of the samples were below the USEPA health advisory of 70 ng/L. Samples from 48 sample locations did not contain PFAS above the practical quantitation level. The Sample Study was limited to 45 waterworks. As a follow-up to the 2021 PFAS monitoring and occurrence study, an expanded Phase 2 PFAS Sampling Program of approximately 400 entry points at source groundwater and surface water is being undertaken beginning in July 2022 through spring 2023 to collect additional data on the occurrence in public drinking water supplies (VDH 2021a).

NNWW continues to monitor source waters in coordination with state agencies. PFOS, PFOA, and total PFAS were detected in NNWW finished water at maximum concentrations of 4.3, 5.9, and 9.1 parts per trillion (ppt), respectively in 2021 water quality samples (NNWW 2021). PFOS, PFOA, and total PFAS were detected at maximum concentrations of 3.6, 4.1, and 7.7 ppt, respectively, in the 2022 samples from the NNWW (NNWW 2022).

No PFAS investigation have been conducted at Fort Monroe prior to this PA.

4.2 EVALUATED SITES

During the PA records reviews, interviews, aerial photographic analysis, and site reconnaissance, available documentation and physical evidence were examined for areas having a potential historical PFAS release. For Fort Monroe, the sites evaluated include fire stations; fire training areas (FTAs); landfills; metal plating operations; WWTPs; pesticide facilities; vehicle maintenance shops, which used car washes and engine lubricants; paint shops; and photographic processing facilities, as shown in Figure 4-1 and described in the following sections.

4.2.1 AFFF Use, Storage, and Disposal

The PA included a search for evidence of current or historical AFFF use, storage, or disposal at Fort Monroe. Documentation specifying the use of AFFF at Fort Monroe during Army ownership and operation was not identified during the records reviews and aerial photographic analysis. However,

historical AFFF storage and use were identified through data collected from personnel interviews. There is no known current AFFF use or storage. The areas identified as potential areas of historical AFFF usage and/or storage at Fort Monroe are discussed below.

One historical Fire Station (Building 24) was identified during the PA. The Fire Station was constructed in 1881 and operated as a fire station until 2010. 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. The fire trucks were washed down on the Fire Station ramp. AFFF was stored at the Fire Station in 5-gallon metal cans (later switched to plastic cans), which may have leaked. Ten 5-gallon cans were stored. In 2017, the building was converted for use as a cafe known as Firehouse Coffee 1881.

Building 38 was constructed in 1934 and, according to personnel interviews, was used for smoke training and storage of fire extinguishers. According to the Environmental Condition of Property (ECP) Report, the building was used as a Fire Station, Rescue Facility, and for equipment storage (SAIC 2008).

A former Fire Training Pit was located off Fenwick Road near Building 38 and encompassed approximately 0.04 acres. 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 Deputy Fire Chief, it was determined that wood containing creosote and lead-based paint (LBP) was ignited using jet propulsion fuel No. 4 (JP-4), jet propulsion fuel No. 5 (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, 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.

Walker Airfield consists of a small airfield and helicopter landing area. Fixed wing airplanes were discontinued in the late 1960s; after that time, the airfield was used only for helicopters (SAIC 2008). According to personnel interviews, fire training exercises were conducted at the airfield in the vicinity of the fire hydrant (southeast of Building 247). According to the ECP Report (SAIC 2008), fire suppression equipment for the helipad was located at Building 247, Walker Airfield Terminal Building. The Former Deputy Fire Chief indicated that the fire training exercises included the use of AFFF. Approximately 10 5-gallon cans of AFFF were stored in former Building 206. This building was used as a Former Auto Craft Shop and was located approximately 350 feet east of Walker Airfield. When in operation, the Former Auto Craft Shop was composed of an approximately 10,050-ft^2 garage with four service bays, an associated asphalt parking area, and a small concrete building (Building 211). Building 206 was razed in the 1990s, and the building footprint is currently a maintained (mowed) grass-covered area.

On October 1, 1981, a large fire at the Marina destroyed the Old Point Yacht Club piers, two buildings, four automobiles, and seven boats. In addition to the Fort Monroe fire unit, the off-post Hampton and Norfolk Fire Departments responded to the fire, and three Navy tugboats and three USCG cutters directed firehoses on the blaze (Daily Press 1989). Based on interviews with fire department personnel, AFFF was used by the Hampton Fire Department until the mid-2000s. However, records of the October 1981 Marina fire are not available because emergency response records are only retained for 6 years. Thus, it is unconfirmed whether AFFF was used to suppress the October 1981 fire at the Marina.

4.2.2 Metal Plating Operations

No current or historical metal plating operations were identified at Fort Monroe.

4.2.3 Wastewater Treatment Plants

The former WWTP was built in 1915 to provide a way to dispose of sewage from Fort Monroe and eliminate the possibility of any pollution reaching the Chesapeake Bay and surrounding areas. It also provided services for the increased population at Fort Monroe. Building 12 was constructed in 1937 to serve as an addition to the former WWTP (SAIC 2008).

The former WWTP served strictly as a primary treatment plant and was in operation until 1951. The former WWTP consisted of two sets of three 150,000-gallon septic tanks, one 150,000-gallon chlorinating chamber, one 150,000-gallon siphon chamber, one 100- by 200-foot outdoor stone filter bed, and one double sludge bed with two 20- by 20-foot compartments. The former WWTP was connected to the Hampton Roads Sanitation District (HRSD) in 1949. The former WWTP was converted to the Engineer Machine shop in 1951. Between 1971 and 1994, the former WWTP housed the Post Exchange (PX), the Class VI store, racquetball courts, a package store, and a gym; the building was later used as a thrift store (SAIC 2011). In 2016, the building was converted for use as a brewery known as the Oozlefinch.

4.2.4 Landfills

This section describes the two former landfills (Area 200 and Dog Beach Landfill) at Fort Monroe:

- **Area 200** – The former Area 200 landfill is west of the Wherry Housing Area. It was in operation from the 1800s to the mid-1930s (Weston 1990). The landfill was unlined and reportedly used for construction/demolition debris and household wastes (USACE 2003). The landfill has since had a PX and parking lot constructed on top of it.
- **Dog Beach Landfill** – Records indicate that Dog Beach Landfill, encompassing an area of approximately 40 acres, received unknown quantities of construction demolition debris, incinerator ash, and household solid waste between the mid-1930s and late 1960s. The landfill is unlined. Although a 1957 map entitled "Refuse Disposal Plan for Fort Monroe, VA" (U.S. Army 1957) indicates that 2 feet of soil cover would be placed over "garbage and waste material," it is not known if or when these practices were employed. Based on aerial photography analysis (USEPA 1994), portions of the landfill were covered with "light-toned material," possibly sand, in the 1960s. No additional information regarding the disposal practices implemented at the landfill has been located.

