FINAL PRELIMINARY ASSESSMENT AND SITE INSPECTION OF PER- AND POLYFLUOROALKYL SUBSTANCES

Joint Base Myer-Henderson Hall, Virginia

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Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

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CONTENTS

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

The United States Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), at Army installations nationwide. The PA identifies areas of potential interest (AOPIs) where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred. The SI includes multi-media sampling at AOPIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. This Joint Base Myer-Henderson Hall (JBM-HH) PA/SI was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), National Oil and Hazardous Substances Pollution Contingency Plan, and Army/Department of Defense policy and guidance.

JBM-HH is a Joint Base of the U.S. military that was established by the Base Realignment and Closure process and is made up of Fort Myer, Fort McNair, and Henderson Hall. Fort McNair is in the southern region of Washington, D.C., where the Potomac and Anacostia rivers converge. Fort McNair, established in 1791, occupies approximately 112 acres), where it is home to the Military District of Washington and National Defense University. The population at JBM-HH is comprised of over 9,800 active-duty service men and women, 3,500 family members, and 1,000 civilians in the National Capital Region (Military OneSource 2021). Fort Myer is in Arlington, Virginia, in Arlington County in the northern most portion of the state. It resides directly west of the Potomac River and Washington, D.C. The installation occupies approximately 269 acres,which includes housing, support, and services to military personnel. It is bordered to the east by Arlington Cemetery, the west by the highly developed commercial and residential areas of Arlington, and to the south by Henderson Hall. Henderson Hall is a military installation of the U.S. Marine Corps (USMC) located on the southern edge of the Arlington National Cemetery and adjacent to Fort Myer. Henderson Hall occupies approximately 25.6 acres and is home to the USMC headquarters company unit and associated education facilities. Henderson Hall is not part of the PFAS PA/SI at JBM-HH and will not be discussed again in this document.

The JBM-HH PA identified four AOPIs for investigation during the SI phase. SI sampling results from the four AOPIs were compared to risk-based screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, and PFBS. PFOS, PFOA, and/or PFBS were detected in soil and/or groundwater at all four AOPIs; two of the four AOPIs had PFOS, PFOA, and/or PFBS present at concentrations greater than the risk-based screening levels. The JBM-HH PA/SI identified the need for further study in a CERCLA remedial investigation. **Table ES-1** below summarizes the PA/SI sampling results and provides recommendations for further study in a remedial investigation or no action at this time at each AOPI.

Table ES-1. Summary of AOPIs Identified during the PA, PFOS, PFOA, and PFBS Sampling at JBM-HH, and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NS)		Recommendation
	GW	SO	
Building 415 – Current JBM-HH Fire Station	Yes	No	Further study in remedial investigation
Building 237 – Former JBM-HH Fire Station	Yes	No	Further study in remedial investigation
Building 307 – Historical AFFF Storage Location	No	NS	No action at this time
Fort McNair Fire Apparatus Shelter	No	No	No action at this time

Notes:

Light gray shading – detection greater than the OSD risk screening level

GW – groundwater

NS – not sampled

SO – soil

1 INTRODUCTION

The United States (U.S.) Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), at Army installations (installations) nationwide. The Army is the lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Executive Order 12580 and is conducting the PA/SI consistent with its authority under CERCLA, 42 United States Code §§ 9600, et seq. (as amended), and the Defense Environmental Restoration Program, 10 United States Code §§ 2701, et seq. The PFAS PA/SI included two distinct efforts. The PA identified locations that are areas of potential interest (AOPIs) at Joint Base Myer-Henderson Hall (JBM-HH) based on the use, storage and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release has occurred, and the PFOS, PFOA, and PFBS results were compared to the Office of the Secretary of Defense (OSD) PFOS, PFOA, and PFBS risk screening levels to determine whether further investigation is warranted. This report provides the PA/SI for JBM-HH and was completed in accordance with CERCLA and The National Oil and Hazardous Substances Pollution Contingency Plan.

1.1 Project Background

PFAS are a class of compounds that have been used in a wide range of industrial applications and commercial products due to their unique surface tension/leveling properties. Due to industry and regulatory concerns about the potential health effects and adverse environmental impacts, there has been a reduction in the manufacture and use of PFAS worldwide. In the U.S., significant reductions in the production, importation, and use of PFOS and PFOA (two individual compounds in the PFAS class) occurred between 2001 and 2015 (Interstate Technology Regulatory Council 2017). PFBS replaced PFOS in some applications and is currently used and manufactured in the U.S.

In 2016, the United States Environmental Protection Agency (USEPA) established a lifetime health advisory of 70 nanograms per liter (ng/L) in drinking water for PFOS or PFOA and for the sum of PFOS and PFOA when both are present (USEPA 2016). On 15 October 2019, the OSD provided guidance on the investigation of PFOS, PFOA, and PFBS at Department of Defense (DoD) restoration sites (OSD 2019). The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in tap water and soil, calculated using the USEPA's Regional Screening Level (RSL) calculator for residential and industrial/commercial worker receptor scenarios. Following the issuance of the 2019 OSD memo, on 08 April 2021, USEPA published an updated toxicity assessment for PFBS (USEPA 2021). Based on the updated toxicity assessment for PFBS, the OSD issued a memorandum on 15 September 2021 to include updated PFBS risk screening levels (OSD 2021). The September 2021 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program is provided for reference as **Appendix A**. The OSD risk screening levels for tap water (also used to evaluate groundwater or surface water used as drinking water sources) are 40 ng/L for PFOS and PFOA, and 600 ng/L for PFBS. The PFOS and PFOA soil screening levels for the residential and industrial/commercial scenarios are 0.13 milligrams per kilogram (mg/kg) (residential) and 1.6 mg/kg (industrial/commercial).

The soil screening levels for PFBS are 1.9 mg/kg (residential) and 25 mg/kg (industrial/commercial). These screening criteria are discussed further in **Section 6.5**.

1.2 PA/SI Objectives

This PA/SI was conducted consecutively because the results of the PA yielded AOPIs that necessitated continuing onto the SI phase in accordance with CERCLA. Consequently, this report provides the combined objectives of both PA and SI reports.

1.2.1 PA Objectives

During the PA, investigators collect readily available information and conduct site reconnaissance. This PA will evaluate and document areas where PFAS-containing materials were used, stored, and/or disposed, so the Army can distinguish between sites that pose little or no threat to human health and the environment and sites that require further investigation.

1.2.2 SI Objectives

An SI is conducted when the PA determines an AOPI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at AOPIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required.

Installation-specific data quality objectives (DQOs) and the sampling design and rationale are summarized in **Sections 6.1** and **6.2**.

1.3 PA/SI Process Description

For JBM-HH, PA/SI development followed the process as described below. **Section 3** provides a summary of the PA activities completed, and **Section 6** provides a summary of the SI activities completed for JBM-HH. The PA and SI processes are documented in the PA/SI Quality Control Checklist included as **Appendix B**.

1.3.1 Pre-Site Visit

First, an installation kickoff teleconference was held between applicable points of contact (POCs) from United States Army Environmental Command (USAEC), United States Army Corps of Engineers (USACE), JBM-HH, and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred on 22 April 2020, 4 to 6 weeks before the site visit to discuss the goals and scope of the PA, project scheduling, installation access, timeline for the site visit, access to installation-specific databases, and to request available records.

Records review was conducted before the site visit to obtain electronically available documents from the installation and external sources for review. The purpose of the records research was to identify any area

on the installation that may have been a location where PFAS-containing materials were used, stored, and/or disposed, as well as to gather information on the physical setting and site history at JBM-HH.

A read-ahead package was prepared and submitted to the appropriate POCs 2 weeks before the site visit. The read-ahead package contains the following information:

- The Installation Management Command (IMCOM) operation order.
- The Army PA Operations Security requirements package, which includes the antiterrorism/operations security review cover sheet (**Appendix C**).
- The PFAS PA kickoff call minutes.
- An information paper on the PA portion of the Army's PFAS PA/SI.
- Contact information for key POCs.
- A list of the data sources requested and reviewed.
- A list of preliminary locations identified during the kickoff call and pre-site visit records review to be evaluated for use, storage, and/or disposal of PFAS-containing materials, where additional information on those areas will be collected through personnel interviews, additional document review, and site reconnaissance.
- A list of roles for the installation POC to consider when recommending potential interviewees.

1.3.2 Preliminary Assessment Site Visit

The site visit was conducted on 28 August 2020. An in-brief meeting was held to provide installation staff with the objectives of the site visit and team introductions. **Section 3** includes information regarding personnel interviewed.

Personnel interviews were conducted with individuals having significant historical knowledge at JBM-HH. The interviews focused on confirming information discussed in historical documents, collecting information that may have not been in historical documents, corroborating other interviewees' information.

Site reconnaissance included visual surveys that assessed the points of potential use, storage, and/or disposal of PFAS-containing materials, as well as potential secondary impacts, and the migration potential from each AOPI (e.g., stormwater drains, building drains and sumps, cracks in the floor/pavement). Physical attributes of the preliminary locations were documented, including local slope and ground and floor conditions (i.e., paved, unpaved, visual staining), surface water bodies and surface flow, potential receptors, and the distance to the installation boundary. Access to existing groundwater monitoring wells, if present, were also noted during the site reconnaissance in case the monitoring wells could be proposed for SI sampling. Photo documentation of the preliminary locations was collected, and access limitations or advantages related to potential future sampling activities were noted.

An exit briefing was offered to installation personnel at the conclusion of the site visit to raise any items identified during the site visit, discuss any follow-up items, and review the schedule for submitting deliverables. The exit briefing was conducted via telephone with the JBM-HH Directorate of Public Works Environmental Chief on 28 August 2020 to discuss preliminary findings of the PA site visit.

1.3.3 Post-Site Visit

Information collected before, during, and after the PA site visit was reviewed and corroborated by cross-referencing records and reviewing interview details and observations noted during site visit reconnaissance. A site visit trip report was completed and provided to the installation POC, applicable USAEC POCs, and USACE regional POCs following the site visit. The information collected during the pre-site visit and site visit activities was compiled to develop the installation-specific PA portion of the PA/SI report (**Section 3**). Site data obtained during the PA were used to develop preliminary conceptual site models (CSMs) for each AOPI, which serve as the basis for developing the SI scope of work presented in an installation-specific Quality Assurance Project Plan (QAPP) Addendum.

1.3.4 Site Inspection Planning and Field Work

The SI process was initiated at the installation to evaluate PFOS, PFOA, and PFBS presence or absence at each AOPI and determine whether further investigation is warranted. First, an SI kickoff teleconference was held between the Army PA team and the JBM-HH.

The objectives of the SI kickoff teleconference were to:

- discuss the AOPIs selected for sampling and the proposed sampling plan for each AOPI.
- gauge regulatory involvement requirements or preferences.
- identify overlapping unexploded ordnance or cultural resource areas.
- identify specific installation access requirements and potential schedule conflicts.
- discuss general SI deliverable and field work schedule information and logistics.

Following development of the SI sampling technical approach, an SI scoping teleconference was held to obtain concurrence on the SI sampling plan from USAEC, USACE, and the installation. Additional discussion topics included:

- confirm the plan for investigation-derived waste (IDW) handling and disposal.
- confirm specific installation access requirements and potential schedule conflicts.
- provide an updated SI deliverable and field work schedule.

A Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP) was developed and finalized in October 2019 for the USAEC PFAS PA/SI (Arcadis 2019). The PQAPP details general planning processes for collecting data and describes the implementation of quality assurance (QA) and quality control (QC) activities for the SI portion for Army installations nationwide. Additionally, an installation-specific QAPP Addendum was developed to define the DQOs, present the sampling design and rationale, and provide qualifications for project personnel. The SI field work was completed in accordance with the PQAPP (Arcadis 2019) and the approved installation-specific QAPP Addendum. A Site Safety and Health Plan (SSHP) was also developed as an attachment to the QAPP Addendum to identify specific health and safety hazards that may be encountered at the installation during sampling. The SSHP was designed to supplement the Accident Prevention Plan (Arcadis 2018), which was developed for Army installations nationwide. The QAPP Addendum and SSHP were submitted to the installation and finalized before commencement of field work.

The DQOs, sampling design and rationale, and field methods employed for the SI are summarized from the QAPP Addendum developed for JBM-HH (Arcadis 2021) in **Sections 6.1** through **6.3**.

After finalization of the QAPP Addendum and SSHP, field planning and coordination with the installation and subcontractors was completed. Once the schedule was determined, field teams mobilized to the installation to complete the scope of work defined in the QAPP Addendum.

1.3.5 Data Analysis, Validation, and Reporting

Environmental samples collected during the SI were submitted to a laboratory which is DoD Environmental Laboratory Accreditation Program (ELAP)-accredited for PFOS, PFOA, and PFBS analysis by liquid chromatography with tandem mass spectrometry and compliant with the DoD Quality Systems Manual (QSM) 5.3 (DoD and Department of Energy 2019). Laboratory analytical results were then validated and verified by a project chemist to assess the usability of the data collected. Validated analytical results were summarized in the context of OSD risk screening levels (defined in **Section 6.5**).

2 INSTALLATION OVERVIEW FOR JOINT BASE MYER – HENDERSON HALL

2.1 Installation Overview for Fort Myer

The following subsections provide general information about Fort Myer, including the location and layout, the installation mission(s) over time, a brief site history, current and projected land use, climate, topography, geology, hydrogeology, surface water hydrology, potable wells within a 5-mile radius of the installation, and applicable ecological receptors.

2.1.1 Site Location

Fort Myer is part of JBM-HH, a Joint Base of the U.S, military that was established by the Base Realignment and Closure process and is made up of Fort McNair and Fort Myer, which are both operated by the U.S. Army, and Henderson Hall, which is operated by the USMC (**Figure 2-1**). Henderson Hall is not part of the scope-of-work for this PFAS PA/SI.

Fort Myer is in Arlington, Virginia, in Arlington County in the northern most portion of the state. It resides directly west of the Potomac River and Washington, District of Columbia (D.C.) (**Figure 2-2**). The installation occupies approximately 269 acres (USACE 2015), which includes housing, support, and services to military personnel. It is bordered to the east by Arlington Cemetery, the west by the highly developed commercial and residential areas of Arlington, and to the south by Henderson Hall. Henderson Hall is a military installation of the USMC located on the southern edge of the Arlington National Cemetery and adjacent to Fort Myer. Henderson Hall occupies approximately 25.6 acres (JBM-HH 2011) and is home to the USMC headquarters company unit and associated education facilities.

2.1.2 Mission and Brief Site History

Fort Myer, previously known as Fort Cass and Fort Whipple, served as a calvary post starting in 1861, and became Fort Myer in 1881. By 1909, most of the present-day historic district of Fort Myer had been built. At the beginning of the U.S. involvement in World War II, the Cavalry was mechanized, and the post served as a processing station and housing for defense troops, which were stationed at Fort Myer to protect the nation's capital. The installation houses several organizations that provide base operations support for the U.S. Army and DoD. The population of JBM-HH is comprised of over 9,800 active-duty service men and women, 3,500 family members, and 1,000 civilians in the National Capital Region (Military OneSource 2021).

2.1.3 Current and Projected Land Use

The area around Fort Myer is fully developed. Land uses near Fort Myer include transportation (interstate, major thoroughfares, and surface streets), residential (low density, medium density, and high density), commercial properties (general commercial, offices, and hotels), government installations (the Pentagon and Ronald Reagan-Washington National Airport), and parks and open space (Alliance Consulting Group [Alliance] 2018).

2.1.4 Climate

Fort Myer is in a humid continental area within the southern temperate region. Temperatures range from below freezing to 90 degrees Fahrenheit (°F). Mean daily temperatures are 79°F in July to 35°F in January. The average annual precipitation is 40 inches, with summer constituting 30 percent (%) of annual rainfall. Minimum rainfall occurs during January when monthly averages are approximately 2 inches (Weather Spark 2021).

2.1.5 Topography

The topography of Fort Myer consists of mostly flat terrain. Elevations range from a low of approximately 100 feet above mean sea level (amsl) to a high of approximately 240 feet amsl (**Figure 2-3)**. Fort Myer resides within the Rock Creek subwatershed, a subwatershed of the Potomac River Watershed, which drains to the Potomac River (Alliance 2018).

2.1.6 Geology

The regional geology of Fort Myer consists of river-terrace deposits of Pleistocene Age and coastal plain deposits of Cretaceous age (Patapsco, Arundel, and Patuxent Formations). The soils located in the Patuxent Formation are likely 40 feet or less thick based upon the location of the bedrock outcrop. The Patuxent Formation generally consists of pink, red and gray clay with interbedded irregular sand lenses that grade into clay lenses. Basal sections generally consist of gravel, sand, and arkose in some places. Atlantic Coastal Plain deposits are highly erratic, and lenticular and lithology may differ significantly within a few feet. The Patapsco, Arundel, and Patuxent Formations lie unconformably on the Sykesville Formation (Basement Rocks) of undetermined age. The Sykesville Formation outcrops approximately 700 feet to the southeast of the site according to The Geologic Map of Washington, D.C. and Vicinity (CDM Smith 2011).

2.1.7 Hydrogeology

Groundwater at Fort Myer is typically encountered at a depth of approximately 40-feet below ground surface (bgs), thereby providing an average aquifer thickness of 40 to 50 feet at the site. The regional groundwater flow direction is typically east, with an estimated hydraulic conductivity of 15 feet per day (USACE 1993); however, water level measurements from the surficial aquifer indicate a southerly flow direction in shallow groundwater (CDM Smith 2012). Clay lenses within the surficial aquifer are considered to be discontinuous at the site.

2.1.8 Surface Water Hydrology

There are no surface water bodies on-post at Fort Myer. Stormwater from the installation ultimately discharges to the Potomac River, which is the nearest open water body and is located approximately 0.9 mile to the east of the installation.

2.1.9 Relevant Utility Infrastructure

The following subsections provide general information regarding the installation's stormwater and wastewater management systems, as well as information on how the utility infrastructures may influence the fate and transport of PFAS constituents at JBM-HH.

2.1.9.1 Stormwater Management System Description

Stormwater from Fort Myer discharges from the installation to the east via an unnamed intermittent stream that flows through Arlington Cemetery and ultimately discharges to the Potomac River via Boundary Channel, north through Arlington County storm drains within the Rocky Run watershed (and ultimately to the Potomac River), or west and south through Arlington County storm drains to Lower Long Branch Creek, which is a tributary to Four-Mile Run and the Potomac River (USACE 2015).

2.1.9.2 Sewer System Description

Municipal sewage service is provided by Arlington County. The primary sanitary sewer service line is the Potomac Interceptor line, a 42-inch sanitary sewer line that generally follows the alignment of Eisenhower Drive. The Potomac Interceptor line connects with a 54-inch county main that extends along Joyce Street. Effluent is treated at the Arlington County Sewage Treatment Plant south of the Pentagon (Alliance 2018).

2.1.10 Potable Water Supply and Drinking Water Receptors

An Environmental Data Resources, Inc. (EDR) report includes search results from a variety of environmental, state, city, and other publicly available databases for a referenced property. An EDR report was generated for JBM-HH and identified five off-post public wells within 5 miles of the installation boundary. Following receipt of the EDR report, the report was reviewed for accuracy and it was determined that the five identified wells were either abandoned or nonexistent; therefore, no potable supply wells were identified within 5 miles of the installation boundary. The EDR report that includes the provided well search results is included as **Appendix E**.

Potable water for Fort Myer and the surrounding area is supplied by Arlington County. Arlington County receives its drinking water from the USACE operated Dalecarlia and McMillian Water Treatment Plants (WTPs), which collect and treat water from the Great Falls Intake and Little Falls Intake located along the Potomac River. Both intakes are located up-river of Fort Myer.

2.1.11 Ecological Receptors

The PA team collected information regarding ecological receptors that was available in the installation documents. The following information is provided for future reference should the Army decide to evaluate exposure pathways relevant to the ecological receptors.

The Arlington House Woodlands, located near Fort Myer, occupy approximately 12 acres situated along a ravine adjacent to Arlington House. The ravine forest consists of canopy species, including oaks, hickories, tulip tree, and American beech. Common understory species include fringetree, witch-hazel, pinxter azalea, black haw, and maple-leaved viburnum. No regionally unique ecological communities or

rare plant species have been identified at Fort Myer. Twenty-eight species are classified as invasive by The Virginia Department of Conservation and Recreation, including one landscape plant (tree-of-heaven) and two lawn weeds (Canada thistle and Johnson grass), which are considered highly invasive.

Wildlife that may occur at Fort Myer include species that can accommodate to urban development. Mammals that have been observed, or that would be expected to occur, include raccoon, opossum, white-tailed deer, eastern cottontail, gray squirrel, eastern chipmunk, and red fox. Birds that would be expected to occur include blue jay, red-winged blackbird, American robin, eastern bluebird, and red-tailed hawk. The U.S. Fish and Wildlife Service Information for Planning and Consultation website database identifies 24 migratory birds that could occur at or near Fort Myer, including one year-round resident (bald eagle), three winter residents (rusty blackbird, red-throated loon, and snowy owl), 13 summer breeding residents (black-billed cuckoo, bobolink, Canada warbler, cerulean warbler, eastern whip-poor-will, golden-winged warbler, Kentucky warbler, least tern, Prairie warbler, Prothonotary warbler, red-headed woodpecker, willett, and wood thrush), and seven species that occur only as migrants (dunlin, golden eagle, lesser yellowlegs, ruddy turnstone, semi-palmated sandpiper, short-billed dowatcher, and Whimbrel) (Alliance 2018).

There are several introduced insect species that can greatly damage ornamental landscape trees and shrubs. Many of these, such as the European elm bark beetle, Hemlock Wooly Adelgid, and gypsy moth, have had established populations for many decades and are closely monitored as their population spread.

2.1.12 Previous PFAS Investigations

No previous PFAS Investigations have been conducted at the installation. As detailed in Section 2.1.10, potable water for Fort Myer is supplied by Arlington County. Arlington County receives its drinking water from the USACE operated Dalecarlia and McMillian WTPs. Under the Third Unregulated Contaminant Monitoring Rule (UCMR3), four surface water samples were collected from the Dalecarlia WTP surface water intake in 2014 (January, April, July, and October). The collected samples were analyzed for PFOA and PFOS (minimal reportable level: 20, and 40 ng/L respectively). PFOA and PFOS were not detected in any of the surface water intake samples collected.

2.2 Installation Overview for Fort McNair

2.2.1 Site Location

JBM-HH is a Joint Base of the U.S. military made up of Fort Myer, Fort McNair, and Henderson Hall (**Figure 2-1**). Fort McNair is in the southern region of Washington, D.C., where the Potomac and Anacostia rivers converge (**Figure 2-4**). Fort McNair, established in 1791, occupies approximately 112 acres (JBM-HH 2017), where it is home to the U.S. Army Military District of Washington (MDW) and National Defense University (NDU).

2.2.2 Mission and Brief Site History

Fort McNair is a post of the Fort Myer Military Community, under the command of the MDW. MDW headquarters and operations are located at Fort McNair. Fort McNair provides facilities, community

support, and safety and security services to assigned personnel and several tenant organizations. One of the tenant organizations located at Fort McNair is the NDU. The NDU is an information age university for national security leaders and a learning organization for military and civilian leaders (STV Incorporated 2003).

2.2.3 Current and Projected Land Use

Land uses at Fort McNair include administration, community facilities, housing, medical, recreation, training, and service storage. Land uses surrounding Fort McNair include residential, commercial, and industrial developments. Prominent features are the U.S. Coast Guard facility, and Potomac Electric Power Company Buzzard Point Generating Plant, and Syphax Gardens (low-income residential housing) (STV Incorporated 2003).

2.2.4 Climate

Fort McNair is in a humid continental area within the southern temperate region. Temperatures range from below freezing to 90 °F. Mean daily temperatures are 79°F in July to 35°F in January. The average annual precipitation is 40 inches, with summer constituting 30% of annual rainfall. Minimum rainfall occurs during January when monthly averages are approximately 2 inches (Weather Spark 2021).

2.2.5 Topography

The topography of Fort McNair consists of mostly flat terrain, sloping southeast toward the Anacostia River. Elevations range from a low of approximately 0.0 feet amsl to a high of approximately 20 feet amsl (**Figure 2-5)**. Fort McNair resides within the Rock Creek – Potomac River and Anacostia River Watersheds.

2.2.6 Geology

The regional geology at Fort McNair consists of alluvial and coastal plain deposits of Pleistocene and Recent age. Sediments found at the installation are from the Pamlico Formation and from Recent alluvium. The Pamlico Formation and alluvium consists of fine to coarse grained sand and gravel which is commonly clayey. The sands and gravels are interbedded with silts and clays. The sediment color is tan to rusty orange. The Pamlico Formation is entirely fluvial and estuarine in the Washington, D.C. area. The formation probably does not exceed 30 feet in thickness (Engineering Technologies Associates, Inc. 1994).

2.2.7 Hydrogeology

Regional groundwater at Fort McNair is typically encountered at a depth of approximately 10-feet below grade in the Columbia Aquifer. The regional groundwater flow direction is typically east due to the presence of the Anacostia River, with an estimated hydraulic conductivity ranging from 0.0007 to 3.7 feet per day. The Columbia Aquifer is defined as predominately sandy surficial deposits above the Yorktown confining beds of Pliocene Age. The sediments of the Columbia Aquifer are of Pleistocene and Holocene age. The aquifer is generally unconfined but locally can be present in confined or semi-confined

conditions. The aquifer consists of sediments that are a result of marine transgressions with a fining upwards depositional sequence (Engineering Technologies Associates, Inc. 1994).

2.2.8 Surface Water Hydrology

Surface water at Fort McNair drains from the Rock Creek – Potomac River and Anacostia River Watersheds to the Potomac River and the Lower Anacostia River. All stormwater discharges off-post via stormwater outfalls directly south into the Potomac River.

2.2.9 Relevant Utility Infrastructure

The following subsections provide general information regarding the installation's stormwater and wastewater management systems, as well as information on how the utility infrastructures may influence the fate and transport of PFAS constituents at Fort McNair.

2.2.9.1 Stormwater Management System Description

Stormwater from Fort McNair ultimately discharges off-post to the Potomac River, which directly borders the southern edge of the installation. Storm water is collected via storm water inlets and routed southward, discharging to the Potomac River.

2.2.9.2 Sewer System Description

Wastewater collection consists of a sewer collection system, the treatment of which is performed off-site. The wastewater collection system is made of manholes and gravity fed piping. Wastewater generated is gravity-fed to the District of Columbia's collection lines and transported and treated at the District of Columbia Blue Plains Sewage Treatment Plant (STV Incorporated 2003).

2.2.10 Potable Water Supply and Drinking Water Receptors

An EDR report includes search results from a variety of environmental, state, city, and other publicly available databases for a referenced property. As discussed in Section 2.1.10, the EDR report generated for JBM-HH identified five off-post public wells within 5 miles of the installation boundary. Following receipt of the EDR report, the report was reviewed for accuracy and it was determined that the five identified wells were either abandoned or nonexistent; therefore, no potable supply wells were identified within 5 miles of the installation boundary. The EDR report that includes the provided well search results is included as **Appendix E**.

Drinking water is not supplied by surface water located on post. Potable water for Fort McNair is supplied by D.C. Water. D.C. Water also receives water from the Dalecarlia WTP located along the Potomac River approximately 5-miles upriver of Fort McNair.

2.2.11 Ecological Receptors

The PA team collected information regarding ecological receptors that was available in the installation documents. The following information is provided for future reference should the Army decide to evaluate exposure pathways relevant to the ecological receptors.

Fort McNair consists of existing structures and parking lots, with scattered ornamental landscaping. Vegetation consists of a fallow field with scattered trees. Dominant trees included Tree-of-Heaven, red maple, and black cherry.

Wildlife within Fort McNair is restricted due to the limited amount of vegetation. However, the proximity of the Washington Channel of the Potomac River and the Anacostia River encouraged several species of birds to use the area for nesting. Wildlife observed at the site includes starlings, sparrows, pigeons, Canada Geese, sea gulls, red tailed hawks, great blue herons, and squirrels. Other species likely to exist at the site include various rodents such as chipmunks, white footed mice, and rats, and various songbirds such as robins, mockingbirds, and mourning doves. Information received from the U.S. Fish and Wildlife Service did not indicate a concern for migratory birds in the area. However, the Krestel Falcon is known to migrate to the area in winter.

2.2.12 Previous PFAS Investigations

No previous PFAS Investigations have been conducted at the installation. As detailed in Section 2.2.10, potable water for Fort McNair is supplied by D.C. Water, which receives water from the Dalecarlia WTP located along the Potomac River approximately 5-miles upriver of Fort McNair. Under the Third Unregulated Contaminant Monitoring Rule, four surface water samples were collected from the Dalecarlia WTP surface water intake in 2014 (January, April, July, and October). The collected samples were analyzed for PFOA and PFOS (minimal reportable level: 20, and 40 ng/L respectively). PFOA and PFOS were not detected in any of the surface water intake samples collected.

3 SUMMARY OF PA ACTIVITIES

To document areas where any potential current and/or historical PFAS-containing materials were used, stored and/or disposed at JBM-HH, data were collected from three principal sources of information and are described in the subsections below:

1. Records review
2. Personnel interviews
3. Site reconnaissance

Preliminary locations of potential use, storage, and/or disposal of PFAS-containing materials were then evaluated in the PA (during records review, personnel interviews, and/or site reconnaissance) and were categorized as AOPIs or as areas not retained for further investigation at this time based on a combination of information collected (e.g., records reviewed, personnel interviews, internet searches). A summary of the observations made, and data collected through records reviews (**Appendix F**), installation personnel interviews (**Appendix G**), and site reconnaissance logs (**Appendix H**) during the PA process for JBM-HH is presented in **Section 4**. Further discussion regarding rationale for not retaining areas for further investigation is presented in **Section 5.1**, and further discussion regarding categorizing areas as AOPIs is presented in **Section 5.2**.

3.1 Records Review

The records reviewed for this PA included, but were not limited to, various Installation Restoration Program (IRP) administrative record documents, compliance documents, JBM-HH fire department documents, JBM-HH directorate of public works documents, and geographic information system files. Internet searches were also conducted to identify publicly available and other relevant information. A list of the specific documents reviewed for JBM-HH is provided in **Appendix F**.

3.2 Personnel Interviews

Due to COVID-19 protocols in place at the installation, interviews were conducted via telephone prior to the site visit. The list of roles for the installation personnel interviewed during the PA process for JBM-HH is presented below (affiliation is with JBM-HH unless otherwise noted).

- Fire Chief
- Retired Assistant Fire Chief
- Retired Fire Chief
- Retired Hazardous Waste Manager
- Environmental Protection Specialist
- Environmental Management Division Directorate of Public Works Chief

The compiled interview logs are provided in **Appendix G**.

3.3 Site Reconnaissance

Site reconnaissance and visual surveys were conducted at Fort Myer and Fort McNair on 28 August 2020. The site reconnaissance logs are provided in **Appendix H**.

Access to existing groundwater monitoring wells, if present, were also noted during the site reconnaissance in case the monitoring wells could be proposed for SI sampling.

4 POTENTIAL PFAS USE, STORAGE, AND/OR DISPOSAL AREAS

JBM-HH was evaluated for all potential current and historical use, storage, and/or disposal of PFAS-containing materials. There are a variety of PFAS-containing materials 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 prevalent potential source of PFAS chemicals at DoD facilities. As such, this section is organized to summarize the AFFF-related uses first, and all remaining potential PFAS-containing materials in the subsequent section.

4.1 Fort Myer

4.1.1 AFFF Use, Storage, and Disposal Areas

AFFF was developed in the mid-1960s in response to a need for firefighting foams better suited to extinguish Class B, fuel-based fires. AFFF formulations consist of water, an organic solvent, up to 5% hydrocarbon surfactants, and 1 to 3% PFAS (Interstate Technology Regulatory Council 2020). AFFF concentrate is designed to be diluted with water to become a 1, 3, or 6% foam. AFFF releases at DoD facilities may have occurred during firefighter training, emergency response actions, equipment testing, or accidental releases. The military still primarily uses AFFF for Class B fires; however, the current formulations of AFFF contain significantly lower amounts of PFOS, PFOA, and their precursors, and significant operational changes have been implemented to restrict uncontrolled releases and non-essential use of PFAS-containing foams. Army installations may still house AFFF, commonly stored in closed containers (e.g., 55-gallon drums, 5-gallon buckets), within designated storage buildings or at firehouses.

According to Fort Myer's Fire Chief interviewed during the site visit, the current JBM-HH Fire Station (Building 415) housed two vehicles stocked with AFFF foam. The Fire Chief also stated that a number of empty 5-gallon pails were stored at the end of the Fire Station and were used to transfer AFFF concentrate into and out of the fire trucks. The Fire Chief also stated that a vendor occasionally came to this location to test AFFF apparatuses for compliance and effectiveness, though they had no recollection of foam being released during these testing exercises. This procedure was reportedly halted in 2015 or 2016. In addition, the Pentagon Helipad Aircraft Rescue and Firefighting (ARFF) truck was occasionally housed at this location. Morning testing of the ARFF unit was conducted each morning regardless of parking location. Daily testing would include flowing 50 gallons of water from the ARFF unit. Testing would also include opening and closing of AFFF tank valves. During an interview with the Fire Chief, it was noted that small amounts of AFFF could potentially have entered the flow line due to these valve testing exercises. A retired JBM-HH Fire Chief recalled occasional foaming of water during these tests.

Two vehicles stocked with AFFF foam were reportedly stored at the Former JBM-HH Fire Station (Building 237) per the interviewed Fire Chief. Per an email from the Assistant Fire Chief received during the records review process, AFFF for the out-of-service Pentagon Helipad ARFF Unit was stored at this location around April 2020. The AFFF has since moved back to the Pentagon Helipad located north of the

Pentagon. Parking and testing of the Pentagon Helipad ARFF unit similar to what occurred at the current JBM-HH Fire Station also reportedly occurred at the Former Fire Station.

An interview with a retired JBM-HH Assistant Fire Chief stated that Building 307 was used as a storage space for Fire Department equipment and materials from the mid-2000s to 2015. AFFF was reportedly stored at this location before being disposed of through the JBM-HH Hazardous Waste Program in 2015.

Following the review of available records and interviews with retired and active installation personnel, no dedicated fire-training areas were identified at Fort Myer.

4.1.2 Other PFAS Use, Storage, and/or Disposal Areas

Following document research, personnel interviews, and site reconnaissance at Fort Myer, former laundry and dry-cleaning facilities, a former motor pool area, a vehicle wash rack, and former burn pits were also identified as preliminary locations for use, storage, and/or disposal of PFAS-containing materials. A summary of information gathered in the PA for each of these preliminary locations is described below. Specific discussion regarding areas not retained for further investigation is presented in **Section 5.1.1** and specific discussion regarding areas retained as AOPIs is presented in **Section 5.2**.1.

Dry-Cleaning and Laundry Facilities

A former laundry facility (Building 448) and a dry-cleaning plant (Building 443) were identified at Fort Myer as preliminary locations for use, storage, and/or disposal of PFAS containing materials. In addition to laundry activities, Building 448 housed a paint shop, carpenter shop, upholstery repairs, tailor shop, and shoe and typewriter repair facilities. Laundry operations were discontinued in the building in 1982 and the building was subsequently dedicated to general purpose storage. Dry cleaning operations took place at Building 443 between 1932 and 1990, when it was demolished. Dry cleaning solvents were stored in underground storage tanks throughout the operation period. The principal solvent used at the facility was perchloroethylene.

Motor Pool and Vehicle Washing Areas

A former motor pool area (Tanks 10 to 15) and the Building 209 vehicle wash rack were also identified as preliminary locations for the use, storage, and/or disposal of PFAS containing materials due to the potential washing of AFFF capable fire vehicles at both locations. Historical investigations at the Building 209 vehicle wash rack indicated that detergents were used for vehicle washing operations. The wash rack was also equipped with a sand trap for removal of sediment, oil, and grease. An interviewed JBM-HH Fire Chief confirmed that wash racks at Fort McNair were not used to clean AFFF capable fire vehicles at the installation.

Burn Pits

Two historical burn pits located at Fort Myer were operated between 1930 and 1965. These burn pits were used to incinerate wastes not disposed of in the historical Fort Myer landfill. Previous investigations at these burn pits identified soils that had been impacted by polychlorinated biphenyls, volatile organic compounds, semivolatile compounds, petroleum hydrocarbons, and metals.

During a telephonic interview with the IMCOM Pest Management Consultant, it was noted that products containing Sulfluramid (i.e., associated with insecticides) may have contained PFAS and were phased out

in 1996. During the PA records review, the IMCOM Pest Management Consultant provided records of potentially PFAS-containing pesticides and insecticides used at and/or stored at Army installations and did not identify JBM-HH as an installation having used or stored PFAS-containing pesticides/insecticides. Additionally, the PA team reviewed available pesticide use inventory documentation provided by the installation and did not identify PFAS-containing pesticides use, storage, or disposal.