An incinerator for household and office trash and other waste generated on Fort Monroe operated near the end of Incinerator Lane from the early-1940s through the 1960s. The incinerator, which included an uncovered concrete tipping floor, had a rated capacity of 5 tons every 8 hours (USAEC & Fort Monroe 2005). Aerial photographs indicate that the ash was disposed of in an area north of the incinerator within the southern boundary of Dog Beach Landfill (USATEC 2008). The likely presence of the incinerator ash disposal area in the southern portion of the landfill was confirmed during the SI for Dog Beach Landfill (SAIC 2008) by the dark soil horizon in the test pits in the area. The area in the southern portion of Dog Beach Landfill north of the former incinerator was identified as a possible or actual Incinerator Disposal Field on a 1953 map (U.S. Army 1953) and on all of the Fort Monroe 1942 to 1954 aerial photographs (1942, 1945, 1947, 1948, 1953, and 1954) included in the USATEC aerial photography analysis (USATEC 2008).

4.2.5 Other Potential Sources of PFAS

In addition to AFFF-related PFAS sources, other potential sources of PFAS may be associated with the use of some types of pesticides, car washes, engine lubricants, paint shops, laundry or waterproofing facilities, and photographic processing facilities. Potential non-AFFF PFAS sources at Fort Monroe are noted in Figure 4-1 and discussed below:

- **Maintenance Activities** – Maintenance activities were conducted at Building 206 (Former Auto Craft Shop), Marina, Building 28, Building 59 (Former Ordnance Machine Shop), Post Engineer Shops, Building 164, Building 204/205 (Boat Maintenance), and Building 218 (Auto Craft Shop). Boat, vehicle, and equipment maintenance activities were conducted; maintenance activities required the use of engine oils, fuels, lubricants, antifreeze, cleaning solvents, spray paints, adhesives, and sealers (SAIC 2006).

- **Laundry** – Built in 1920, the post laundry and associated boiler house were located at the location of former Building 168 (demolished in 2017). During the 1940s, the building was used for laundry collection, as well as typewriter repair and furniture manufacturing, including a paint spraying booth. Building 178 was built in 1941 as the officers' latrine but was converted to a laundry in 1960. Building 178 was used as a laundry until it was converted for pesticide storage in 1970 (SAIC 2006). Although a complete list of products used for laundry operations is not available, it is understood that common products used in wet and dry laundry facilities may have contained low concentrations of PFAS-containing materials and would not be considered a significant source of PFAS contamination. In addition, the activities associated with the post laundry were not tied to any other known areas where PFAS-containing materials were used, stored, or disposed of. As a result, the potential PFAS impacts were determined to be unlikely. Significant PFAS impacts would have been more likely from fire protective clothing and turnout gear being laundered at the facilities.
- **Photographic Processing** – Photographic processing occurred in Graphic Aids (Building 27), Photo Laboratory (Building 97), and Printing Plant (Building 183). Silver was recovered from these fluids, and all effluent went to the sanitary sewer. Since the spring of 2002, the photography shop converted to 100 percent digital photography. Building 97 has been removed. Building 27 was built in 1860 (previously used as an arsenal/munitions factory and a maintenance shop for cannons/guns). Building 183 was built in 1934 as the Old Point Comfort Yacht Club (SAIC 2006, USATHAMA 1990). A complete list of photographic processing chemicals used, stored, or disposed of at Fort Monroe is not available. However, the use of PFAS-containing materials did not become prevalent in the photography industry until approximately the mid-1990s (Kodak 2002). Given the operational period of Fort Monroe, the likelihood of PFAS impacts due to the use, storage, or disposal of photographic processing chemicals is assumed to be low.
- **Wash Racks –** Building 57 and former Building 164 contained wash racks. Building 57, constructed in 1934, contains both an indoor and outdoor wash rack. The wash racks were in use until 1988 (USATHAMA 1990). Discharges flowed through an oil/water separator (OWS) to the sanitary sewer. The building housed the Roads and Grounds Shop in the eastern portion and the Motor Pool in the western portion. Light maintenance was conducted on heavy machinery, such as trucks and bulldozers, which requires the use of engine oils, fuels, lubricants, antifreeze and cleaning solvents, spray paints, adhesives, and sealers (SAIC 2006). Building 164, constructed in 1962, was used as a service station until 1997. A concrete pit was installed inside the building as part of a wash rack. It is believed that it doubled as an OWS before the facility ceased operation as a service station. This building has been deconstructed. Although a complete list of products used for wash rack operations is not available, it is understood that common products used in vehicle washing may have contained minor amounts of PFAS-containing materials and would not be considered a significant source of PFAS contamination. In addition, the activities adjacent to the wash racks were not tied to any other known areas where PFAS-containing materials were used, stored, or disposed of. As a result, the potential PFAS impacts were determined to be unlikely. Significant PFAS impacts would have been more likely from emergency vehicles being serviced at the wash racks.
- **Pesticides** – Building 178 was built in 1941 as the officers' latrine, was converted to a laundry in 1960, and was converted to the pesticide control facility in 1970. Building 178 (Entomology Shop) was used as the pesticide control facility from 1970 until the late 1980s. Approximately 630 pounds and 50 gallons of unserviceable pesticides were being stored in Building 178. Building 178 consisted of two separate storage rooms (insecticide and herbicide), a separate office room, and a single large room with non-segregated pesticide mixing and change/shower/toilet areas. Mixing and filling of large spray tanks were being performed on a wooden boardwalk over sandy soil outside the building, and external rinse-down of spray rigs was being performed on adjacent grassy areas (USAEHA 1987). The

Entomology Shop moved from Building 178 to Building 81 in the late 1980s; Building 81 contained the Hazardous Waste Storage Area and the Entomology Shop (USATHAMA 1990). It was built in 1943 and is a concrete masonry building that is bermed. One hundred gallons of hazardous waste were stored in the Hazardous Waste Storage Area, and 400 gallons of pesticides and herbicides were stored in the Entomology Shop. Pesticides and herbicides were being stored and mixed for use at Fort Monroe (SAIC 2006). Although a complete list of pesticides used, stored, or disposed of at Fort Monroe is not available, the use of fluorinated pesticides was infrequent until about the mid-2000s (Alexandrino et al. 2022). Given the operational period of Fort Monroe, the likelihood of PFAS impacts due to pesticide use, storage, or disposal is assumed to be low.

During the document research and site visit, no additional potential PFAS-containing material use, storage, or disposal were identified.