4.1.3 Readily Identifiable Off-Post PFAS Sources

An exhaustive search to identify all potential off-post PFAS sources (i.e., not related to operations at Fort Myer) is not part of the PA/SI. However, potential off-post PFAS sources within a 5-mile radius of the installation that were identified during the records search and site visit are described below.

Nearby off-post areas, such as the Pentagon Helipad and the Pentagon (West Site) could potentially be off-post PFAS sources within close proximity of Fort Myer.

Fort Myer has tasking through the MDW to provide fire and emergency services to the Pentagon. AFFF and ARFF vehicles owned and operated by the Fort Myer Fire Department are stored and manned at a fire apparatus shelter next to the Pentagon Helipad located north of the Pentagon and along South Washington Boulevard.

AFFF was released as part of fire response to the 11 September 2001 Pentagon attack. The Fort Myer Fire Department operated ARFF unit was destroyed during Pentagon fire-rescue operations. All AFFF stored within the ARFF unit was reportedly discharged to the ground-surface. AFFF was also released onto and around the western wall of the Pentagon by multiple responding fire departments.

4.2 Fort McNair

4.2.1 AFFF Use, Storage, and Disposal Areas

An interviewed JBM-HH Fire Chief stated that AFFF tank filling may have occurred at the Fort McNair Fire Apparatus Shelter installed atop an old basketball court at Fort McNair. Fire Engine 46 has been stored at this location along with 25 gallons of AFFF. The Fire Chief recalled that the Engine 46 truck was sent off-post to the Delmarva Pump Center located in Marydel, Delaware for repairs to the AFFF pump-system. Prior to leaving Fort McNair, the AFFF was emptied into containers and stored at the Fire Apparatus Shelter. Following repairs, the truck was taken back to the Fire Apparatus Shelter and filled with the same AFFF.

4.2.2 Other PFAS Use, Storage, and/or Disposal Areas

Following document research, personnel interviews, and site reconnaissance at Fort McNair, photo laboratories and vehicle wash racks were also identified as preliminary locations for use, storage, and/or disposal of PFAS-containing materials. A summary of information gathered in the PA for each of these preliminary locations is described below. Specific discussion regarding areas not retained for further investigation is presented in **Section 5.1** and specific discussion regarding areas retained as AOPIs is presented in **Section 5.2**.

Photo Laboratories

Records review and personnel interviews identified two photo-processing operation centers as preliminary locations for the use, storage, and/or disposal of PFAS containing materials at Fort McNair: Building 45 – Photo Hobby Laboratory and the Building 52 – Former Inter American Defense College Photo Laboratory. A retired JBM-HH Hazardous Waste Program Manager stated that photo-processing operations conducted at the locations were small scale, and review of historical investigations at the two sites did not identify any releases of photo-processing chemicals to the surrounding environment.

Vehicle wash racks

Two vehicle wash rack locations, the Building 37 Wash Rack and the PX Motor Shop Wash Rack, were identified as preliminary locations for the use, storage, and/or disposal of PFAS containing materials due to the potential washing of AFFF capable fire vehicles at both locations. An interviewed JBM-HH Fire Chief confirmed that wash racks at Fort McNair were not used to clean AFFF capable fire vehicles at the installation.

Pesticides and Insecticides

During a telephonic interview with the IMCOM Pest Management Consultant, it was noted that products containing Sulfluramid (i.e., associated with insecticides) may have contained PFAS and were phased out in 1996. During the PA records review, the IMCOM Pest Management Consultant provided records of potentially PFAS-containing pesticides and insecticides used at and/or stored at Army installations and did not identify JBM-HH as an installation having used or stored PFAS-containing pesticides/insecticides.

4.2.3 Readily Identifiable Off-Post PFAS Sources

An exhaustive search to identify all potential off-post PFAS sources (i.e., not related to operations at Fort McNair) is not part of the PA/SI. However, potential off-post PFAS sources within a 5-mile radius of the installation that were identified during the records search and PA site visit are described below.

AFFF was released as part of fire response to the 11 September 2001 Pentagon attack. The Fort Myer Fire Department operated ARFF unit was destroyed during Pentagon fire-rescue operations. All AFFF stored within the ARFF unit was reportedly discharged to the ground-surface. AFFF was also released onto and around the western wall of the Pentagon by multiple responding fire departments.

5 SUMMARY AND DISCUSSION OF PA RESULTS

The preliminary locations evaluated for potential use, storage, and/or disposal of PFAS-containing materials at JBM-HH, were further refined during the PA process and identified either as an area not retained for further investigation or as an AOPI. In accordance with the established process for the PA/SI, four areas have been identified as AOPIs. The process used for refining these areas is presented on **Figure 5-1**, below.

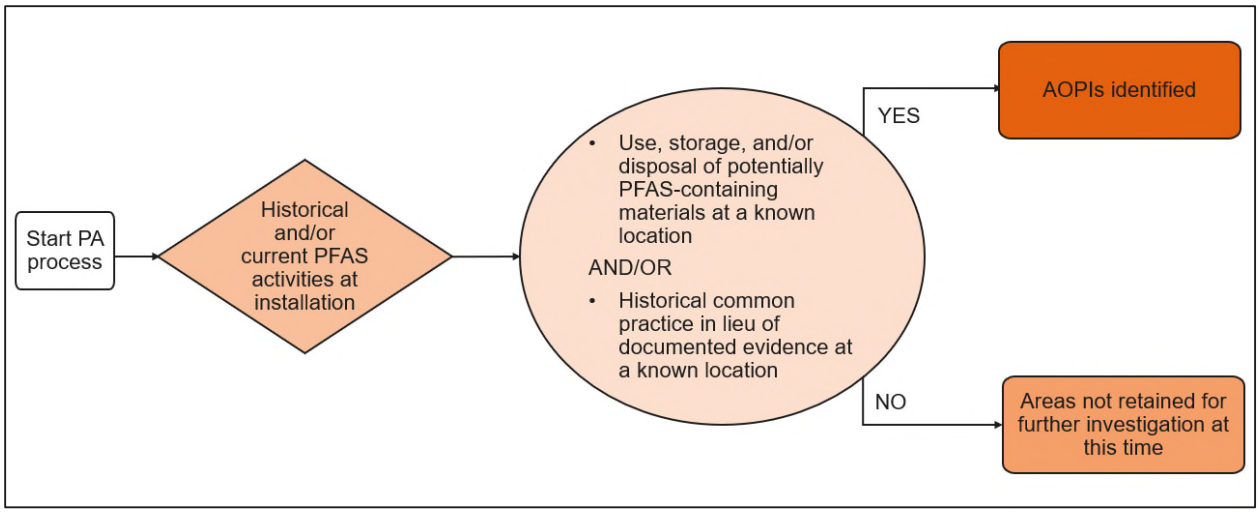

Figure 5-1: AOPI Decision Flowchart

The areas not retained for further investigation are presented in **Section 5.1.1** (Fort Myer) and **Section 5.2.1** (Fort McNair). The areas retained as AOPIs are presented in **Section 5.1.2** (Fort Myer) and **Section 5.2.2** (Fort McNair).

Data limitations for this PA/SI at JBM-HH are presented in **Section 8**.

5.1 Fort Myer

5.1.1 Areas Not Retained for Further Investigation at Fort Myer

Through the evaluation of information obtained during records review, personnel interviews, and/or site reconnaissance, the Fort Myer areas described below were categorized as areas not retained for further investigation at this time.

A brief site history and rationale for areas not retained for further investigation are presented in **Table 5-1**, below.

Table 5-1. Installation Areas Not Retained for Further Investigation at Fort Myer

Area Description	Dates of Operation	Relevant Site History	Rationale
Former Burn Pits	1930s to 1965	Two burn pits were located within the vicinity of the Former Landfill that operated from the1930s to 1965. Previous investigations identified that soils had been impacted by polychlorinated biphenyls, volatile organic compounds, semi-volatile organic compounds, petroleum hydrocarbons, and metals.	No evidence of PFOS, PFOA, or PFBS use, storage, or disposal. Area identified due to the potential of AFFF use, but was confirmed to have no use, storage, or disposal based on the dates of operation. AFFF was created in 1969.
Building 448 – Former Laundry Facility	1941 to 1991	Laundry building operated from 1941 to 1982. After operations ceased in 1982, the first floor of the building was used for general purpose storage, including storage of photographic and water treatment chemicals.	No evidence of PFOS, PFOA, or PFBS containing materials used, stored, and/or disposed of at this location. Although PFOS, PFOA, or PFBS containing chemicals have been known to be used as part of water-proofing operations, following review of relevant records, no water-proofing operations that may have involved the use of PFOS, PFOA, or PFBS -containing materials were identified at this location.
Building 443 – Dry Cleaning Plant	1932 to 1990	Former dry-cleaning plan began operating in 1932 and was demolished in 1990. Dry cleaning solvents were stored in underground and aboveground storage tanks throughout the operation period.	No evidence of PFOS, PFOA, or PFBS containing materials used, stored, and/or disposed of at this location. Although PFOS, PFOA, or PFBS containing chemicals have been known to be used as part of water-proofing operations. Following review of relevant records, no water-proofing operations that may have involved the use of PFOS, PFOA, or PFBS- containing materials were identified at this location.
Former Motor Pool Area (Tanks 10 to 15)	Unknown to 1993	Motor pool located around former buildings 206 through 209. Reportedly scheduled for demolition in 1993 for the development of a Warehouse/Administrative building.	No evidence of PFOS, PFOA, or PFBS use, storage, or disposal. Confirmed during interviews that a fire truck maintenance or cleaning would not have been conducted at this location.

Area Description	Dates of Operation	Relevant Site History	Rationale
Building 209 – Vehicle Wash Rack	1907 to 1994	Building 209 was constructed in 1907 and was used as a wash rack. Detergents were used during vehicle washing. The wash rack reportedly had a sand trap for removal of sediment, oil, and grease. Vehicle washing at this location was stopped prior to 1994 because USEPA cited that the building was not equipped with an oil/water separator.	No evidence of PFOS, PFOA, or PFBS use, storage, or disposal. Confirmed during interviews that a fire truck maintenance or cleaning would not have been conducted at this location.

5.1.2 AOPIs at Fort Myer

Overviews for each AOPI identified during the PA process are presented in this section. One of the AOPIs overlaps with JBM-HH IRP sites and/or Headquarters Army Environmental System (HQAES) sites (**Figure 5-2**). The AOPI, overlapping IRP site identifier, HQAES number, and current site status are discussed within each AOPI subsection presented below. At the time of this PA, none of the JBM-HH IRP sites have historically been investigated or are currently being investigated for the possible presence of PFAS.

The AOPI locations are shown on **Figure 5-2**. Aerial photographs of each AOPI that also show the approximate extent of AFFF use (if applicable) are presented on **Figures 5-3** through **5-5** and include active monitoring wells in the vicinity of each AOPI.

5.1.2.1 Building 415 – Current JBM-HH Fire Station

The Building 415 – Current JBM-HH Fire Station is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to the reported parking of vehicles stocked with AFFF and occasional apparatus testing. Empty 5-gallon pails were stored at the end of the fire station and were used inside the fire station and along the fire station driveways to transfer AFFF concentrate into and out of the fire trucks. Occasional testing of AFFF apparatuses was reportedly conducted on the fire station driveways. Residual AFFF may have been released to the fire station driveways, surrounding soils, and introduced to the surrounding area and stormwater management systems via surface water runoff.

The AOPI is located along the south-western boundary of Fort Myer and resides atop a well-developed, re-graded area defined by a slow-slopping topographic gradient directed towards the south. The surrounding area is sparsely vegetated intermixed with buildings, roadways, and paved areas. Surface runoff flows along topography towards the south and into the Fort Myer stormwater system before eventually draining off post towards Washington Boulevard.

The Building 415 – Current JBM-HH Fire Station AOPI resides directly downgradient of one existing JBM-HH IRP site: The Old Dry Cleaning Plant-Soil Vapor Extraction and Groundwater Risk (FMY-01). In the early 1990s, a tetrachloroethene and benzene, toluene, ethylbenzene and xylenes (collectively BTEX) release from underground storage tanks, aboveground storage tanks, and interior floor drains from dry cleaning operations and the old gas station, was discovered. Soon after, a soil vapor extraction system

was installed in 1993 and operated until 1997, when the Virginia Department of Environmental Quality and JBM-HH determined it was no longer effective. In 1996, during construction of a Post Exchange building, contaminated soils were excavated and disposed. Groundwater sampling in 2007 by the U.S. Army Public Health Command indicated the presence of chlorinated volatile organic compoinds at concentrations above maximum contaminant levels. A pilot study was completed in 2011, as the first phase of a two-phased treatability study, to determine the effectiveness of biostimulation and bioaugmentation to facilitate the complete reduction of chlorinated contaminants in groundwater. As of 2020, a remedial investigation report and draft feasibility study were scheduled to be completed in 2016. Future groundwater remedial work is anticipated.

5.1.2.2 Building 237 – Former JBM-HH Fire Station

Similar to the Building 415 – Current JBM-HH Fire Station, the Building 237 - Former JBM-HH Fire Station is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to the reported parking of vehicles stocked with AFFF and occasional apparatus testing. In addition to occasional apparatus testing, an ARFF unit with AFFF capabilities (owned by JBM-HH but assigned to the Pentagon), was occasionally parked at the Former JBM-HH Fire Station for cleaning, AFFF tank filling, and inspections. AFFF for use with the Pentagon ARFF unit was reportedly stored at this location for a short period of time in early 2020. Residual releases of AFFF from fire truck cleaning, AFFF tank filling, and valve testing were reported at this AOPI. These releases may have impacted the former fire station driveways and surrounding soils and introduced to nearby areas and stormwater management systems via surface water runoff.

The AOPI is located along the north-western boundary of Fort Myer and resides atop a well-developed, re-graded area defined by a slow-sloping topographic gradient directed towards the south. The surrounding area is sparsely vegetated intermixed with buildings, roadways, and paved areas. Surface runoff flows along topography towards the south and into the Fort Myer stormwater system before eventually draining off post towards Washington Boulevard.

5.1.2.3 Building 307 – Historical AFFF Storage Location

The Building 307 – Historical AFFF Storage Location is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to the reported use of this location as a storage space for JBM-HH Fire Department equipment and materials from the mid-2000s to 2015. AFFF was reportedly stored inside a small storage room located inside the building before being disposed to an unknown off-post location in 2015. Residual AFFF may have been released to building floors due to AFFF storage container manipulation and/or transport and introduced to the surrounding area and stormwater management systems via internal building drainage system.

The AOPI is located along the north-eastern boundary of Fort Myer and resides atop a well-developed, re-graded area defined by a slow-sloping topographic gradient directed towards the south. The surrounding area is sparsely vegetated intermixed with buildings, roadways, and paved areas. Surface runoff flows along topography towards the south and into the Fort Myer stormwater system before eventually draining off post towards Washington Boulevard.

5.2 Fort McNair

5.2.1 Areas Not Retained for Further Investigation at Fort McNair

Through the evaluation of information obtained during records review, personnel interviews, and/or site reconnaissance, the areas described below were categorized as areas not retained for further investigation at Fort McNair this time.

A brief site history and rationale for areas not retained for further investigation are presented in **Table 5-2**, below.

Table 5-2. Installation Areas Not Retained for Further Investigation at Fort McNair

Area Description	Dates of Operation	Relevant Site History	Rationale
Building 45 – Photo Hobby Laboratory	Unknown	Listed in the Fort McNair Installation Action Plan (IAP) as a photo laboratory	A retired JBM-HH Hazardous Waste Manager stated that photo-processing operations conducted at this location were small scale. There is no evidence of PFOS, PFOA, or PFBS containing materials used, stored, and/or disposed of at this location.
Building 37 – Wash Rack	Unknown	Listed in the Fort McNair IAP as a vehicle wash rack.	No evidence of AFFF use, storage, or disposal. Confirmed with current and retired JBM-HH fire department personnel that fire vehicles were not maintained or cleaned at this location.
PX Motor Shop Wash Rack	Unknown	Listed in the Fort McNair IAP as a vehicle wash rack.	No evidence of AFFF use, storage, or disposal. Confirmed with current and retired JBM-HH fire department personnel that fire vehicles were not maintained or cleaned at this location.
Building 52 – Former Inter American Defense College Photo Laboratory	1962 to Uncertain	Listed in the Fort IAP as a photo laboratory that was operated by the Inter American Defense College.	1997 No Further Action Summary as listed in the Fort McNair IAP states: “There is no evidence of chemical contamination.” There is no evidence PFOS, PFOA, or PFBS containing materials used, stored, and/or disposed of at this location.

5.2.2 AOPIs at Fort McNair

An overview for the AOPI identified during the PA process is presented in this section. The identified AOPI does not overlap with any JBM-HH IRP sites and/or HQAES sites (**Figure 5-2**). The AOPI is discussed in subsection presented below. At the time of this PA, none of the JBM-HH IRP sites have historically been investigated or are currently being investigated for the possible presence of PFAS.

The AOPI location is shown on **Figure 5-6**. An aerial photograph that shows the AOPI and the approximate extent of AFFF release at the AOPI is presented on **Figure 5-7**.

5.2.2.1 Fort McNair Fire Apparatus Shelter

The Fort McNair Fire Apparatus Shelter is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to the reported parking of an AFFF capable fire truck along with 25 gallons of AFFF. In addition, the AFFF system for the fire truck was repaired at some point, and the AFFF was reportedly emptied into containers before the truck was sent to the off-post contractor Delmarva Pump Center for repairs. Once repairs were completed, the truck was taken back to the apparatus shelter and filled with the same AFFF. Residual releases of AFFF from fire truck cleaning operations, AFFF tank filling, and valve testing were reported at this location. AFFF may have been released to the Fort McNair Fire Apparatus Shelter driveways and surrounding soils as well as introduced to nearby areas and stormwater management systems via surface water runoff.

The AOPI is located along the central-eastern boundary of Fort McNair and resides atop a well-developed, re-graded area defined by a slow-sloping topographic gradient directed towards the south. The surrounding area is fairly vegetated (mostly grassy areas) intermixed with buildings, roadways, and paved areas. Surface runoff flows along topography towards the south and into the Fort McNair stormwater system before eventually draining off post towards the Washington Channel and Potomac River.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at JBM-HH, an SI for PFOS, PFOA, and PFBS was conducted in accordance with CERCLA. SI sampling was completed at JBM-HH at all four AOPIs to evaluate presence or absence of PFOS, PFOA, and PFBS in comparison with the OSD risk screening levels. As such, an installation-specific QAPP Addendum (Arcadis 2021) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A preliminary CSM was prepared for each of the installation's AOPIs in accordance with the USACE Engineer Manual on Conceptual Site Models, EM 200-1-12 (USACE 2012). 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 two pathways (soil and groundwater) as potentially complete which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on each AOPI's preliminary CSM. The SI scope of work was completed in December 2021 through the collection of field data and analytical samples.

The SI field work was completed in accordance with the standard operating procedures (SOPs), technical guidance instructions (TGIs), sampling design, and QA/QC requirements as detailed in the QAPP Addendum (Arcadis 2021) and PQAPP (Arcadis 2019). The subsections below summarize the DQOs, sampling design and rationale, sampling activities and methods, and data analyses procedures for the SI phase at JBM-HH. Non-conformances to the prescribed procedures in the PQAPP and QAPP Addendum are described in **Section 6.3.3**. Analytical results obtained through SI field activities are summarized in **Section 7**.

6.1 Data Quality Objectives

As identified during the DQO process and outlined in the site-specific QAPP Addendum (Arcadis 2021), the objective of the SI is to identify whether there has been a release to the environment at the AOPIs identified in the PA and to determine if further investigation is warranted. This SI evaluated groundwater and soil, for PFOS, PFOA, and PFBS presence or absence at each of the sampled AOPIs.

6.2 Sampling Design and Rationale

The rationale for sampling at each AOPI is illustrated on **Figure 6-1** below.

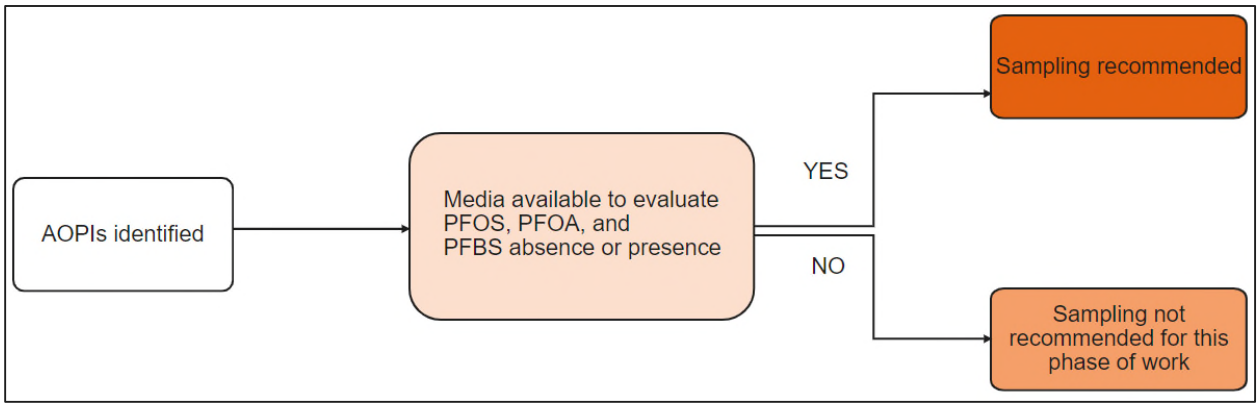

Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at JBM-HH is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2021). Briefly, the areas of focus for this SI (i.e., three AOPIs at Fort Myer [Building 415 – Current JBM-HH Fire Station, Building 237 – Former JBM-HH Fire Station, and Building 307 – Historical AFFF Storage Location] and one AOPI at Fort McNair [Fort McNair Fire Apparatus Shelter]) were selected based on a review of historical documents and data and information obtained by conducting personnel interviews during the PA. Soil and/or groundwater samples were collected from all four AOPIs in the areas of known or suspected use, storage, and/or disposal of PFOS, PFOA, and PFBS-containing materials. Surface water and sediment samples were not collected due to the absence of surface water bodies in close proximity of the AOPIs.

Sampling points were positioned at locations of known or suspected PFOS, PFOA, and PFBS-containing material uses, locations of runoff collection, and locations downgradient of known or suspected uses of PFAS-containing materials and were determined based on specific historical evidence and surface runoff/groundwater flow conditions at each AOPI. Groundwater and soil samples were collected from three of the four AOPIs, and where practicable, groundwater samples were collected from previously existing monitoring wells. Only groundwater samples were collected from one AOPI where the former storage area was built below grade and consists entirely of concrete, therefore, the soil exposure pathway for on-installation site workers (i.e., installation personnel) is considered to be incomplete.

The sampling depths at existing monitoring wells were at approximately the center of the saturated screened interval. **Table 6-1** includes the monitoring well construction details for the wells sampled during the SI (if available).

6.3 Sampling Methods and Procedures

Environmental data were collected and analyzed in accordance with the PQAPP (Arcadis 2019), the SOPs and TGIs included as Appendix A to the PQAPP, the QA/QC requirements identified in Worksheet #20 of the PQAPP, the approved scope and sampling methods outlined in the site-specific QAPP Addendum (Arcadis 2021), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2021). The sampling methods described in the SOPs and TGIs establish equipment requirements, procedures for preparing equipment and containers before sampling, sampling

procedures under various conditions, and procedures for storing samples to ensure that sample contamination does not occur during collection, and transport. In general, sampling techniques used in the SI were consistent with conventional sampling techniques used in the environmental industry, but special considerations were made regarding PFAS-containing materials and equipment and cross-contamination potential.

The sampling methods employed during the SI are detailed in the PQAPP (Arcadis 2019) and QAPP Addendum (Arcadis 2021). The subsections below provide a summary of the field methods and procedures utilized to complete the SI scope of work. Field notes and field forms (i.e., soil boring logs, groundwater purging logs, equipment calibration forms, tailgate health and safety forms, and sample collection logs) documenting the SI sampling activities are included in **Appendices I** and **J**, respectively.

6.3.1 Field Methods

Grab groundwater samples were collected via direct-push technology from six discrete direct-push points. Shallow (first encountered) groundwater was sampled as determined by the field geologist and based on typically encountered groundwater levels in the region. A Virginia and D.C.-licensed driller operated the direct-push technology rig. In addition, samples were collected from three existing monitoring wells at Building 415 – Current JBM-HH Fire Station. For existing monitoring wells, groundwater samples were collected from the center of the saturated screened interval. Field parameters (temperature, pH, specific conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential) were measured during purging and allowed to stabilize in accordance with the TGI for PFAS Sampling Procedures and Low-Flow Groundwater Purging for Monitoring Wells (P-11 in Appendix A to the PQAPP; Arcadis 2019) (or purged for a maximum of 60 minutes, whichever occurred first) before groundwater sampling to ensure a representative sample is collected and, potentially, to inform the interpretation of analytical data.

Soil samples will be collected via hand auger methods in accordance with the TGI for PFAS-Specific Drilling and Monitoring Well Installation (P-12 in Appendix A to the PQAPP; Arcadis 2019) from 11 discrete points. At each sampling point, soil samples were collected from approximately 0.5 to 2 feet of native soil.

Decontamination procedures for non-dedicated equipment used during sampling are described in **Section 6.3.4**.

6.3.2 Quality Assurance/Quality Control

Worksheets #20 of the PQAPP and QAPP Addendum provide QA/QC requirements for field duplicates, matrix spike/matrix spike duplicates, equipment blanks (EBs), source blanks for water used in the initial decontamination step for drill tooling, and field blanks for laboratory-supplied water used in the final decontamination step.

QA/QC samples were collected at the frequencies specified in the QAPP Addendum (Arcadis 2021), typically at a rate of 1 per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicate samples were collected for media sampled for PFOS, PFOA, and PFBS, and total organic carbon (TOC) only. EBs were collected for media sampled for PFOS, PFOA, and PFBS, at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2021). The decontaminated reusable equipment from which EBs were collected include tubing, bladder pump, drill

bit, hand augers, and water-level meters as applicable to the sampled media. Source blanks were collected from the water used to pressure-wash drill tooling. Analytical results for blank samples are discussed in **Section 7.6**.

6.3.3 Field Change Reports

No instances of major scope modifications (i.e., those that may have had a significant impact on the project scope and/or data usability/quality, or required stop-work, and warranted discussion with USACE) were encountered during the JBM-HH SI work.

In some cases, clarifications to the established scope of work were needed but do not necessarily constitute a non-conformance from the sampling plans described in the QAPP Addendum. Minor modifications from and clarifications for the procedures and scope of work detailed in the QAPP Addendum and PQAPP and that did not affect DQOs are documented in Field Change Reports (FCRs) included as **Appendix K** and are summarized below:

- One FCR was completed for the existing well JBMHH-MW-S7 at the Building 415 – Current JBM-HH Fire Station AOPI. During utility mark-outs, existing monitoring wells were located and inspected. JBMHH-MW-S7 was found along the side of the fire station driveway as expected; however, the well had been seriously crushed and damaged and was inaccessible for sampling. Another existing downgradient monitoring well (JBMHH-WF-1) located approximately 20 feet southeast was identified and selected for sampling instead.
- One FCR was completed for the Building 237 – Former JBM-HH Fire Station AOPI. During utility mark-outs, subsurface gas, electric, and cable lines were found within a 10-foot radius of the proposed sample point JBMHH-B237-1-GW. Due to the staggered layout of the lines, no safe drilling point (i.e., a minimum distance of 30 inches from subsurface utility) could be plotted. Due to the presence of another downgradient grab-groundwater sample at the AOPI, it was decided to abandon proposed sample point JBMHH-B237-1-GW in response to health and safety concerns.
- One FCR was completed for the Building 307 – Historical AFFF Storage Location AOPI. During utility mark outs at the AOPI, a subsurface gas line was identified within 30 inches of proposed sample point JBMHH-B307-2-GW. In response, sample point JBMHH-B307-2-GW was shifted eastward and placed directly downgradient of the historical AFFF storage area. Furthermore, sample point JBMHH-B307-1-GW was also shifted further southward to account for the presence of a large, low hanging tree that impeded rig access at the original sampling location.

6.3.4 Decontamination

Non-dedicated reusable sampling equipment (e.g., hand augers, drill cutting shoes and casing, water-level meters) that came into direct contact with sampling media was decontaminated before first use, between sampling locations/intervals, and before demobilization in accordance with P-09, TGI - Groundwater and Soil Sampling Equipment Decontamination (Arcadis 2019, Appendix A).

6.3.5 Investigation-Derived Waste

IDW, including soil cuttings, groundwater, and decontamination fluids generated at Fort Myer were collected and disposed on the ground at the point of collection. IDW generated at Fort McNair, including soil cuttings, groundwater, decontamination fluids, and equipment were collected in a single Department of Transportation-approved 55-gallon drum, labeled as non-hazardous, and relocated to a 180-day non-hazardous waste staging area. Equipment IDW includes personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, and high-density polyethylene and silicon tubing) that may come in contact with sampling media. Equipment IDW from Fort Myer and Fort McNair were containerized, characterized by laboratory testing, and disposed in accordance with applicable D.C. and federal laws and regulations. All wastes generated during this project are anticipated to be non-hazardous. IDW disposal was coordinated and handled by the JBM-HH Hazardous Waste Program Manager. The groundwater and soil PFAS analytical data for samples collected at the Fort McNair Fire Apparatus Shelter was used as representative analytical data for the waste profiling process. At the time of report publication, no details on the date of disposal or the final disposal location have been reported.

6.4 Data Analysis

The subsections below summarize the laboratory analytical methods and the methodology used to evaluate data collected during the SI through data verification and usability assessments (as completed by a project chemist, independent of the project team).

6.4.1 Laboratory Analytical Methods

Analytical samples collected during the SI were submitted to Eurofins Lancaster Laboratories Environmental, an ELAP-accredited laboratory for PFAS analysis, including PFOS, PFOA, and PFBS, by liquid chromatography with tandem mass spectrometry. Laboratory analyses associated with the SI were completed in accordance with Worksheets #12.1 through #12.5 in the PQAPP (Arcadis 2019). Eighteen PFAS-related compounds, including PFOS, PFOA, and PFBS, were analyzed for in groundwater and soil samples using an analytical method that is ELAP-accredited and compliant with QSM 5.3 (DoD and Department of Energy 2019), Table B-15.

Additionally, the following general chemistry and physical characteristic analyses were completed for select soil samples in accordance with Worksheet #18 of the QAPP Addendum (Arcadis 2021) by the analytical method noted:

- TOC by Solid Waste Test Method 846 9060A
- Grain size analysis by American Society for Testing and Materials D422-63
- pH by Solid Waste Test Method 846 9045D.

These data are collected as they may be useful in future fate and transport studies.

The laboratory limit of detection (LOD) is defined as “the lowest concentration for reliable reporting of a non-detect of a specific analyte in a specific matrix with a specific method at 99 percent confidence” (DoD 2017). The lowest concentration of a substance that produces a quantitative result within specified limits of precision and bias is known as the limit of quantitation (LOQ; DoD 2017). Concentrations detected

between the LOD and LOQ, therefore, are considered estimates and are qualified as such on laboratory analytical reports. Instrument-specific detection limits (e.g., the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99 percent confidence; DoD 2017), as provided for each analyte by the laboratory, are reported along with the LODs and LOQs in the laboratory analytical reports included in the Data Usability Summary Report (DUSR) (**Appendix L**).

6.4.2 Data Validation

All analytical data generated during the SI, except grain size, were verified and validated in accordance with the data verification procedures described in Worksheets #34 through #36 of the PQAPP (Arcadis 2019). Each laboratory data package/sample delivery group underwent Stage 3 data validation in accordance with DoD QSM 5.3 (DoD and Department of Energy 2019). Additionally, 10% of the data underwent Stage 4 data validation. Copies of the data validation reports for each sample delivery group are included as attachments to the DUSR in **Appendix L**. The Level IV analytical reports are included within **Appendix L** in the final electronic deliverable only.

6.4.3 Data Usability Assessment and Summary

A data usability assessment was completed for all analytical data associated with SI sampling at JBM-HH. Documentation generated during the data usability assessments, which were compiled into a DUSR (**Appendix L**), was prepared in accordance with the USACE Engineer Manual 200-1-10 (USACE 2005), the Final DoD General Data Validation Guidelines (DoD 2019) and the Final DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per-and Polyfluoroalkyl Substances Analysis by QSM Table B-15 (DoD 2020), that reviewed precision, accuracy, completeness, representativeness, comparability, and sensitivity. A statement of overall data usability is included in the DUSR.

Based on the final data usability assessment, the environmental data collected at JBM-HH during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUSR and its associated data validation reports (**Appendix L**), and as indicated in the full analytical tables (**Appendix M**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and JBM-HH QAPP Addendum (Arcadis 2021). Data qualifiers applied to laboratory analytical results for samples collected during the SI at JBM-HH are provided in the data tables, data validation reports, and the Data Usability Summary Table located at the end of DUSR. Qualifiers for data shown on figures are defined in the notes of figures.

6.5 Office of the Secretary of Defense Risk Screening Levels

The OSD risk screening levels for PFOS, PFOA, and PFBS in groundwater (tap water) and soil were calculated using the USEPA's RSL calculator for residential and industrial/commercial worker receptor scenarios and current toxicity values. These risk screening levels are shown in **Table 6-2**.

Table 6-2 OSD Risk Screening Levels Calculated for PFOS, PFOA, and PFBS in Tap Water and Soil Using USEPA's Regional Screening Level Calculator

Chemical	Residential Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator		Industrial/Commercial Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator
	Tap Water (ng/L or ppt) [1]	Soil (mg/kg or ppm) [1,2]	Soil (mg/kg or ppm) [1,2]
PFOS	40	0.13	1.6
PFOA	40	0.13	1.6
PFBS	600	1.9	25

Notes:
1. Risk screening levels for tap water and soil provided by the OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September 15 (**Appendix A**).
2. All soil data will be screened against both the Residential Scenario and Industrial/Commercial risk screening levels (if collected from less than 2 feet bgs), regardless of the current and projected land use of the AOPI.
mg/kg = milligram per kilogram
ng/L = nanograms per liter
ppm = parts per million
ppt = parts per trillion

The OSD residential tap water risk screening levels will be used to compare all groundwater for this Army PFAS PA/SI. While the current and most likely future land uses of the AOPIs at JBM-HH are industrial/commercial, both residential and industrial/commercial soil risk screening levels for PFOS, PFOA, and PFBS will be used to evaluate detected soil concentrations. The data from the SI sampling event are compared to the OSD risk screening levels in **Section 7**. If concentrations of PFOS, PFOA, or PFBS are detected greater than the applicable OSD risk screening levels, further study in a remedial investigation is recommended in **Section 8**.

7 SUMMARY AND DISCUSSION OF SI RESULTS

This section summarizes the analytical results obtained from samples collected during the SI at JBM-HH (field duplicate results are provided in the associated tables). Sampled media and QA/QC samples were analyzed for the constituents prescribed per Worksheet #18 of the QAPP Addendum (Arcadis 2021). The sample results discussion below focuses on the PFOS, PFOA, and PFBS analytical results because they have OSD risk screening levels. The Army will make subsequent investigation decisions based on these constituents' concentrations relative to the OSD risk screening levels.

Tables 7-1 and **7-2** provide a summary of the groundwater and soil analytical results for PFOS, PFOA, and PFBS. **Table 7-3** summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix M** includes the full suite of analytical results for these media, as well as for the QA/QC samples. An overview of AOPIs at JMB-HH with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2** through **7-5** show the PFOS, PFOA, and PFBS analytical results in groundwater and/or soil for each AOPI. Non-detected results are reported as less than the LOQ. Detections of PFOS, PFOA, and/or PFBS greater than the applicable OSD risk screening levels are highlighted in summary tables and on figures. Final qualifiers applied to the data by the laboratory and the project chemist (as defined in **Section 6.4.3**) are presented on the analytical tables. Groundwater data collected during the SI are reported in ng/L, or parts per trillion, and soil data are reported in mg/kg, or parts per million.

Field parameters measured for groundwater during low-flow purging and sample collection are provided on the field forms in **Appendix J**. Soil descriptions are provided on the field forms in **Appendix J**. The results of the SI are grouped by AOPI and discussed for each medium as applicable. Groundwater was generally first encountered at depths of approximately 30 to 40 feet bgs at Fort Myer and 5 to 10 feet bgs at Fort McNair.

Table 7-3 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Yes/No)
Building 415 – Current JBM-HH Fire Station	Yes
Building 237 – Former JBM-HH Fire Station	Yes
Building 307 – Historical AFFF Storage Location	No
Fort McNair Fire Apparatus Shelter	No

7.1 Building 415 – Current JBM-HH Fire Station

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Building 415 – Current JBM-HH Fire Station AOPI. Due to the lack of surface water and sediment in the vicinity of the identified AOPIs, no surface water or sediment samples were collected. One representative soil sample was collected from soil located directly beneath the fire station outfall.