4.3 POTENTIAL OFF-POST AND POST TRANSFER PFAS SOURCES

The search to identify potential off-post PFAS sources (i.e., not related to the Army's operations at Fort Monroe), although not exhaustive, included review of significant potential contributors (i.e., airports, landfills, WWTPs). In addition, EDR conducted a search of state and Federal environmental databases for the Fort Monroe property and adjacent properties (EDR 2021). No known PFAS-containing material releases have occurred post transfer on Fort Monroe property. Most of the surrounding area consists of the Chesapeake Bay or Mill Creek. The adjacent property to the north consists of beach-front housing. Figure 4-2 shows the fire stations, airports, helipads, WWTPs, and car washes located within a 5-mile radius from Fort Monroe.

5. SUMMARY OF PA RESULTS

The areas evaluated for potential PFAS use and/or storage at Fort Monroe were further refined during the PA process and categorized as an AOPI or not retained. Areas not retained as AOPIs are discussed in Section 5.1. AOPIs are discussed in Section 5.2.

5.1 AREAS NOT RETAINED AS AOPIs

Based on analysis of information obtained during this PA, the areas described below were not retained as AOPIs. These areas were previously identified as potential PFAS sources (e.g., AFFF storage, car washes, automobile maintenance, paint shops, photographic processing, pesticide use or storage, WWTPs, landfills). However, PA research does not indicate that PFAS-containing materials were used, stored, or disposed of at these areas. A brief site history and the rationale for eliminating the areas as AOPIs are presented in Table 5-1.

Table 5-1. Summary of Areas Not Retained as AOPIs at Fort Monroe

Area Description	Dates of Operation	Relevant Site History	Rationale
Fire Equipment Storage Building (Building 38)	1934 to 2010	Based on personnel interviews, Building 38 was previously used for smoke training and storage of non-AFFF fire extinguishers. Building 38 was not used to store AFFF.	No evidence that PFAS-containing materials were used, stored, or disposed of.
Former WWTP	1937 to 1951	The former WWTP served strictly as a primary treatment plant. The former WWTP consisted of septic tanks, a chlorinating chamber, a siphon chamber, an outdoor stone filter bed, and a double sludge bed with two compartments. The former WWTP was connected to HRSD in 1949.	Dates of WWTP operation precede the wide use of PFAS-containing materials; therefore, it is unlikely PFAS-containing materials were used, stored, or disposed of.
Dog Beach Landfill	Mid-1930s to late 1960s	Encompassed an area of approximately 40 acres and received unknown quantities of construction demolition debris, incinerator ash, and household solid waste.	Dates of landfill operation precede the wide use of PFAS-containing materials; therefore, it is unlikely PFAS-containing materials were used, stored, or disposed of.
Area 200	1800s to mid-1950s	The landfill was unlined and reportedly used for construction/demolition debris and household wastes (USACE 2003). There also was a potential for pathological wastes to be disposed of in the landfill. An estimated 20,000 yd^3 of waste were disposed of in the landfill at a maximum depth of 4 feet (Weston 1992).	Dates of landfill operation precede the wide use of PFAS-containing materials; therefore, it is unlikely PFAS-containing materials were used, stored, or disposed of.
Maintenance Buildings (B206, B28, B59, Post Engineer Shops, B164, B204/B205, and B218)	Various	Boat and vehicle maintenance activities were conducted and required the use of engine oils, fuels, lubricants, antifreeze, cleaning solvents, spray paints, adhesives, and sealers.	No evidence that PFAS-containing materials were used, stored, or disposed of. SDSs were unavailable for review at the time of the PA.

Table 5-1. Summary of Areas Not Retained as AOPIs at Fort Monroe (Continued)

Area Description	Dates of Operation	Relevant Site History	Rationale
Laundry (Buildings 168 and 178)	1940s (post laundry) and 1960 to 1970 (Building 178)	Built in 1920, the post laundry and associated boiler house were at the former Building 168 location. During the 1940s, the building was used for laundry collection. Building 178 also was temporarily used as a laundry from 1960 to 1970.	No evidence that PFAS-containing materials were used, stored, or disposed of. SDSs were unavailable for review at the time of the PA; however, the activities associated with the post laundry were not tied to any other known areas where PFAS-containing materials were used, stored, or disposed of. As a result, the potential PFAS impacts were determined to be unlikely.
Photographic Processing (Buildings 27, 97, and 183)	Until 2002	Photographic processing fluids were processed through a silver recovery unit before being discharged into the sanitary sewer system. Building 97 has been removed. Buildings 27 and 183 are no longer used for photographic processing.	No evidence that PFAS-containing materials were used, stored, or disposed of. SDSs were unavailable for review at the time of the PA. Based on the period of operation for Fort Monroe, the dates of photographic processing at the facility pre-date the prevalent use of PFAS-containing chemicals in the photography industry.
Wash Racks (Buildings 57 and 164)	1934 to 1988 (Building 57) 1962 to 1997 (Building 164)	Building 57 contains both an indoor and outdoor wash rack. Discharges flow through an OWS to the sanitary sewer. A concrete pit was installed inside Building 164 as part of a wash rack. It is believed that it doubled as an OWS before the facility ceased operation as a service station. Building 164 has been deconstructed.	No evidence that PFAS-containing materials were used, stored, or disposed of. SDSs were unavailable for review at the time of the PA; however, the minor amounts of PFAS containing material used in vehicle washing would not be considered a significant source of PFAS contamination. The activities conducted adjacent to the wash racks were also not tied to any other known areas where PFAS-containing materials were used, stored, or disposed of; therefore, the potential PFAS impacts were determined to be unlikely.
Pesticide Storage (Buildings 81 and 178)	1970 to 2010	Building 178 was built in 1941 as the officers' latrine, converted to a laundry in 1960, and converted to the Entomology Shop in 1970. The Entomology Shop was moved to Building 81 from the late 1980s until 2010.	No evidence that PFAS-containing materials were used, stored, or disposed of. SDSs were unavailable for review at the time of the PA. Based on the period of operation for Fort Monroe, the dates of pesticide use at the facility pre-date the use of fluorinated pesticides.

5.2 AOPIs

Based on analysis of information obtained during document research, personnel interviews, and/or site reconnaissance, four areas were categorized as AOPIs and are presented in Table 5-2 and Figure 5-1. Site research conducted for this PA indicates that PFAS-containing material use, storage, or disposal is potentially suspected at these areas.

Table 5-2. Summary of AOPIs at Fort Monroe

Area Description	Dates of Operation	Relevant Site History	Rationale
Marina	October 1, 1981	A fire started in the yacht club building and spread along the length of the marina.	Large fire with suspected AFFF use to extinguish the fire.
Fire Training Pit (FTMON-IR-06)	1950s to 1980s	Fire training activities were conducted three to four times per month and included the potential use of AFFF. Wood containing creosote and LBP was ignited using JP-4, JP-5, and waste oil. The Fire Training Pit was previously investigated during the non-PFAS SI (SAIC 2008) and Supplemental SI (SAIC 2011). Chemical concentrations in soil and groundwater were compared to COC screening criteria and based on the results, no further action was recommended.	Fire training activities with potential AFFF use.
Walker Airfield	1950s to 1980s	Fire training activities were conducted at the airfield in the vicinity of the fire hydrant, and fire training exercises included the use of AFFF. AFFF was stored in former Building 206.	Fire training activities with reported AFFF use and AFFF storage in a former building.
Fire Station (Building 24)	1881 to 2010	Fire trucks with AFFF were historically stored and washed at the fire station.	Fire station with reported AFFF use.

A summary of the preliminary CSM is presented in Section 5.2.1. AOPI overviews and CSM summaries for each AOPI are presented in Sections 5.2.2 through 5.2.5.

5.2.1 Preliminary CSM

A preliminary CSM was prepared for each of the Installation's AOPIs in accordance with the *Environmental Quality, Conceptual Site Models, EM 200-1-12* (USACE 2012) and USEPA guidance. The preliminary CSMs identified potential human receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSMs identified soil and groundwater pathways as potentially complete.

Based on the documented or potential historical use, storage, or disposal of PFAS-containing materials at Fort Monroe, affected media are likely to consist of soil, groundwater, surface water, and sediment. Release and transport mechanisms include dissolution/desorption from soil to groundwater, runoff/dissolution/adsorption with surface water or stormwater, and recharge to groundwater from surface water. While other potential exposure media (i.e., soil and sediment) besides drinking water sources (i.e., groundwater and/or surface water) may be impacted by PFAS, direct ingestion via drinking water is the most likely exposure route, and thus the Army's primary concern for human exposure. Therefore, the focus of the Army's PA program is on potential human exposures via drinking water ingestion. The potential for human exposures to PFAS through non-drinking water pathways has not yet been established and may be evaluated in the future if it is determined that those pathways warrant further consideration.

The CSMs presented in this report focus on drinking water pathways via groundwater and surface water that are known to be used as a source of potable water.

Potable use of groundwater underlying the site is unlikely because it is in a shallow water-bearing zone and is high in salinity. Drinking water at Fort Monroe is supplied by NNWW. As discussed in Section 2.8, there are no nearby water supply wells used as a drinking water source. A groundwater exposure pathway is considered potentially complete where constituents of interest (COIs) could migrate from the AOPI source area to groundwater that is used for drinking water. Otherwise, the groundwater exposure pathway is considered incomplete. The following parameters are used to determine if an AOPI source area had a potentially complete groundwater exposure pathway:

- AOPIs located upgradient or in the vicinity of drinking water sources and that have the potential to influence groundwater associated with these potable sources are considered to have a potentially complete groundwater exposure pathway for onsite drinking water receptors.
- AOPIs that have the potential to influence groundwater that flows offsiteare considered to have a potentially complete exposure pathway for offsite receptors.

The soil exposure pathway is considered potentially complete where COIs could be present in soil. A surface water exposure pathway is considered potentially complete where COIs could be present in a surface water body (e.g., a reservoir or large river) that serves as a potable water source. No onsite surface water features are used as a drinking water source nor is surface water migration a potential exposure medium for offsite drinking water receptors. Surface water at Fort Monroe includes the Moat, portions of the Mill Creek tidal basin, and the Chesapeake Bay shoreline. Figure 5-1 presents the locations of the AOPIs. AOPI-specific CSM summaries are provided in Tables 5-3 through 5-6.

5.2.2 Marina AOPI Rationale and CSM

The Marina is located on property that has been transferred to FMA and was identified as an AOPI following records reviews and interviews. 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 (Daily Press 1989). Based on interviews with fire department personnel, AFFF was used by the Hampton Fire Department until the mid-2000s. Records of the October 1981 Marina fire are not available because emergency response records are only retained for 6 years. Based on the time frame, respondents, and magnitude of the fire, AFFF was likely used to suppress the October 1981 fire at the Marina. The use and consumption of groundwater are prohibited at the Marina AOPI by a memorandum of understanding (MOU) between VDEQ and the FMA (VDEQ and FMA 2016). The MOU was established in 2016 to address chemicals of potential concern (COPCs) in the groundwater at a number of sites at Fort Monroe (see Figure 2-3). COPCs include volatile organic compounds, metals, polycyclic aromatic hydrocarbons, and pesticides.

Table 5-3. AOPI CSM Information Profile – Marina

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI site structures/description	The Marina restaurant and Building 183 are present as well as piers that were rebuilt after the fire. The Phoebus Channel borders to the north, west, and south (McNair Drive is to the east). Approximately 1.6 acres of submerged property of the Chesapeake Bay along the Marina.
	Latitude, longitude	37.00262, -76.3144
	Size	0.55 acres
Land Use	Current/future land use	Mixed Use – Retail/Dining Focus

Table 5-3. AOPI CSM Information Profile – Marina (Continued)

Profile Type	Information Needs	Preliminary Assessment Findings
CSM Profile	Source media	Soil/sediment/surface water
	Migration routes/release mechanisms	Constituents could migrate from soil to groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff, dissolution, and adsorption from stormwater and recharge to groundwater from surface water.
	Exposure pathways, media, and human receptors	Soil is considered a complete exposure pathway at the Marina. Although on-post groundwater is not currently used and unlikely to be used for drinking water at Fort Monroe (due to shallow water-bearing zone and high salinity) and groundwater use is prohibited at the Marina, a potential future exposure pathway exists on-post because PFAS are not identified as COPCs associated with the groundwater use restrictions at this AOPI. In addition, migration potential to drinking water sources off-post is unlikely.

5.2.3 Fire Training Pit AOPI Rationale and CSM

A former Fire Training Pit (FTMON-IR-06) was located off Fenwick Road near Building 38 and encompassed approximately 0.04 acres 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 Deputy Fire Chief, it was determined that wood containing creosote and LBP was ignited using JP-4, 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, 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 (COC) screening criteria, and based on the results, no further action was recommended.

Table 5-4. AOPI CSM Information Profile – Fire Training Pit

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI site structures/description	The concrete pad at the AOPI is surrounded by a grassy area that is depressed on the northern side. The site is adjacent to the east of Fenwick Drive.
	Latitude, longitude	37.02278, -76.297
	Size	0.04 acres
Land Use	Current/future land use	Recreational Use
CSM Profile	Source media	Soil
	Migration routes/release mechanisms	Constituents could migrate from soil to groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff, dissolution, and adsorption from stormwater and recharge to groundwater from surface water.
	Exposure pathways, media, and human receptors	Soil is considered a complete exposure pathway at the Fire Training Pit. Although on-post groundwater is not currently used and unlikely to be used for drinking water at Fort Monroe (due to shallow water-bearing zone and high salinity) a potential future exposure pathway exists on-post because no groundwater use restrictions are in place at this AOPI. In addition, migration potential to drinking water sources off-post is unlikely.