7.1.1 Groundwater

Groundwater samples were collected from three existing monitoring wells at Building 415 – Current JBM-HH Fire Station AOPI (**Figure 7-2**). Groundwater samples were collected from approximately the center of the saturated screen interval. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS and PFOA were detected above the OSD risk screening level of 40 ng/L at JBMHH-WF1 (530 ng/L and 120 ng/L, respectively). PFOS was detected below the OSD risk screening level of 40 ng/L at JBMHH-WCS1 (17 ng/L). PFOA was detected below the OSD risk screening level of 40 ng/L at JBMHH-WCS1 (15 ng/L) and JBMHH-MW-S2 (5.7 [6] ng/L, respectively in the sample and the field duplicate). PFOS was not detected in the sample or field duplicate at JBMHH-MW-S2. PFBS was detected below the OSD risk screening level of 600 ng/L at all three locations: JBMHH-WF1 (62 ng/L), JBMHH-WCS1 (54 ng/L), and JBMHH-MW-S2 (7.6 [7.8] ng/L, respectively in the sample and the field duplicate).

7.1.2 Soil

Soil samples were collected from four locations at the Building 415 – Current JBM-HH Fire Station AOPI (**Figure 7-2**). Soil samples were collected at each boring at a depth of 0.5 to 2 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

PFOS was detected below the OSD risk screening level for residential soil (0.13 mg/kg) and industrial/commercial soil (1.6 mg/kg) at three locations: JBMHH-B415-2-SO (0.00089 mg/kg), JBMHH-B415-3-SO (0.00087 mg/kg), and JBMHH-B415-4-SO (0.0014 mg/kg). PFOS was detected below the OSD risk screening level for residential soil (0.13 mg/kg) and industrial/commercial soil (1.6 mg/kg) at JBMHH-B415-1-SO (0.00069J mg/kg). The qualifier “J” indicates that the analyte was positively identified; however, the associated numerical value is an estimated concentration. . PFOA and PFBS were not detected at any of the four locations: JBMHH-B415-1-SO, JBMHH-B415-2-SO, JBMHH-B415-3-SO, and JBMHH-B415-4-SO.

7.2 Building 237 – Former JBM-HH Fire Station

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Building 237 – Former JBM-HH Fire Station AOPI. Surface water and sediment samples were not collected since water bodies are not in close proximity of the AOPI.

7.2.1 Groundwater

A grab groundwater sample was collected from one boring via direct-push technology and screenpoint sampling at the Building 237 – Former JBM-HH Fire Station AOPI (**Figure 7-3**). The groundwater sample was collected at a depth interval of 35 to 40 feet bgs at JBMHH-B237-2-GW. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS and PFOA were detected above the OSD risk screening level of 40 ng/L at JBMHH-B237-2-GW (84 ng/L and 140 ng/L, respectively). PFBS was detected below the OSD risk screening level of 600 ng/L at JBMHH-B237-2-GW (18 ng/L).

7.2.2 Soil

Soil samples were collected from three locations at the Building 237 – Former JBM-HH Fire Station AOPI (**Figure 7-3**). Soil samples were collected at each boring at a depth of 0.5 to 2 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2.**

PFOS and PFOA were detected below the OSD risk screening level for residential soil (0.13 mg/kg) and industrial/commercial soil (1.6 mg/kg) at all three locations: JBMHH-B237-1-SO (0.024 mg/kg and 0.014 mg/kg, respectively), JBMHH-B237-2-SO (0.024 mg/kg and 0.0019 mg/kg, respectively), and JBMHH-B237-3-SO (0.013 mg/kg and 0.0028 mg/kg, respectively). PFBS was not detected at in any of the three locations: JBMHH-B237-1-SO, JBMHH-B237-2-SO, and JBMHH-B237-3-SO.

7.3 Building 307 – Historical AFFF Storage Location

The subsections below summarize the groundwater PFOS, PFOA, and PFBS analytical results associated with the Building 307 – Historical AFFF Storage Location AOPI. Soil samples were not collected due to building footprint being covered by concrete. Surface water and sediment samples were not collected since water bodies are not in close proximity of the AOPI.

7.3.1 Groundwater

Grab groundwater samples were collected from three borings via direct-push technology and screenpoint sampling at the Building 307 – Historical AFFF Storage Location AOPI (**Figure 7-4**). The groundwater samples were collected at a depth interval of 30 to 35 feet bgs at JBMHH-B307-1-GW, JBMHH-B307-2-GW, and JBMHH-B307-3-GW. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS and PFOA were detected below the OSD risk screening level of 40 ng/L at all three locations: JBMHH-B307-1-GW (31 ng/L and 19 ng/L, respectively), JBMHH-B307-2-GW (14 ng/L and 12 ng/L, respectively), and JBMHH-B307-3-GW (29 ng/L and 23 ng/L, respectively). PFBS was detected below the OSD risk screening level of 600 ng/L at all three locations: JBMHH-B307-1-GW (9.8 ng/L), JBMHH-B307-2-GW (7.9 ng/L), and JBMHH-B307-3-GW (13 ng/L).

7.4 Fort McNair Fire Apparatus Shelter

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Fort McNair Fire Apparatus Shelter AOPI. Surface water and sediment samples were not collected since water bodies are not in close proximity of the AOPI.

7.4.1 Groundwater

Grab groundwater samples were collected from two borings via direct-push technology and screenpoint sampling at the Fort McNair Fire Apparatus Shelter AOPI (**Figure 7-5**). The groundwater samples were collected at first-encountered groundwater depth interval from 5 to 10 feet bgs at JBMHH-FAS-1-GW and JBMHH-FAS-2-GW. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected below the OSD risk screening level of 40 ng/L at JBMHH-FAS-1-GW (1.2 J ng/L). PFOS was not detected at JBMHH-FAS-2-GW. PFOA was detected below the OSD risk screening level of 40 ng/L at JBMHH-FAS-1-GW (8.7 ng/L) and JBMHH-FAS-2-GW (4 ng/L). PFBS was detected below the OSD risk screening level of 600 ng/L at JBMHH-FAS-1-GW (320 ng/L) and JBMHH-FAS-2-GW (180 ng/L).

7.4.2 Soil

Soil samples were collected from four locations at the Fort McNair Fire Apparatus Shelter AOPI (**Figure 7-5**). Soil samples were collected at each boring at a depth of 0.5 to 2 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2.**

PFOS was detected below the OSD risk screening level for residential soil (0.13 mg/kg) and industrial/commercial soil (1.6 mg/kg) at JBMHH-FAS-3-SO (0.00057 J mg/kg) and JBMHH-FAS-4-SO (0.00066 J mg/kg). PFOS was not detected at JBMHH-FAS-1-SO and JBMHH-FAS-2-SO. PFOA and PFBS were not detected at any of the four locations: JBMHH-FAS-1-SO, JBMHH-FAS-2-SO, JBMHH-FAS-3-SO, and JBMHH-FAS-4-SO.

7.5 TOC, pH, and Grain Size

In addition to sampling soil for PFOS, PFOA, and PFBS, one soil sample per AOPI was analyzed for TOC, pH, moisture content, and grain size data as they may be useful in future fate and transport studies. The TOC in the soil samples ranged from 3,310 to 15,400 mg/kg. The TOC at this installation was within a range typically observed in topsoil (5,000 to 30,000 mg/kg). The combined percentage of fines (i.e., silt and clay) in soils at JBM-HH ranged from 27.3 to 27.9% with an average of 27.6%. In general, PFAS constituents tend to be more mobile in soils with less than 20% fines (silt and clay) and lower TOC. The percent moisture of the soil (17.8%) was typical for clay (0 to 20%). The pH of the soil was neutral (approximately 7.2 standard units). Based on these geochemical and physical soil observed underlying the installation during the SI, PFAS constituents are expected to be relatively less mobile at JBM-HH than in soils with lower percentages of fines and TOC. While PFAS constituents are relatively less mobile in soils with high percentages of fines, depleted TOC may allow for enhanced mobility of the constituents in soil.

7.6 Blank Samples

Equipment blank samples were collected on all non-disposable sampling equipment and tubing. The following sample IDs were associated with the following sampling equipment: JBMHH-EB-GW-1-120221 (water level meter), JBMHH-EB-GW-2-120221 (tubing), JBMHH-EB-GW-3-120221 (bladder pump), JBMHH-EB-GW-4-120221 (drill bit), and JBMHH-EB-SO-1-120221 (hand auger). A source blank sample JBMHH-SB-2-120121 (driller) was collected from the driller's decontamination water. Field blank sample JBMHH-FB-1-120121 was collected on the first day of sampling activities. Because the lab provided water used to collect the field blank was also used for Arcadis' equipment decontamination, field blank sample JBMHH-FB-1-120121 is representative of Arcadis' decontamination water. Detections of PFOS and PFOA constituents are summarized below for blank samples. All detected concentrations were low

level. Other than those noted below, concentrations of PFOS, PFOA, and PFBS in all other blank samples were not detected.

- PFOS and PFOA were detected in the source blank (JBMHH-SB-2-120121) at concentrations of 1.0 J ng/L and 1.6 J ng/L, respectively. The source blank was collected to determine PFAS presence in source water used during the decontamination process. The highest observed concentration of PFOS and PFOA below their respective OSD risk screening levels was 31 ng/L for PFOS (Sample ID: JBMHH-B307-1-GW-120221) and 23ng/L for PFOA (Sample ID: JBMHH-B307-3-GW-120221). Because PFOS or PFOA were not detected in any groundwater samples at Fort Myer or Fort McNair at concentrations within 2.0 ng/L of their respective OSD risk screening levels, the detections observed in the source blanks would not have affected any conclusions based on the OSD risk screening levels for the two compounds.

The full analytical results for blank samples collected during the SI are included in **Appendix M**.

7.7 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2021) were re-evaluated and updated, if necessary, based on the SI sampling results. The CSMs presented on **Figures 7-6** through **7-9** and in this section therefore represent the current understanding of the potential for human exposure. For some AOPIs, the CSM is the same and thus shown on the same figure.

Many of the PFAS constituents found in AFFF and metal plating operations are surfactants (which do not volatilize) and are found in a charged or ionic state at environmentally-relevant pH (i.e., pH 5 to 9 standard units). PFOS, PFOA, and PFBS are each negatively charged at environmentally-relevant pH. The media potentially affected by PFOS, PFOA, PFBS releases at Army installations are soil, groundwater, surface water, and sediment. Once released to the environment, a primary factor that inhibits the movement of PFAS constituents is the presence of organic matter and organic co-constituents in soils and sediments. Generally, PFAS constituents are mobile in the potentially affected media, and they are not known to be fully broken down by natural processes.

Based on the use, storage, and/or disposal of PFAS-containing materials at the AOPIs, affected media are likely to consist of soil, groundwater, surface water, and sediment. Release and transport mechanisms include dissolution/desorption from soil to groundwater, transport via sediment carried in and dissolution to stormwater and surface water, discharge/recharge between groundwater and surface water, and adsorption/desorption between surface water and sediment. Generic categories of potential human receptors and their associated exposure scenarios that are typically evaluated in a CERCLA human health risk assessment were considered and include on-installation site workers (e.g., industrial/commercial workers, utility workers, or future construction workers who could be exposed to chemicals in soil at an AOPI or to chemicals in tap water in an industrial/commercial building), on-installation residents (e.g., adults and children who could be exposed to chemicals in tap water in a residence), and on-installation recreational users (e.g., hikers or hunters who could be exposed to chemicals in waterways at an installation). Off-installation receptor types could include drinking water receptors (i.e., commercial/industrial workers or residents) and recreational users.

Human exposure pathways are shown as “complete”, “potentially complete”, or “incomplete” on the CSM figures. A complete exposure pathway consists of a constituent source and release mechanism, a

transport or retention medium, an exposure point where human contact with the contaminated medium could occur, and an exposure route at the exposure point. If any of these elements is missing, the exposure pathway is incomplete. Pathways are “potentially complete” where data are insufficient to conclude the pathway is either “complete” or “incomplete”. Additionally, the CSMs do not include ecological receptors and exposure pathways. The potential for ecological exposures to PFOS, PFOA, and PFBS may be evaluated at a future date if those pathways warrant further consideration.

CSMs were developed for each individual AOPI and were combined where source media, potential migration pathways and exposure media, and human exposure pathway determinations are congruent. The following exposure pathway determinations apply to all CSMs located at Fort Myer and Fort McNair:

- The AOPIs are not used for residential purposes and are not likely to be regularly accessed by on-installation recreational users, or by off-installation receptors. Therefore, the soil exposure pathways for on-installation residents and recreational users and for off-installation receptors are incomplete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at all AOPIs. There are no drinking water wells used to supply potable water at Fort Myer or Fort McNair. Future drinking water wells are unlikely because potable water is supplied to Fort Myer and Fort McNair by Arlington County and D.C. Water, respectively. Both public water agencies receive drinking water from the USACE operated Dalecarlia and McMillian WTPs, which collect and treat water from the Great Falls Intake and Little Falls Intake located along the Potomac River approximately 5 miles upriver from Fort Myer. However, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are considered to be potentially complete to account for potential future use of the downgradient on-post groundwater as a potable water source.
- Recreational users are not likely to contact groundwater during outdoor recreational activities; therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.

Additional exposure pathway descriptions for each CSM are listed below by figure.

Figure 7-6 shows the CSM for the Building 415 – Current JBM-HH Fire Station AOPI. This location sheltered the Pentagon’s ARFF and morning testing was conducted every morning. In addition, a number of empty 5-gallon pails were stored at the end of the fire station and used to transfer AFFF concentrate into and out of fire trucks.

- PFOS was detected in soil at Building 415 – Current JBM-HH Fire Station and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- Stormwater originating from this AOPI discharges south through an on-post stormwater outfall before eventually flowing off-post and into Arlington County storm drains. Arlington County storm drains eventually discharge to Lower Long Branch Creek, a tributary of the Potomac River. PFOS was detected in soil collected from an on-post stormwater system outfall connected to and located directly south of the Building 415 – Current JBM-HH Fire Station AOPI. Site workers could contact constituents in stormwater/surface water and sediment/soil at this outfall location via incidental ingestion and dermal contact when conducting maintenance activities. Therefore, the sediment/soil exposure pathway for on-installation site workers is complete, and the stormwater/surface water pathway is potentially complete.

- On-post residents and recreational users are not likely to contact stormwater drain sediment or surface water and sediment/soil at the outfall location. Therefore, these exposure pathways are incomplete.
- Stormwater from the on-post outfall eventually flows across land and off-post along Washington Boulevard, directly adjacent to the AOPI. The ultimate discharge location for this stormwater is off-post to the Potomac River, which is located approximately 0.9 mile to the east of Fort Myer. Recreational users could contact constituents in surface water and sediment in the Potomac River. Therefore, the surface water and sediment exposure pathways for off-installation receptors are potentially complete.
- Groundwater originating at this AOPI flows off-post through Fort Myer's southern installation boundary. While no potable wells were identified within a 5-mile radius of the installation, in the absence of land use controls preventing potable use of the groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is considered to be potentially complete.

Figure 7-7 shows the CSM for the Building 237 – Former JBM-HH Fire Station AOPI. Two vehicles and AFFF for a stocked out-of-service Pentagon Helipad ARFF Unit were stored in the former fire engine bay of this building around April 2020. The building is now used as a Veterinary Center office.

- PFOS and PFOA were detected in soil at Building 237 – Former JBM-HH Fire Station and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- Stormwater originating from this AOPI is captured via drainage swales and discharged to an off-post surface water outfall located directly west of the AOPI. No on-post surface water bodies or outfalls that could inform on the presence or absence of PFAS were present within the vicinity of the AOPI. On-installation site workers could contact constituents present in stormwater/surface water and sediment/soil at this outfall location via incidental ingestion and dermal contact when conducting maintenance activities; therefore, the surface water and sediment exposure pathways for these receptors are potentially complete. Residents and recreational users are unlikely to contact drainage swales or the outfall; therefore, the surface water and sediment exposure pathways for these receptors are incomplete.
- Stormwater originating from this AOPI discharges to an off-post stormwater outfall located along Washington Boulevard, before ultimately discharging off-post via Arlington County stormwater systems to the Potomac River, which is located approximately 0.9 mile to the east of Fort Myer. Recreational users could contact constituents in surface water and sediment in the Potomac River. Therefore, the surface water and sediment exposure pathways for off-installation receptors are considered potentially complete.
- Groundwater originating at this AOPI flows off-post through Fort Myer's southern installation boundary. While no potable wells were identified within a 5-mile radius of the installation, in the absence of land use controls preventing potable use of the groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is considered to be potentially complete.

Figure 7-8 shows the CSM for the Building 307 – Historical AFFF Storage Location AOPI. This building was used as a storage space for JBM-HH Fire Department equipment and materials from the mid-2000s to 2015. AFFF was reportedly stored at this location before being disposed of in 2015.

- The historical AFFF storage location is built below grade and consists entirely of concrete. Therefore, the soil exposure pathway for on-installation site workers is incomplete.
- Drains within the storage building capture run-off from the building interior and eventually discharge via outfalls. On-installation site workers could contact constituents in stormwater drain sediment or in surface water and sediment near the outfalls. Therefore, these exposure pathways are potentially complete. On-installation residents and recreational users (if present) are not likely to contact stormwater drain sediment or surface water and sediment near the outfalls. Therefore, these exposure pathways are considered to be incomplete.
- Stormwater ultimately discharges off-post to the Potomac River, which is located approximately 0.9 mile to the east of Fort Myer. Recreational users could contact constituents in surface water and sediment of the Potomac River. Therefore, the surface water and sediment exposure pathways for off-installation receptors are considered potentially complete.
- Groundwater originating at this AOPI flows off-post through Fort Myer's southern installation boundary. While no potable wells were identified within a 5-mile radius of the installation, in the absence of land use controls preventing potable use of the groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is considered to be potentially complete.

Figure 7-9 shows the CSM for the Fort McNair Fire Apparatus Shelter AOPI, where residual AFFF releases to soil via tank fueling are suspected to have occurred.

- PFOS were detected in soil at Fire Apparatus Shelter AOPI and site workers (i.e., installation personnel) could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- There are no on-post surface water bodies proximal to this AOPI. The nearest down-topography surface water body is the Potomac River, located approximately 0.45 mile due south of the AOPI. Therefore, the surface water and sediment exposure pathways for on-installation receptors are incomplete.
- Stormwater from the installation is collected via storm water inlets and routed southward, discharging to the Potomac River. Recreational users could contact constituents in surface water and sediment of the Potomac River. Therefore, the surface water and sediment exposure pathways for off-installation receptors are considered potentially complete.
- Groundwater originating at this AOPI flows off-post through Fort McNair's southern installation boundary and directly into the Potomac River. The Potomac River is likely a hydraulic barrier preventing the migration of constituents from groundwater in the vicinity of the AOPI to areas where groundwater could be used for potable uses; therefore, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is considered to be incomplete.