5.2.4 Walker Airfield AOPI Rationale and CSM

Walker Airfield, consisting of a small airfield and helicopter landing area, is located on property that has been transferred to NPS. Fixed wing airplanes were discontinued in the late 1960s; after that time, the airfield was used only for helicopters (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.

Table 5-5. AOPI CSM Information Profile – Walker Airfield

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI site structures/description	Walker Airfield consists of an asphalt runway, a fire hydrant, a grassy area, and several concrete pads. Building 247 is still present but is unoccupied.
	Latitude, longitude	37.015, -76.301
	Size	8.5 acres
Land Use	Current/future land use	Recreational Use
CSM Profile	Source media	Soil
	Migration routes/release mechanisms	Constituents could migrate from soil to groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff, dissolution, and adsorption from stormwater and recharge to groundwater from surface water.
	Exposure pathways, media, and human receptors	Soil is considered a complete exposure pathway at Walker Airfield. Although on-post groundwater is not currently used and unlikely to be used for drinking water at Fort Monroe (due to shallow water-bearing zone and high salinity) a potential future exposure pathway exists on-post because no groundwater use restrictions are in place at this AOPI. In addition, migration potential to drinking water sources off-post is unlikely.

5.2.5 Fire Station AOPI Rationale and CSM

The Fire Station (Building 24) was constructed in 1881 and operated as a fire station until 2010. The Fire Station is located on property that has been transferred to FMA, and the building is currently being used as a cafe. 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. The fire trucks were washed down on the Fire Station ramp.

Table 5-6. AOPI CSM Information Profile – Fire Station

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI site structures/description	Building 24 is present but has been converted for use as a cafe.
	Latitude, longitude	37.005, -76.311
	Size	0.05 acres
Land Use	Current/future land use	Mixed Use – Residential Focus
CSM Profile	Source media	Soil
	Migration routes/release mechanisms	Constituents could migrate from soil to groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff, dissolution, and adsorption from stormwater and recharge to groundwater from surface water.
	Exposure pathways, media, and human receptors	Soil is considered a complete exposure pathway at the Fire Station. Although on-post groundwater is not currently used and unlikely to be used for drinking water at Fort Monroe (due to shallow water-bearing zone and high salinity) a potential future exposure pathway exists on-post because no groundwater use restrictions are in place at this AOPI. In addition, migration potential to drinking water sources off-post is unlikely.

5.3 DATA LIMITATIONS

The data limitations relevant to the development of this PA for PFAS at Fort Monroe are discussed below.

A comprehensive well survey was not completed as part of this PA; therefore, the information reviewed regarding off-post wells is limited to the desktop survey completed. No off-post water supply wells were found in the EDR well search report (Appendix F).

Records reviewed during the PA process were limited in information regarding PFAS-containing materials, including AFFF use, procurement records, and firefighter training records. Generally, interviews were crucial to understanding past practices and identifying the potential for use, storage, or disposal of PFAS-containing materials because records are often not available after Installation closure. Interviews providing information regarding potential PFAS-containing material use were limited in quantity but inclusive of personnel knowledgeable about fire, emergency response, and industrial activities over the time frame from 1972 to the present.

The PA was conducted through observation of operational periods, site usage, aerial photographs, records reviews, anecdotal evidence, and personnel interviews to evaluate the use, storage, or disposal of PFAS-containing materials. Therefore, some conclusions and recommendations presented in this report are based on available information, professional judgment, and industry best practices.

6. CONCLUSIONS

This PA was conducted in accordance with DoD, Army and USEPA guidance documents. Programmatically, the Army has focused its PFAS PA efforts to identify locations where a potential for a release of PFAS exists (i.e., those locations where there was use, storage, or disposal of PFAS-containing materials). Locations on Army Installations with the greatest likelihood of releases of PFAS were evaluated as part of this PA, including FTAs, AFFF storage locations, aircraft crash sites, fuel farms, and sites associated with aviation assets. However, other potential sources of PFAS at the Installation were considered and have been documented in this PA. A combination of document review, Internet searches, interviews with Installation personnel, and an Installation site visit were used to identify specific areas of suspected PFAS use and releases at Fort Monroe.

The entire former Fort Monroe Installation was assessed. Twenty-two preliminary areas were identified and evaluated for potential use, storage, and/or disposal of PFAS-containing materials, were further refined during the PA process, and then were either identified as an area not retained for further investigation or as an AOPI. In accordance with the established process for the PA, four of the preliminary areas have been identified as AOPIs.

The AOPIs identified during this this PA at Fort Monroe are listed below:

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

A site-specific CSM was developed for each AOPI based on an assessment of existing records, personnel interviews, and site reconnaissance trips. The CSMs developed for this PA did not identify any of the four AOPIs as currently impacting on-post or off-post drinking water receptors. However, a potential future pathway exists on-post because no groundwater use restrictions are in place.

Given the findings of this PA, the AOPIs presented warrant further evaluation in an SI (40 CFR 300.420(c)).

7. REFERENCES

Alexandrino, D.A.M., C.M.R. Almeida, A.P. Mucha, and M.F. Carvalho. 2022. *Revisiting pesticide pollution: The case of fluorinated pesticides*. Environmental Pollution, 292(1). Available online at: https://doi.org/10.1016/j.envpol.2021.118315.

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.

Daily Press. 1989. Dangers Live in Firefighters' Memories. Published May 11, 1989. Available online at: https://www.dailypress.com/1989/05/11/dangers-live-in-firefighters-memories/.

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). 2021. *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program.* September 15.

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

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.

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). 2020a. *History and use of Per- and Polyfluoroalkyl Substances (PFAS). Washington, DC*. April. Available online at: https://pfas-1.itrcweb.org/fact_sheets_page/PFAS_Fact_Sheet_History_and_Use_April2020.pdf.

ITRC. 2020b. *Per- and Polyfluoroalkyl Substances (PFAS) Fact Sheet, Updated April 14, 2020*. Available online at: https://pfas-1.itrcweb.org/4-physical-and-chemical-properties/#4_2.

ITRC. 2020c. *Aqueous Film-Forming Foam (AFFF). Washington, DC.* April. Available online at: https://pfas-1.itrcweb.org/fact_sheets_page/PFAS_Fact_Sheet_AFFF_April2020.pdf.

Kodak (Eastman Kodak Company, Health, and Environmental Laboratories). 2002. *Comments on the Proposed Significant New Use Rule (SNUR) for Perfluoroalkyl Sulfonates (PFAS) Published March 11, 2002 (67 FR 11014)*. July 1.

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

Leidos. 2021a. *Programmatic Work Plan. Preliminary Assessments of Per- and Polyfluoroalkyl Substances at Multiple BRAC Installations, Nationwide.*

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

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.

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.

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

NNVA (Newport News Virginia). 2021. *Newport News Waterworks Department. Annual Water Quality Report. Summarizing test Results from 2021 for the Lower Peninsula System*. Accessed June 5, 2023. Available online at: https://www.nnva.gov/DocumentCenter/View/33878/Combined_CCR_Web2021?bidId= .

NNVA. 2022. *Newport News Waterworks Department. Annual Water Quality Report. Combined Annual Summarizing Test Results from 2022*. Accessed June 5, 2023. Available online at: https://www.nnva.gov/DocumentCenter/View/353/Water-Quality-Report-PDF?bidId=.

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

NRWG (Natural Resource Working Group). 2009. *Fort Monroe NRWG Report*. Presented to the Fort Monroe Federal Area Development Authority. 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. 2006. *U.S. Army BRAC 2005 Environmental Condition of Property Report, Fort Monroe, Hampton, Virginia*. Final. November.

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. 1953. *Map of Fort Monroe, Virginia.* Headquarters Second Army, Office of the Post Engineer, Fort Monroe, Virginia. November 9.

U.S. Army. 1957. *Refuse Disposal Plan for Fort Monroe.* Headquarters Second Army, Office of the Post Engineer, Fort Monroe, Virginia. November

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

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

U.S. Army. 2010. *Phase 2 Storm Water Management Plan, Fort Monroe, Virginia*. June.

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/hamptoncityvirginiacounty/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.

USACE. 2012. *Environmental Quality, Conceptual Site Models*. EM 200-1-12. December.

USAEC (U.S. Army Environmental Center) & Fort Monroe. 2005. *USAEC and Fort Monroe Department of Public Works.* 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.

USATEC (U.S. Army Topographic Engineering Center). 2008. *Fort Monroe, Virginia, Examination of Historical Photography*. Draft. January.

USATHAMA (U.S. Army Toxic and Hazardous Materials Agency). 1990. *Property Report for Fort Monroe*.

USEPA (U.S. Environmental Protection Agency). 1991. *Guidance for Performing Preliminary Assessments Under CERCLA, EPA/540/G-91013*. September.

USEPA. 1994. Environmental Photographic Interpretation Center. *"Aerial Photographic Analysis of the Fort Monroe Military Reservation, Hampton, Virginia."* September.

USEPA. 2016. *Lifetime Health Advisories and Health Effects Support Documents for Perfluorooctanoic Acid and Perfluorooctane Sulfonate*. EPA-HQ-OW-2014-0138; FRL-9946-91-OW. Federal Register/ Vol. 81. No. 101. May 25. Available online at: https://www.govinfo.gov/content/pkg/FR-2016-05-25/pdf/2016-12361.pdf.

USEPA. 2021. *Human Health Toxicity Values for Perfluorobutane Sulfonic Acid and Related Compound Potassium Perfluorobutane Sulfonate.* U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-20/345F, 2021.

USEPA. 2023. *Fifth Unregulated Contaminant Monitoring Rule*. Available online at: https://www.epa.gov/dwucmr/fifth-unregulated-contaminant-monitoring-rule.

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=32ea4ee4935942c092e41ddcd19e5ec5. Accessed February 21.

VDH (Virginia Department of Health). 2021a. Available online at: https://www.vdh.virginia.gov/drinking-water/pfas/.

VDH. 2021b. *Virginia Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water Sample Study, Summary of Results.* September 30.

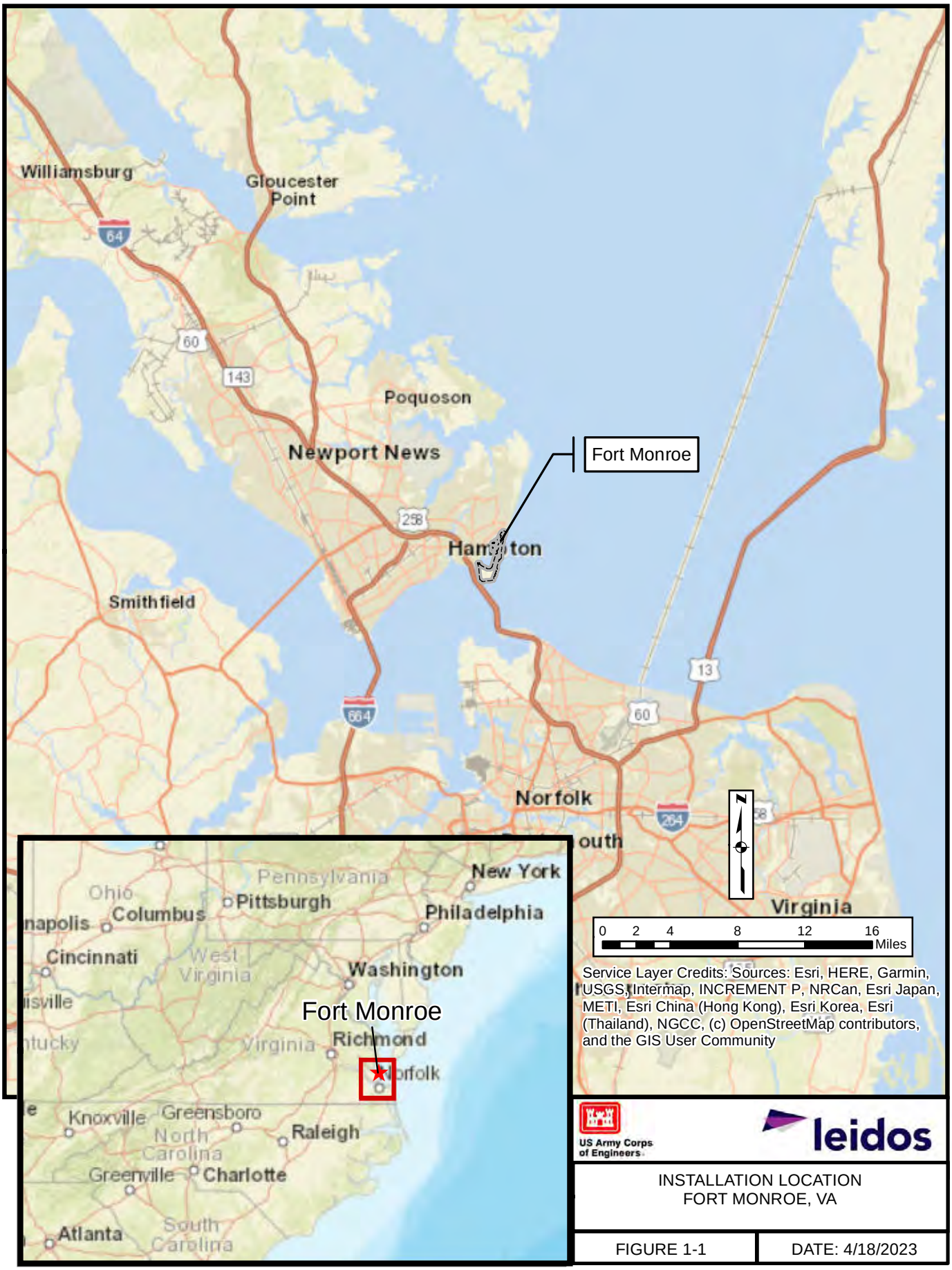
Weather Spark. 2021. Available online at: https://weatherspark.com/y/21666/Average-Weather-in-Hampton-Virginia-United-States-Year-Round.