Following the SI sampling, all four of the AOPIs were considered to have complete or potentially complete exposure pathways. Although the CSMs indicate complete or potentially complete exposure pathways

may exist, the recommendation for remedial investigation is based on the comparison of analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2**).

8 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA/SI included two distinct efforts. The PA identified AOPIs at JBM-HH based on the use, storage, and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release of PFOS, PFOA, and PFBS to the environment occurred.

OSD provided residential risk screening levels based on the USEPA oral reference dose for PFOS, PFOA, and PFBS in soil and groundwater (tap water) and industrial/commercial risk screening levels for PFOS, PFOA, and PFBS in soil (**Appendix A**). A combination of document review, internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFOS, PFOA, and PFBS use, storage, and/or disposal at JBM-HH. Following the evaluation, four AOPIs were identified.

No potable supply wells are present on post or within a 5-mile radius off post at both Fort Myer and Fort McNair. Drinking water is not supplied by surface water located on-post. Potable water for Fort Myer and the surrounding area is supplied by Arlington County. Arlington County receives its drinking water from the USACE operated Dalecarlia and McMillian WTPs, which collect and treat water from the Great Falls Intake and Little Falls Intake located along the Potomac River. Both intakes are located up-river of Fort Myer. Potable water for Fort McNair is supplied by D.C. Water. D.C. Water also receives water from the Dalecarlia WTP located along the Potomac River approximately 5-miles upriver of Fort Myer.

All AOPIs were sampled during the SI at JBM-HH to identify presence or absence of PFOS, PFOA, and PFBS at each AOPI. The SI scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the JBM-HH QAPP Addendum (Arcadis 2021). All four AOPIs had detections of PFOS, PFOA, and PFBS in groundwater and/or soil and two AOPIs exceeded OSD risk screening levels. A summary of the SI results is presented below:

All soil detections were below the OSD risk screening levels; however, PFOS, PFOA, and/or PFBS were detected in soil at all three AOPIs where soil samples were collected as follows:

- PFOS was detected in nine of the 12 soil samples with a maximum concentration of 0.024 mg/kg at 0.5 to 2 feet bgs at AOPI Building 237 – Former JBM-HH Fire Station.
- PFOA was detected in three of the 12 soil samples with a maximum concentration of 0.014 mg/kg at 0.5 to 2 feet bgs at AOPI Building 237 – Former JBM-HH Fire Station.
- PFBS was not detected in any of the soil samples.

PFOS, PFOA, and/or PFBS were detected in groundwater at all four AOPIs and above the OSD risk screening levels at two AOPIs. Results are summarized below:

- PFOS exceeded the OSD risk screening level of 40 ng/L in two of the ten groundwater samples with a maximum concentration of 530 ng/L at AOPI Building 415 – Current JBM-HH Fire Station. A PFOS OSD exceedance also occurred AOPI Building 237 – Former JBM-HH Fire Station.

- PFOA exceeded the OSD risk screening level of 40 ng/L in two of the ten groundwater samples with a maximum concentration of 140 ng/L at AOPI Building 237 – Former JBM-HH Fire Station. A PFOA OSD exceedance also occurred at AOPI Building 415 – Current JBM-HH Fire Station.
- PFBS concentrations were below the OSD risk screening level of 600 ng/L in all ten samples. The maximum PFBS concentration of 320 ng/L was detected at AOPI Fort McNair Fire Apparatus Shelter.

Following the SI sampling, all four AOPIs with confirmed PFOS, PFOA, and/or PFBS presence were considered to have complete or potentially complete exposure pathways.

Complete exposure pathways include:

- Soil exposure pathways are complete for on-installation site workers at three of the four AOPIs:
  - Fort Myer Building 415 – Current JBM-HH Fire Station
  - Fort Myer Building 237 – Former JBM-HH Fire Station
  - Fort McNair Fire Apparatus Shelter
- Sediment (at the point of stormwater outfall) exposure pathways are complete for on-installation site workers at one of the four AOPIs:
  - Fort Myer Building 415 – Current JBM-HH Fire Station
- Sediment (in the stormwater-system drains) exposure pathways are complete for on-installation site workers at one of the four AOPIs:
  - Fort Myer Building 415 – Current JBM-HH Fire Station

Potentially complete exposure pathways include:

- Surface water, stormwater and/or sediment (discharge via outfall) pathways are potentially complete for on-installation site-workers at three of the four AOPIs:
  - Fort Myer Building 415 – Current JBM-HH Fire Station
  - Fort Myer Building 237 – Former JBM-HH Fire Station
  - Fort Myer Building 307 - Historical AFFF Storage Location
- Surface water and sediment pathways are potentially complete for off-installation receptors for all four AOPIs.
- The groundwater exposure pathway for off-installation receptors is potentially complete for all four AOPIs.

Although the CSMs indicate complete or potentially complete exposure pathways may exist, the recommendation for future study in a remedial investigation or no action at this time is based on the comparison of the SI analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2**). **Table 8-1** below summarizes the AOPIs identified at JBM-HH, PFOS, PFOA, and PFBS sampling and recommendations for each AOPI; further investigation is warranted at JBM-HH. In accordance with CERCLA, site-specific risk will be assessed during a future phase to evaluate whether remedial actions are required.

Table 8-1 Summary of AOPIs Identified during the PA, PFOS, PFOA, and PFBS Sampling at JBM-HH, and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NS)		Recommendation
	GW	SO	
Building 415 – Current JBM-HH Fire Station	Yes	No	Further study in remedial investigation
Building 237 – Former JBM-HH Fire Station	Yes	No	Further study in remedial investigation
Building 307 – Historical AFFF Storage Location	No	NS	No action at this time
Fort McNair Fire Apparatus Shelter	No	No	No action at this time

Notes:

Light gray shading – detection greater than the OSD risk screening level

GW – groundwater

NS – not sampled

SO – soil

Data collected during the PA (**Sections 3** through **5**) and SI (**Sections 6** through **8**) were sufficient to draw conclusions and recommendations summarized above. The data limitations relevant to the development of this PA/SI for PFOS, PFOA, and PFBS at JBM-HH are discussed below.

Data limitations encountered during the PA process include reporting inaccuracies related to potable well locations within 5-miles of Fort Myer and Fort McNair as encountered in the received EDR report, the uncertainty regarding the volume of foam releases associated with AFFF apparatus testing at fire station AOPIs, and the lack of an exhaustive search performed to identify off-post PFAS sources.

Records gathered for the use, storage and/or disposal of PFAS-containing materials were reviewed during the PA process. Documentation specific to AFFF may have been limited (e.g., each AFFF use; procurement records, documentation of AFFF used during crash responses or fire training activities) due to lack of recordkeeping requirements for the full timeline of common AFFF practices. Anecdotal accounts of AFFF use (and therefore likely PFOS, PFOA, and PFBS use) were limited to available installation personnel, whose knowledge of AFFF use may have been restricted by their time spent at the installation or previous roles held that limited their relevant knowledge of potential AFFF (or other PFAS-containing material) use.

A comprehensive well survey was not completed as part of this PA; therefore, the information reviewed regarding off-post wells is limited to what is contained in the off post well search results (**Appendix E**).

The searches for ecological receptors and off-post PFOS, PFOA, and PFBS sources were not exhaustive and were limited to easily identifiable and readily available information evaluated during the relevant documents research, installation personnel interviews, and site reconnaissance.

Finally, the available PFOS, PFOA, and PFBS analytical data are limited to results from groundwater samples at four AOPIs and soil samples at three AOPIs. Drinking water wells are not present on-post or within a 5-mile radius off-post; and were therefore not sampled as part of the SI. Available data, including PFOS, PFOA, and PFBS, are listed in **Appendix M**, which were analyzed per the selected analytical method.

Results from this PA/SI indicate further study in a remedial investigation is warranted at JBM-HH in accordance with the guidance provided by the OSD.

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10 ACRONYMS

°F	degrees Fahrenheit
%	percent
AFFF	aqueous film-forming foam
Alliance	Alliance Consulting Group
amsl	above mean sea level
AOPI	area of potential interest
ARFF	Aircraft Rescue and Firefighting
Arcadis	Arcadis U.S., Inc.
Army	United States Army
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	conceptual site model
DoD	Department of Defense
D.C.	District of Columbia
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
FCR	Field Change Report
HQAES	Headquarters Army Environmental System
IAP	Installation Action Plan
IDW	investigation-derived waste
IMCOM	Installation Management Command
installation	United States Army or Reserve installation
IRP	Installation Restoration Program
JBM-HH	Joint Base Myer – Henderson Hall
LOD	limit of detection
LOQ	limit of quantitation

MDW	United States Army Military District of Washington
mg/kg	milligrams per kilogram (parts per million)
NDU	National Defense University
ng/L	nanograms per liter (parts per trillion)
NS	not sampled
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	parts per million
ppt	parts per trillion
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RSL	Regional Screening Level
SI	site inspection
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
TGI	technical guidance instruction
TOC	total organic carbon
U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
USMC	United States Marine Corps
WTP	water treatment plant

TABLES

Table 6-1
Monitoring Well Construction Details
USAEC PFAS PA/SI
Joint Base Myer - Henderson Hall
Arlington, Virginia

Associated AOPI	Well Identification	Coordinates		Top of Casing Elevation (ft msl)	Screened Interval (ft bgs)	Total Depth (ft bgs)
		X-Coordinate	Y-Coordinate			
Building 415 – Current JBM-HH Fire Station	S-2	11886774.77	7004600.334	195.11	47.1 - 57.1	57.1
Building 415 – Current JBM-HH Fire Station	WCS-1	11886748.01	7004265.828	182.31	46.5 - 56.5	56.5
Building 415 – Current JBM-HH Fire Station	WF-1	11886662.34	7004421.905	188.91	37 - 47	50

Acronyms and Abbreviations:

AOPI = area of potential interest
bgs = below ground surface
ft = feet
JBM-HH = Joint Base Myer - Henderson Hall
msl = mean sea level
PA = preliminary assessment
PFAS = per- and polyfluoroalkyl substances
SI = site inspection
USAEC = United States Army Environmental Command

Table 7-1
Groundwater PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS PA/SI
Joint Base Myer - Henderson Hall
Arlington, Virginia

						PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
					Analyte						
					OSD Tapwater RiskScreening Level	40		40		600	
Associated AOPI	Location Type	Location	Sample ID / Parent Sample ID	Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Building 237 – Former JBM-HH Fire Station	Monitoring Well	JBMHH-B237-2	JBMHH-B237-2-GW-120221	12/02/2021	N	**84**		**140**		**18**	
Building 307 – Historical AFFF Storage Location	Monitoring Well	JBMHH-B307-1	JBMHH-B307-1-GW-120221	12/02/2021	N	**31**		**19**		**9.8**	
Building 307 – Historical AFFF Storage Location	Monitoring Well	JBMHH-B307-2	JBMHH-B307-2-GW-120221	12/02/2021	N	**14**		**12**		**7.9**	
Building 307 – Historical AFFF Storage Location	Monitoring Well	JBMHH-B307-3	JBMHH-B307-3-GW-120221	12/02/2021	N	**29**	J	**23**		**13**	
Building 415 – Current JBM-HH Fire Station	Monitoring Well	JBMHH-MW-S2	JBMHH-FD-1-GW-120221 / JBMHH-MW-S2-120221	12/02/2021	FD	1.8	U	**6.0**		**7.8**	
			JBMHH-MW-S2-120221	12/02/2021	N	1.8	U	**5.7**		**7.6**	
Building 415 – Current JBM-HH Fire Station	Monitoring Well	JBMHH-WCS1	JBMHH-MW-WCS1-120221	12/02/2021	N	**17**		**15**		**54**	
Building 415 – Current JBM-HH Fire Station	Monitoring Well	JBMHH-WF1	JBMHH-MW-WF1-120221	12/02/2021	N	**530**		**120**		**62**	
Fort McNair Fire Apparatus Shelter	Monitoring Well	JBMHH-FAS-1	JBMHH-FAS-1-GW-120221	12/02/2021	N	**1.2**	J	**8.7**		**320**	
Fort McNair Fire Apparatus Shelter	Monitoring Well	JBMHH-FAS-2	JBMHH-FAS-2-GW-120221	12/02/2021	N	2.1	U	**4.0**		**180**	

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection.
2. Gray shaded values indicate the result was detected greater than the 2021 Office of the Secretary of Defense (OSD) risk screening levels, (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September).

Acronyms/Abbreviations:
AOPI = area of potential interest
FD = field duplicate sample
ID = identification
JBM-HH = Joint Base Myer - Henderson Hall
N = primary sample
ng/L = nanograms per liter (parts per trillion)
PA = preliminary assessment
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier
SI = site inspection
USAEC = United States Army Environmental Command

Qualifier	Description
J	The analyte was positively identified; however, the associated numerical value is an estimated concentration only
U	The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).

Table 7-2
Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS PA/SI
Joint Base Myer - Henderson Hall
Arlington, Virginia

					Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
					OSD Industrial/Commercial Risk Screening Level	1.6		1.6		25	
					OSD Residential RiskScreening Levels	0.13		0.13		1.9	
Associated AOPI	Location Type	Location	Sample ID / Parent Sample ID	Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Building 237 – Former JBM-HH Fire Station	Soil	JBMHH-B237-1	JBMHH-B237-1-SO-(0.5-2)-120121	12/01/2021	N	**0.024**		**0.014**		0.0024	U
Building 237 – Former JBM-HH Fire Station	Soil	JBMHH-B237-2	JBMHH-B237-2-SO-(0.5-2)-120121	12/01/2021	N	**0.024**		**0.0019**		0.0021	U
Building 237 – Former JBM-HH Fire Station	Soil	JBMHH-B237-3	JBMHH-B237-3-SO-(0.5-2)-120121	12/01/2021	N	**0.013**		**0.0028**		0.0021	U
Building 415 – Current JBM-HH Fire Station	Soil	JBMHH-B415-1	JBMHH-B415-1-SO-(0.5-2)-120121	12/01/2021	N	**0.00069**	J	0.00078	U	0.0026	U
Building 415 – Current JBM-HH Fire Station	Soil	JBMHH-B415-2	JBMHH-B415-2-SO-(0.5-2)-120121	12/01/2021	N	**0.00089**		0.00066	U	0.0022	U
Building 415 – Current JBM-HH Fire Station	Soil	JBMHH-B415-3	JBMHH-B415-3-SO-(0.5-2)-120121	12/01/2021	N	**0.00087**		0.00066	U	0.0022	U
Building 415 – Current JBM-HH Fire Station	Soil	JBMHH-B415-4	JBMHH-B415-4-SO-(0.5-2)-120121	12/01/2021	N	**0.0014**		0.00061	U	0.0020	U
Fort McNair Fire Apparatus Shelter	Soil	JBMHH-FAS-1	JBMHH-DUP-SO-120221 / JBMHH-FAS-SO-1-(0.5-2.0)-120221	12/02/2021	FD	0.00072	U	0.00072	U	0.0024	U
			JBMHH-FAS-SO-1-(0.5-2.0)-120221	12/02/2021	N	0.00073	U	0.00073	U	0.0024	U
Fort McNair Fire Apparatus Shelter	Soil	JBMHH-FAS-2	JBMHH-FAS-SO-2-(0.5-2.0)-120221	12/02/2021	N	0.00074	U	0.00074	U	0.0025	U
Fort McNair Fire Apparatus Shelter	Soil	JBMHH-FAS-3	JBMHH-FAS-3-SO-(0.5-2.0)-120221	12/02/2021	N	**0.00057**	J	0.00077	U	0.0026	U
Fort McNair Fire Apparatus Shelter	Soil	JBMHH-FAS-4	JBMHH-FAS-4-SO-(0.5-2.0)-120221	12/02/2021	N	**0.00066**	J	0.00077	U	0.0026	U

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection.
2. Data are compared to the 2021 Office of the Secretary of Defense (OSD) risk screening levels for the residential and commerical/industrial scenario (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.).

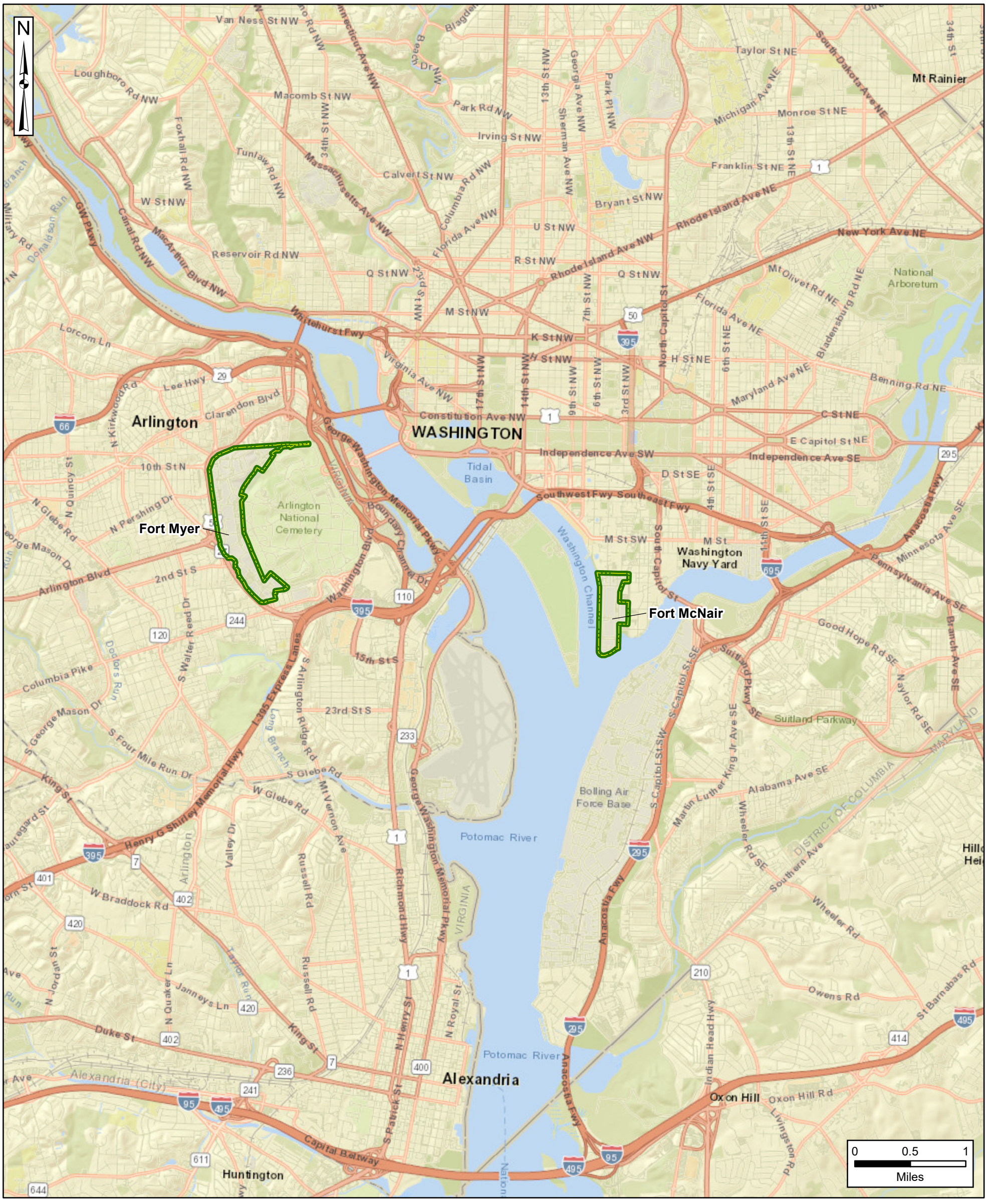
Acronyms/Abbreviations:
AOPI = area of potential interest
DPT = Direct-Push Technology
FD = field duplicate sample
ID = identification
JBM-HH = Joint Base Myer - Henderson Hall
mg/kg = milligrams per kilogram (parts per million)
N = primary sample
PA = preliminary assessment
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier
SI = site inspection
USAEC = United States Army Environmental Command

Qualifier	Description
J	The analyte was positively identified; however, the associated numerical value is an estimated concentration only.
U	The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).