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.

Weston. 1992. *Preliminary Assessment Report Addendum for Fort Monroe*. March.

FIGURES



C:\Users\woodleych\Documents\Work\BRAC PFAS\Fort Monroe\PA\Figure 1-1 FM Installation Location.mxd


Mill Creek
Chesapeake Bay
Hampton Roads
Fenwick Rd
McNair Dr
Ingalls Rd
Legend
Installation Boundary
Buildings
Roads
5-foot Contours
0
5
10
15
20
25
30
Notes:
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
0
1,000
2,000
SCALE: 1" = 3,000'
VA STATE PLANE SOUTH (NAD83)
US Army Corps of Engineers
leidos
SITE FEATURES
FORT MONROE, VA
FIGURE 2-1
DATE: 5/25/2023
C:\Users\woodleych\Documents\Work\BRAC PFAS\Fort Monroe\PA\Figure 2-1 FortMonroe_Site.mxd

2013 LAND USE MASTER PLAN

Note: The Fort Monroe Land Use Master Plan was reproduced from the Fort Monroe Master Plan Final Presentation (Sasaki 2013).

US Army Corps of Engineers

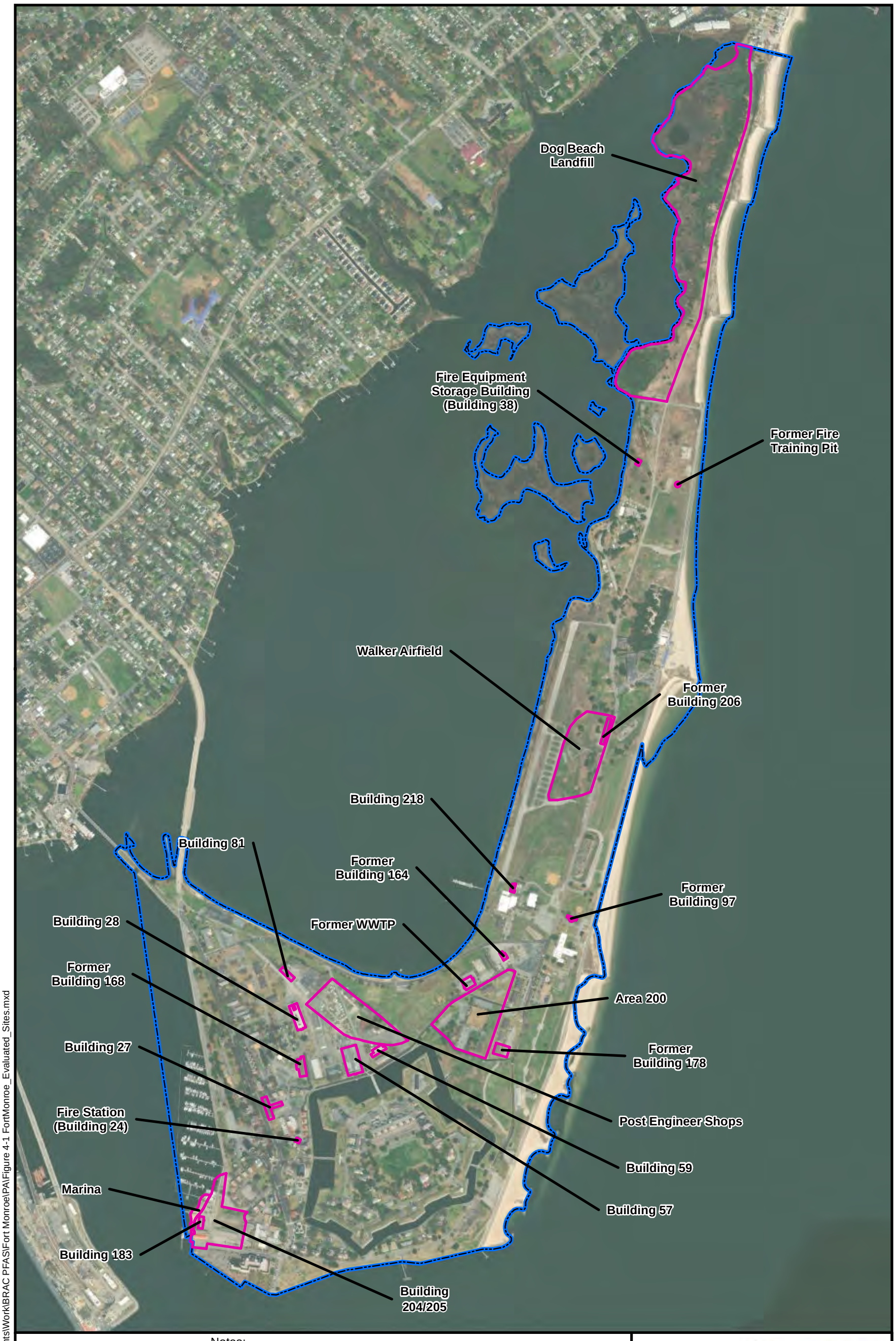
leidos

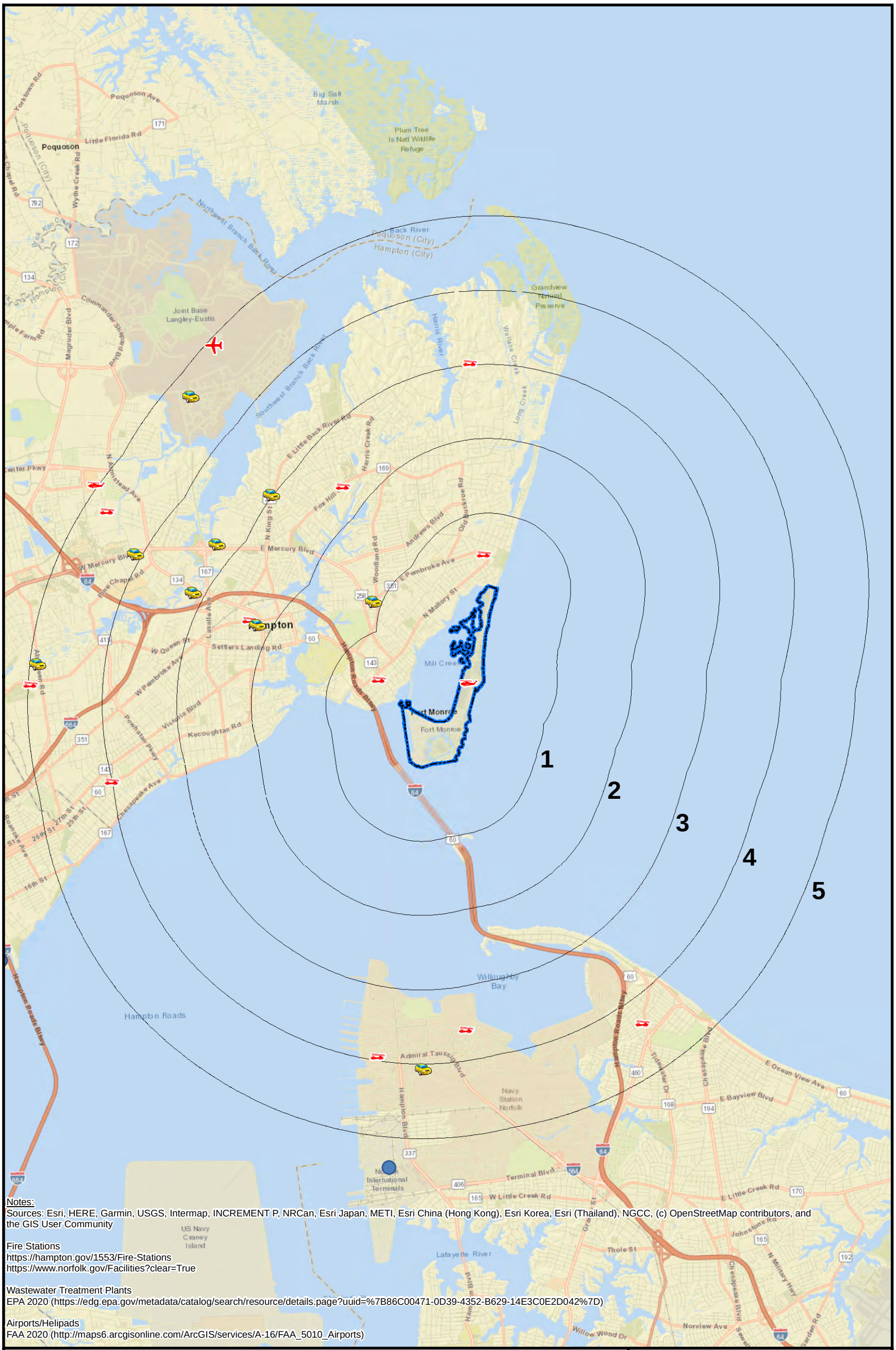
LAND USE MAP
FORT MONROE, VA

FIGURE 2-2 | DATE: 4/18/2023

C:\Users\woodleych\Documents\Work\BRAC PFAS\Fort Monroe\PA\Figure 2-2 FortMonroe_LandUse.mxd


Mill Creek
Fenwick Rd
DEH Compound
PES Compound
McNair Dr
Ingalls Rd
Area 200
Chesapeake Bay
Marina
Building 204/205
Hampton Roads
Legend
Installation Boundary
Buildings
Property Transferred to the Commonwealth of Virginia/FMA
Property FMA Transferred to NPS
Property not yet transferred
MOU prohibits groundwater use and consumption
Roads
Notes:
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Reference: 2016 Memorandum of Understanding (MOU) between VDEQ and FMA on Coordination for Prohibiting Groundwater Use and Fishing at Fort Monroe.
0
1,000
2,000
SCALE: 1" = 3,000'
VA STATE PLANE SOUTH (NAD83)
N
US Army Corps of Engineers
leidos
PARCEL TRANSFER MAP
FORT MONROE, VA
FIGURE 2-3
DATE: 8/17/2023
C:\Users\woodleych\Documents\Work\BRAC PFAS\Fort Monroe\PA\Figure 2-3 FortMonroe_Transferred_Property.mxd


Dog Beach Landfill
Fire Equipment Storage Building (Building 38)
Former Fire Training Pit
Walker Airfield
Former Building 206
Building 218
Building 81
Former Building 164
Former Building 97
Building 28
Former WWTP
Former Building 168
Area 200
Building 27
Former Building 178
Fire Station (Building 24)
Post Engineer Shops
Building 59
Marina
Building 57
Building 183
Building 204/205
Legend
Installation Boundary
Evaluated Sites
Notes:
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
0
1,000
2,000
SCALE: 1" = 3,000'
VA STATE PLANE SOUTH (NAD83)
US Army Corps of Engineers
leidos
EVALUATED SITES
FORT MONROE, VA
FIGURE 4-1
DATE: 5/25/2023
C:\Users\woodleych\Documents\Work\BRAC PFAS\Fort Monroe\PA\Figure 4-1 FortMonroe_Evaluated_Sites.mxd



Notes:
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

Fire Stations
https://hampton.gov/1553/Fire-Stations
https://www.norfolk.gov/Facilities?clear=True

Wastewater Treatment Plants
EPA 2020 (https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7B86C00471-0D39-4352-B629-14E3C0E2D042%7D)

Airports/Helipads
FAA 2020 (http://maps6.arcgisonline.com/ArcGIS/services/A-16/FAA_5010_Airports)

Legend
- Installation Boundary
- Wastewater Treatment Plants
- Airport
- Helipad
- FireStations
- Car Wash

0 4,000 8,000
SCALE: 1" = 3,000'

VA STATE PLANE SOUTH (NAD83)

US Army Corps of Engineers

leidos

POTENTIAL PFAS SOURCES WITHIN A 5-MILE RADIUS
FORT MONROE, VA

FIGURE 4-2 | DATE: 5/25/2023

C:\Users\woodleych\Documents\Work\BRAC PFAS\Fort Monroe\PA\Figure 4-2 FortMonroe_Offsite.mxd


Former Fire
Training Pit
Walker Airfield/
Former Building 206
Fire Station
(Building 24)
Marina
Legend
Installation Boundary
Areas of Potential Interest (AOPI)
Notes:
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
0
1,000
2,000
SCALE: 1" = 3,000'
VA STATE PLANE SOUTH
N
(NAD83)
US Army Corps
of Engineers
leidos
AOPI MAP
FORT MONROE, VA
FIGURE 5-1
DATE: 4/28/2023
C:\Users\woodleych\Documents\Work\BRAC PFAS\Fort Monroe\PA\Figure 5-1 FortMonroe_AOPIs.mxd