FIGURES

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 2-1
Joint Base Myer-Henderson Hall
(Fort Myer and Fort McNair) Site Location



Installation Boundary

Data Sources:
JBMHH, GIS Data, 2020
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 2-2
Site Layout of Fort Myer

Installation Boundary

River/Stream

Water Body

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 2-3
Topographic Map of Fort Myer

Installation Boundary
River/Stream
Water Body
Elevation Contour (feet)

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 2-4
Site Layout of Fort McNair

Installation Boundary

Groundwater Flow Direction

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 2-5
Topographic Map of Fort McNair

Fort McNair Installation Boundary

Groundwater Flow Direction

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 5-2
AOPI Locations at Fort Myer

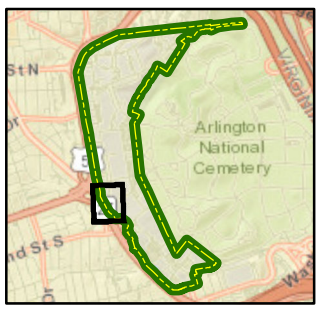
Installation Boundary
River/Stream
Water Body
Groundwater Flow Direction
AOPI

AFFF = aqueous film-forming foam
AOPI = area of potential interest
JBM-HH = Joint Base Myer - Henderson Hall

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA



Fort Myer

Figure 5-3
Aerial Photo of Building 415 - Current JBM-HH Fire Station AOPI

Note:
1. May 2010 Shallow Potentiometric Surface Contours from Final Phase II Pilot Study Work Plan for Former PX Dry Cleaning Facility.

- Installation Boundary
- River/Stream
- Surface Water Runoff Flow Direction
- Groundwater Flow Direction
- Shallow Potentiometric Surface Contour (May 2010)
- Estimated Shallow Potentiometric Surface Contour (May 2010)
- Approximate Area of AFFF Release
- AOPI
- Stormwater Line
- Culvert
- Inlet
- Outfall
- Monitoring Well

AFFF = aqueous film-forming foam
AOPI = area of potential interest
JBM-HH = Joint Base Myer - Henderson Hall

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 5-4
Aerial Photo of Building 237 - Former JBM-HH Fire Station AOPI

Fort Myer

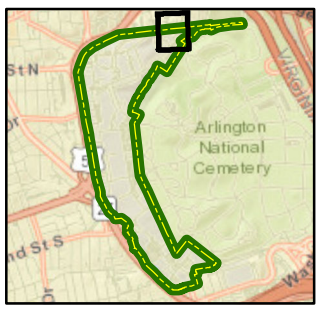
Installation Boundary
Water Body
Groundwater Flow Direction
AOPI
Approximate Area of AFFF Release

AFFF = aqueous film-forming foam
AOPI = area of potential interest
JBM-HH = Joint Base Myer - Henderson Hall

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA



Fort Myer

Figure 5-5
Aerial Photo of Building 307 - Historical AFFF Storage Location AOPI

Installation Boundary

Groundwater Flow Direction

AOPI

Location of AFFF Storage Area in Building 307

AFFF = aqueous film-forming foam
AOPI = area of potential interest

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 5-6
AOPI Locations at Fort McNair

Installation Boundary

Groundwater Flow Direction

AOPI

AOPI = area of potential interest

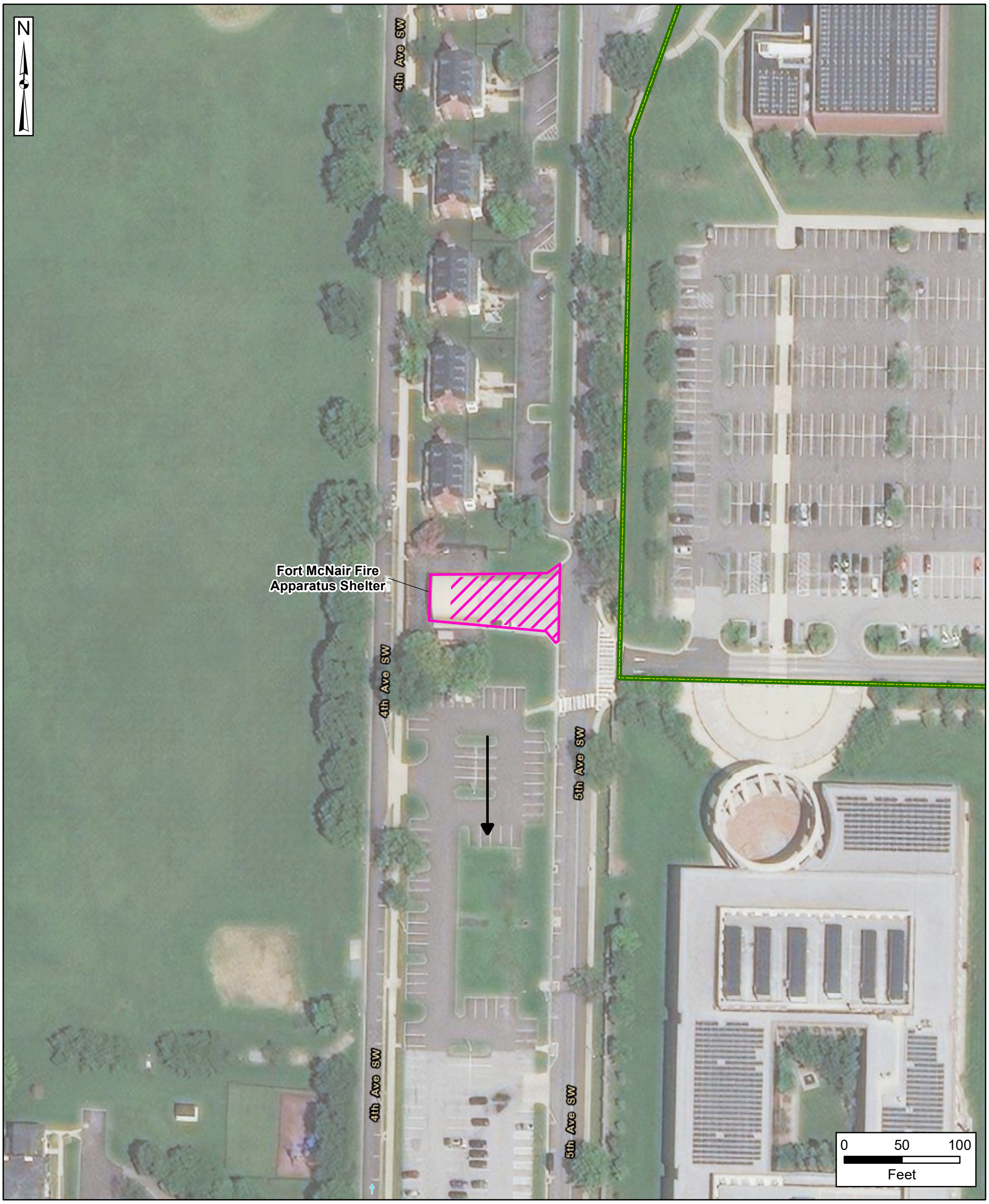
Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 5-7
Aerial Photo of the Fort McNair Fire Apparatus Shelter AOPI

Fort McNair



Installation Boundary
Groundwater Flow Direction
AOPI
Approximate Area of AFFF Release

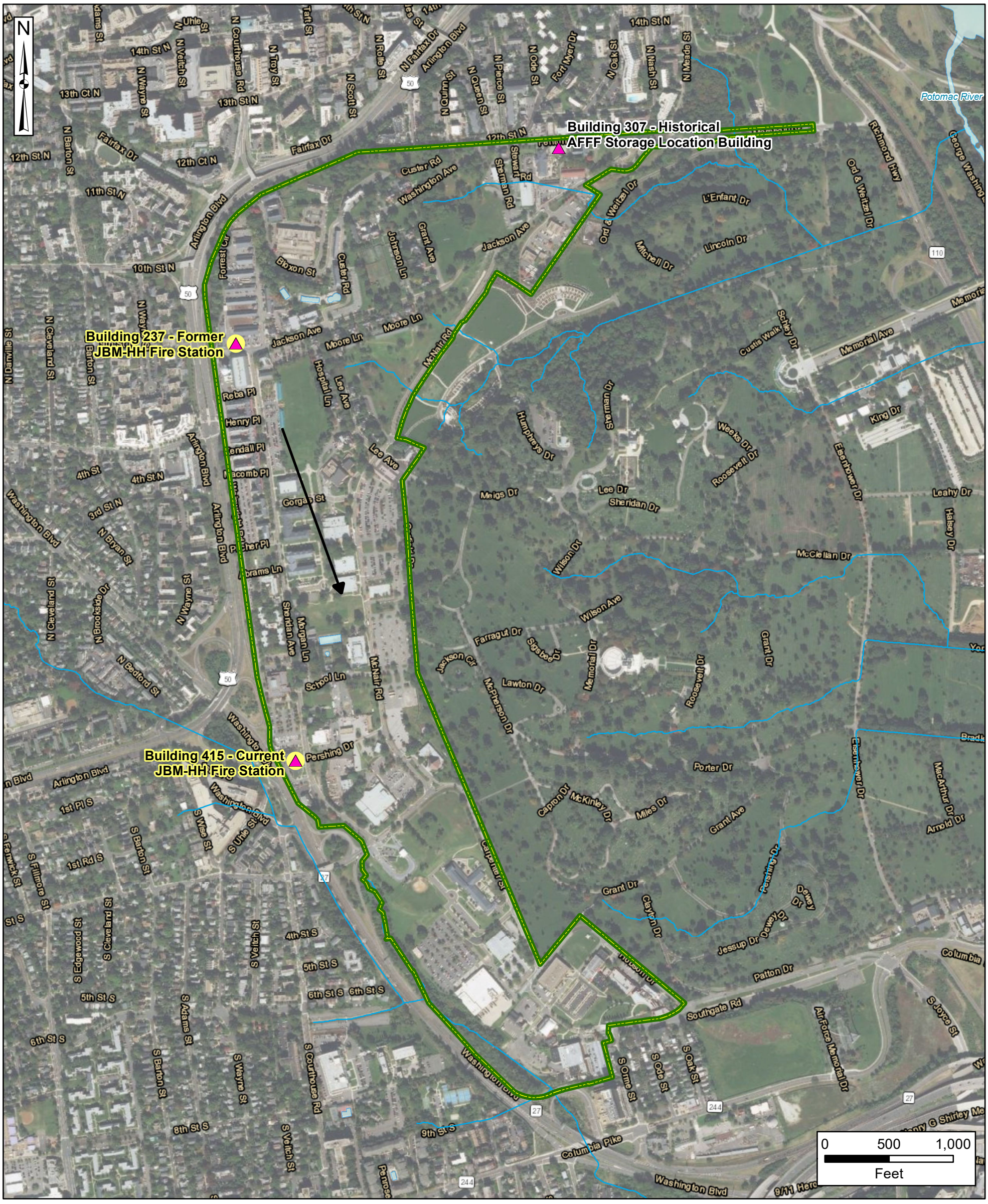
AFFF = aqueous film-forming foam
AOPI = area of potential interest

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 7-1
AOPI Locations and OSD Risk Screening Level Exceedances at Fort Myer



Installation Boundary
River/Stream
Water Body
Groundwater Flow Direction
AOPI
AOPI Location with OSD Risk Screening Level Exceedance

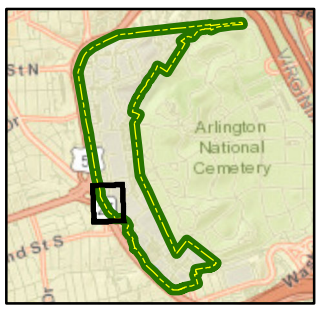
Note:
There were no OSD risk screening level exceedances at Fort McNair.

AFFF = aqueous film-forming foam
AOPI = area of potential interest
JBM-HH = Joint Base Myer - Henderson Hall
OSD = Office of the Secretary of Defense

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA



Fort Myer

Figure 7-2
Building 415 – Current JBM-HH Fire Station
PFOS, PFOA, and PFBS Analytical Results

JBMHH-MW-S2	
Date	12/2/2021
PFOS	1.8 U [1.8 U]
PFOA	**5.7 [6]**
PFBS	**7.6 [7.8]**

Building 415 - Current JBM-HH Fire Station

JBMHH-B415-1-SO	
Date	12/1/2021
Depth	0.5-2 ft bgs
PFOS	**0.00069 J**
PFOA	0.00078 U
PFBS	0.0026 U

JBMHH-B415-2-SO	
Date	12/1/2021
Depth	0.5-2 ft bgs
PFOS	**0.00089**
PFOA	0.00066 U
PFBS	0.0022 U

JBMHH-B415-3-SO	
Date	12/1/2021
Depth	0.5-2 ft bgs
PFOS	**0.00087**
PFOA	0.00066 U
PFBS	0.0022 U

JBMHH-WF1	
Date	12/2/2021
PFOS	**530**
PFOA	**120**
PFBS	**62**

JBMHH-B415-4-SO	
Date	12/1/2021
Depth	0.5-2 ft bgs
PFOS	**0.0014**
PFOA	0.00061 U
PFBS	0.0020 U

JBMHH-WCS1	
Date	12/2/2021
PFOS	**17**
PFOA	**15**
PFBS	**54**

147 146 145 144 143 142 141 140 139 138

Notes:
1. May 2010 Shallow Potentiometric Surface Contours from Final Phase II Pilot Study Work Plan for Former PX Dry Cleaning Facility.
2. Groundwater results (green boxes) are reported in nanograms per liter (ng/L), or parts per trillion.
3. Soil results (yellow boxes) are reported in milligrams per kilogram (mg/kg), or parts per million.
4. Results in brackets are field duplicate sample results.
5. Bolded values indicate detections.
6. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.

Qualifiers:
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 50 100
Feet

Installation Boundary
River/Stream
Surface Water Runoff Flow Direction
Groundwater Flow Direction
Shallow Potentiometric Surface Contour (May 2010)
Estimated Shallow Potentiometric Surface Contour (May 2010)
Approximate Area of AFFF Release
AOPI
Stormwater Line
Culvert
Inlet
Outfall
Monitoring Well
Soil Sampling Location
Groundwater Sampling Location - Existing Well

AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft bgs = feet below ground surface
JBM-HH = Joint Base Myer - Henderson Hall
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

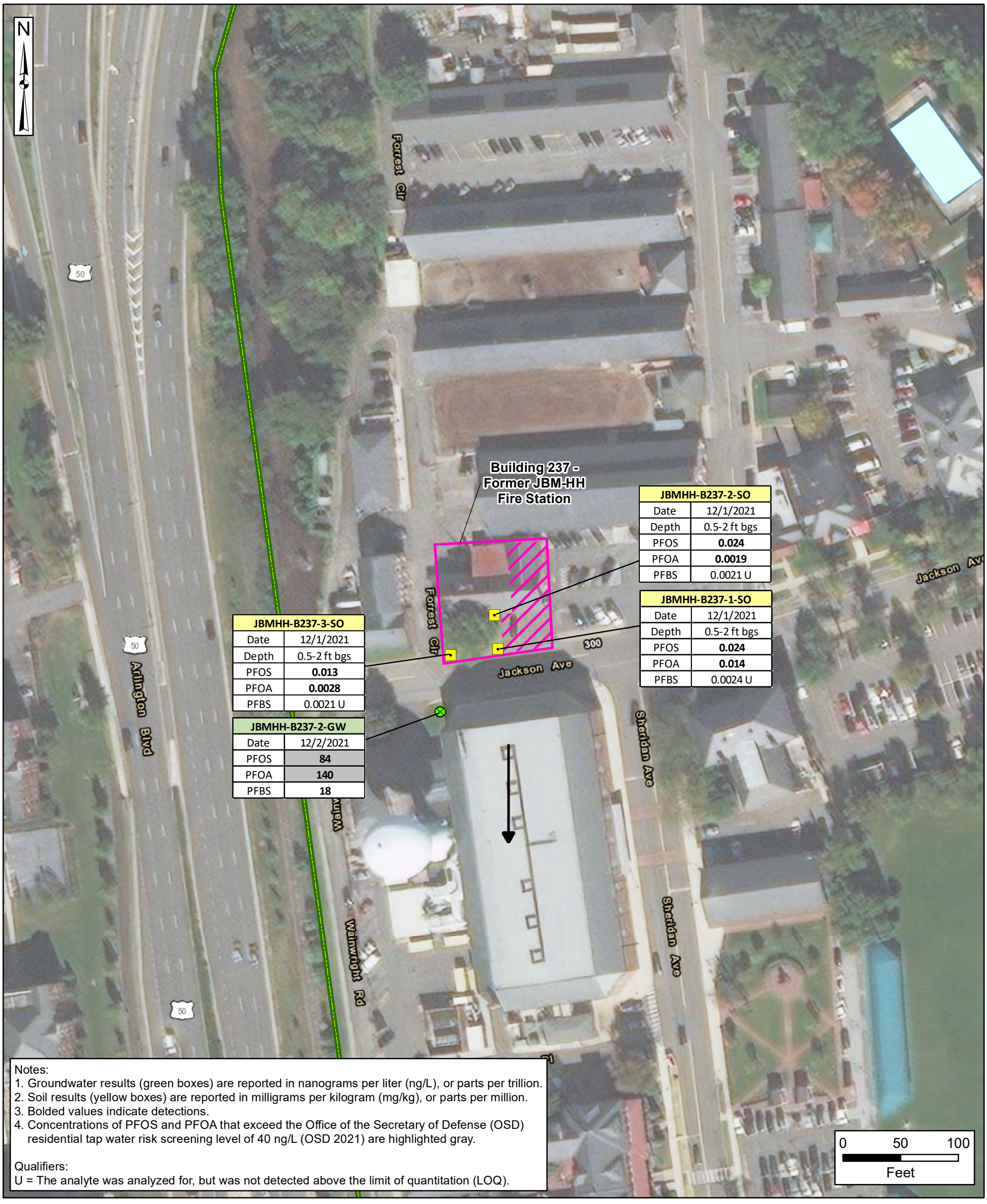
Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 7-3
Building 237 – Former JBM-HH Fire Station
PFOS, PFOA, and PFBS Analytical Results

Fort Myer



JBMHH-B237-2-SO	
Date	12/1/2021
Depth	0.5-2 ft bgs
PFOS	**0.024**
PFOA	**0.0019**
PFBS	0.0021 U

JBMHH-B237-1-SO	
Date	12/1/2021
Depth	0.5-2 ft bgs
PFOS	**0.024**
PFOA	**0.014**
PFBS	0.0024 U

JBMHH-B237-3-SO	
Date	12/1/2021
Depth	0.5-2 ft bgs
PFOS	**0.013**
PFOA	**0.0028**
PFBS	0.0021 U

JBMHH-B237-2-GW	
Date	12/2/2021
PFOS	**84**
PFOA	**140**
PFBS	**18**

Notes:
1. Groundwater results (green boxes) are reported in nanograms per liter (ng/L), or parts per trillion.
2. Soil results (yellow boxes) are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Bolded values indicate detections.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.

Qualifiers:
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

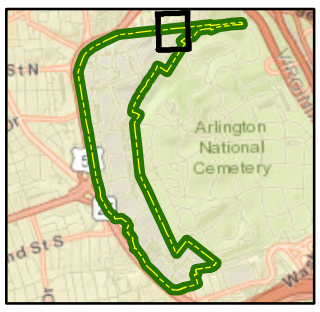
Installation Boundary
Water Body
Groundwater Flow Direction
AOPI
Approximate Area of AFFF Release
Soil Sampling Location
Groundwater Sampling Location

AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft bgs = feet below ground surface
JBM-HH = Joint Base Myer - Henderson Hall
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA



Fort Myer

Figure 7-4
Building 307 – Historical AFFF Storage Location
PFOS, PFOA, and PFBS Analytical Results

Notes:
1. Groundwater results (green boxes) are reported in nanograms per liter (ng/L), or parts per trillion.
2. Bolded values indicate detections.

Installation Boundary
Groundwater Flow Direction
AOPI
Location of AFFF Storage Area in Building 307
Groundwater Sampling Location

AFFF = aqueous film-forming foam
AOPI = area of potential interest
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

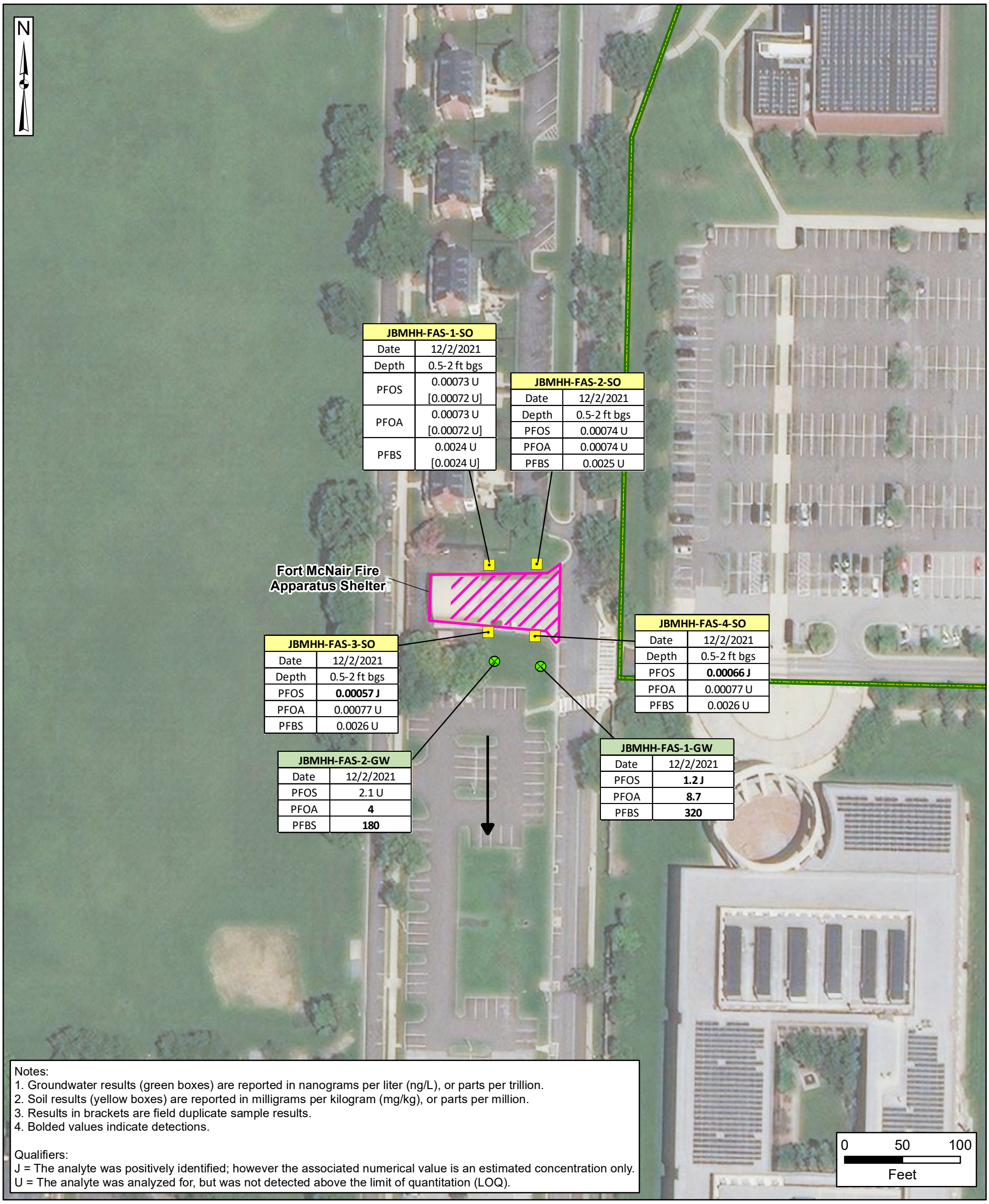
Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Joint Base Myer - Henderson Hall, VA

Figure 7-5
Fort McNair Fire Apparatus Shelter
PFOS, PFOA, and PFBS Analytical Results

Fort McNair



Notes:
1. Groundwater results (green boxes) are reported in nanograms per liter (ng/L), or parts per trillion.
2. Soil results (yellow boxes) are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Results in brackets are field duplicate sample results.
4. Bolded values indicate detections.

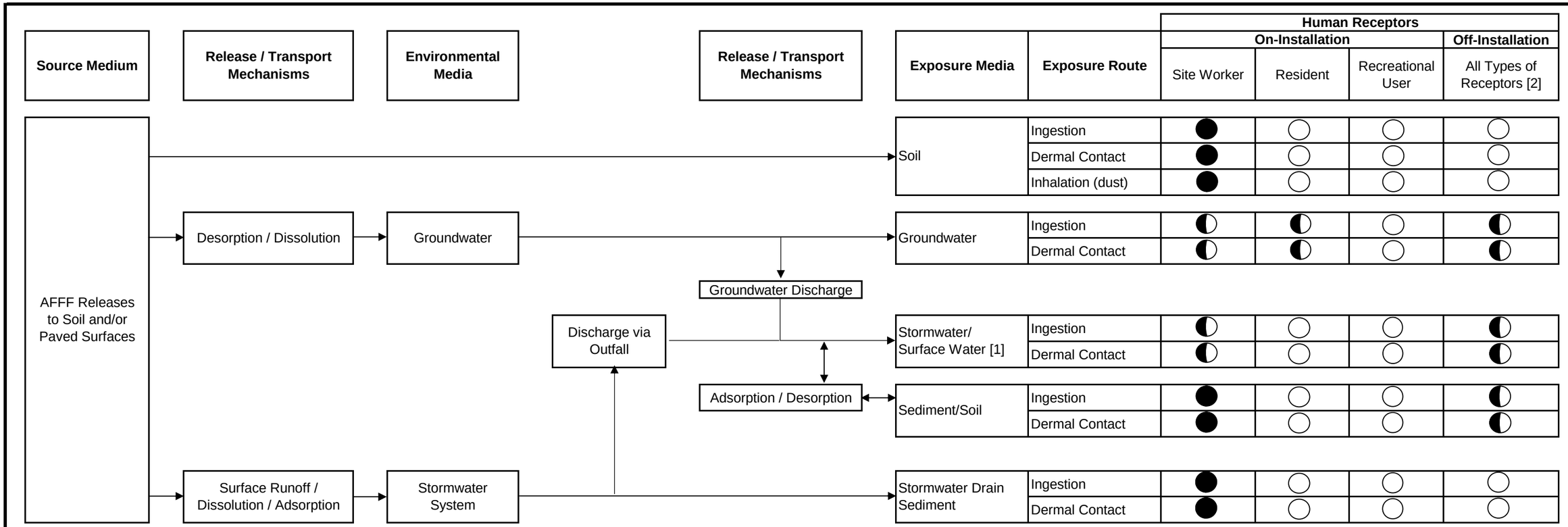
Qualifiers:
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
Groundwater Flow Direction
AOPI
Approximate Area of AFFF Release
Soil Sampling Location
Groundwater Sampling Location

AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
JBMHH, GIS Data, 2020
USGS, NHD Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North



Exposure Media	Exposure Route	Human Receptors: On-Installation: Site Worker	Human Receptors: On-Installation: Resident	Human Receptors: On-Installation: Recreational User	Human Receptors: Off-Installation: All Types of Receptors [2]
Soil	Ingestion	●	○	○	○
	Dermal Contact	●	○	○	○
	Inhalation (dust)	●	○	○	○
Groundwater	Ingestion	◐	◐	○	◐
	Dermal Contact	◐	◐	○	◐
Stormwater/ Surface Water [1]	Ingestion	◐	○	○	◐
	Dermal Contact	◐	○	○	◐
Sediment/Soil	Ingestion	●	○	○	◐
	Dermal Contact	●	○	○	◐
Stormwater Drain Sediment	Ingestion	●	○	○	○
	Dermal Contact	●	○	○	○

Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

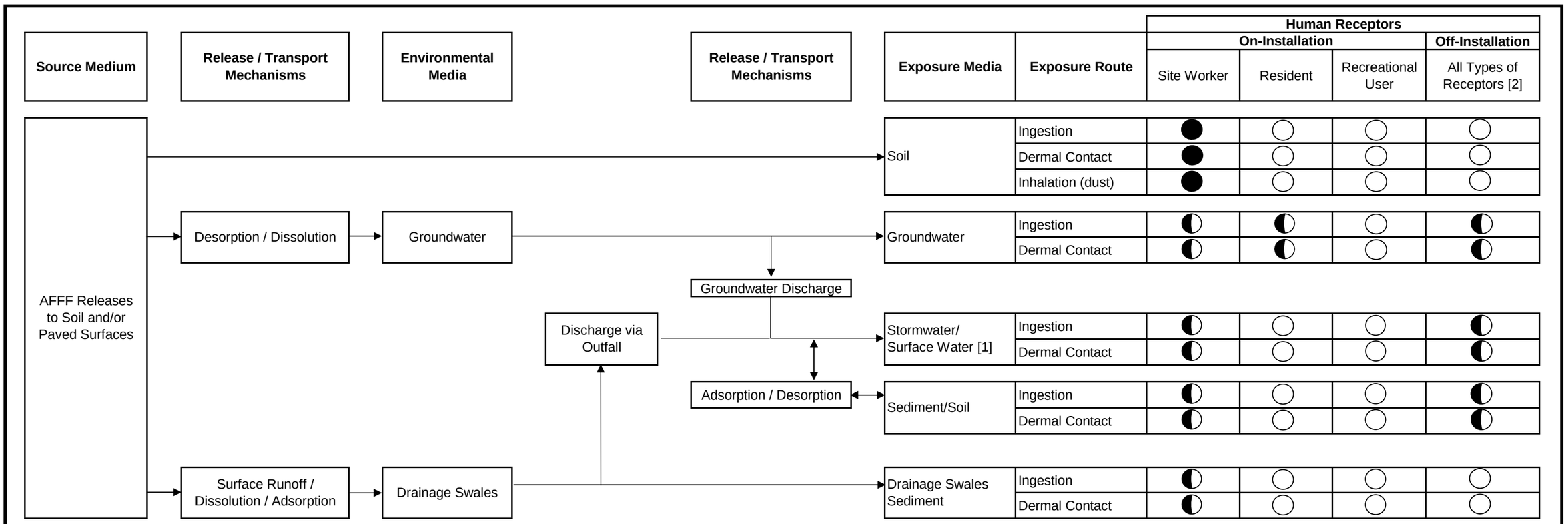
○ = Incomplete Exposure Pathway

Notes:
[1] Surface water exposure pathway for Site Workers and Residents describes a drinking water scenario, and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.
AFFF = Aqueous film forming foam

ARCADIS

Conceptual Site Model for the Building 415 - Current JBM-HH Fire Station AOPI (Fort Myer)
USAEC PFAS QAPP Addendum
Arlington, Virginia

Figure 7-6



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

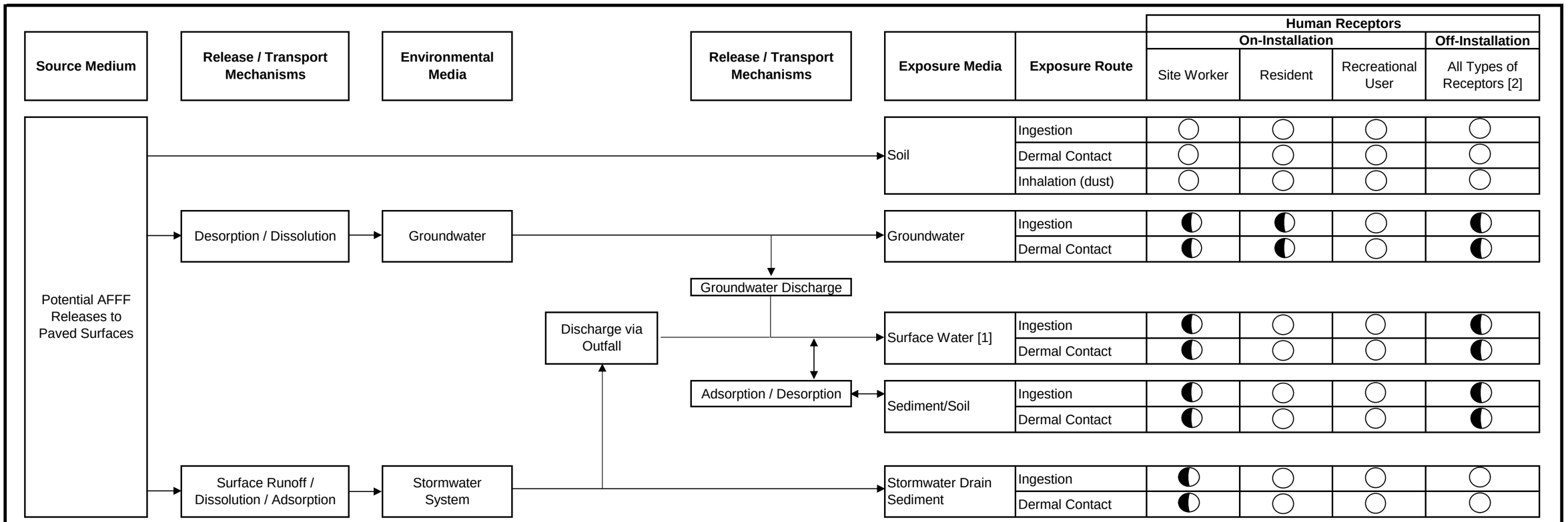
○ = Incomplete Exposure Pathway

Notes:
[1] Surface water exposure pathway for Site Workers and Residents describes a drinking water scenario, and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.
AFFF = Aqueous film forming foam

ARCADIS

Conceptual Site Model for the Building 237 - Former JBM-HH Fire Station AOPI (Fort Myer)
USAEC PFAS QAPP Addendum
Arlington, Virginia

Figure 7-7



Legend:

◐ = Potentially Complete Exposure Pathway

◯ = Incomplete Exposure Pathway

Notes:
[1] Surface water exposure pathway for Site Workers and Residents describes a drinking water scenario, and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.
AFFF = Aqueous film forming foam

ARCADIS

Conceptual Site Model for the Building 307 - Historical AFFF Storage Location AOPI (Fort Myer)
USAEC PFAS QAPP Addendum
Arlington, Virginia

Figure 7-8

Source Medium	Release / Transport Mechanisms	Environmental Media	Release / Transport Mechanisms	Exposure Media	Exposure Route	Human Receptors			
						On-Installation			Off-Installation
						Site Worker	Resident	Recreational User	All Types of Receptors [2]
AFFF Releases to Soil and/or Paved Surfaces				Soil	Ingestion	●	○	○	○
					Dermal Contact	●	○	○	○
					Inhalation (dust)	●	○	○	○
	Desorption / Dissolution	Groundwater		Groundwater	Ingestion	◐	◐	○	○
					Dermal Contact	◐	◐	○	○
			Groundwater Discharge						
	Surface Runoff / Dissolution / Adsorption	Stormwater or Surface Water		Surface Water [1]	Ingestion	○	○	○	◐
					Dermal Contact	○	○	○	◐
			Adsorption / Desorption	Sediment	Ingestion	○	○	○	◐
					Dermal Contact	○	○	○	◐

Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Notes:
[1] Surface water exposure pathway for Site Workers and Residents describes a drinking water scenario, and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.
AFFF = Aqueous film forming foam

ARCADIS

Conceptual Site Model for the Fort McNair Fire Apparatus Shelter AOPI
USAEC PFAS QAPP Addendum
Arlington, Virginia

Figure 7-9