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

Fort Stewart, Georgia

Prepared For:
U.S. Army Corps of Engineers, Baltimore District
2 Hopkins Plaza
Baltimore, Maryland 21201

July 2022

Scott Bostian
Site Inspection Project Manager, Arcadis U.S., Inc.

Rhonda Stone, PMP
Project Manager, Arcadis U.S., Inc.

Eric Killenbeck
Technical Expert, Arcadis U.S., Inc.

Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

Fort Stewart, Georgia

Prepared for:

U.S. Army Corps of Engineers

Contract No.: W912DR-18-D-0004

Delivery Order No.: W912DR1818F0685

Prepared by:

Arcadis U.S., Inc.

7550 Teague Road

Suite 210

Hanover

Maryland 21076

Arcadis Ref.:

30001992

Date:

July 2022

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 (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 Fort Stewart (FST) 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 (DoD) policy and guidance.

FST encompasses approximately 280,000 acres and is located north of Hinesville, Georgia, approximately 40 miles southwest of Savannah, Georgia. The installation is the largest Army installation east of the Mississippi River, spanning portions of Bryan, Evans, Liberty, Long and Tattnall counties and can accommodate training for 50,000 Reserve Component soldiers annually. Tank, field artillery, helicopter gunnery, and small arms ranges are used simultaneously throughout the year.

The FST PA identified 13 AOPIs for investigation during the SI phase. SI sampling results from the 13 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 12 AOPIs; 9 of the 13 AOPIs had PFOS, PFOA, and/or PFBS present at concentrations greater than the risk-based screening levels in samples collected. The FST 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 FST and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/ND/NS)			Recommendation
	GW	SO	SW	
Fire Station 01	No	ND	NS	No action at this time
Fire Station 03	Yes	Yes	NS	Further study in a remedial investigation
Current AFFF Storage	Yes	No	NS	Further study in a remedial investigation
Fire Station 05	Yes	No	NS	Further study in a remedial investigation
Quarterly Crash Drill Area	Yes	Yes	NS	Further study in a remedial investigation

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/ND/NS)			Recommendation
	GW	SO	SW	
Taxiway E	Yes	No	NS	Further study in a remedial investigation
Wright Army Airfield FTA (FST-013)	Yes	No	NS	Further study in a remedial investigation
33R Approach	Yes	ND	NS	Further study in a remedial investigation
Former AFFF Storage	Yes	ND	NS	Further study in a remedial investigation
Post South Central Landfill	ND	NS	NS	No action at this time
Vehicle Fire 01	No	ND	NS	No action at this time
Vehicle Fire 02	No	ND	ND	No action at this time
Building 1838	Yes	No	NS	Further study in a remedial investigation

Notes:

Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
ND – non-detect
NS – not sampled
SO – soil
SW – surface water

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 Fort Stewart (FST) 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 FST 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 or 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 FST, 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 FST. The PA and SI processes are documented in the PA/SI Quality Control Checklist included as **Appendix B**.

1.3.1 Preliminary Assessment 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), FST, and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred on 08 August 2018, 7 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 FST.

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 24 to 26 September 2018. 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 FST. 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, or 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, was also noted during the site reconnaissance in case the monitoring wells could be proposed for SI sampling. 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 on 26 September 2018 with the installation, USAEC, and USACE to discuss preliminary findings of the PA site visit.

1.3.3 Preliminary Assessment Post-Site Visit

Information collected before, during, and after the 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 FST.

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 (UXO) or cultural resource areas
- confirm the plan for investigation-derived waste (IDW) handling and disposal
- 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 regulatory involvement requirements or preferences
- confirm overlapping unexploded ordnance or cultural resources areas
- confirm specific installation access requirements and proposed schedule
- 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 FST (Arcadis 2020a) 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

The following subsections provide general information about FST, 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 Site Location

FST encompasses approximately 280,000 acres and is located north of Hinesville, Georgia, approximately 40 miles southwest of Savannah, Georgia (**Figure 2-1**). FST is the largest Army installation east of the Mississippi River, spanning portions of Bryan, Evans, Liberty, Long and Tattnall counties and can accommodate training for 50,000 Reserve Component soldiers annually. Tank, field artillery, helicopter gunnery, and small arms ranges are used simultaneously throughout the year. FST's proximity to the Port of Savannah and the runway at Hunter Army Airfield (HAAF) help make FST/HAAF the Army's premier heavy, rapid force point of deployment. **Figure 2-2** depicts the layout of the installation.

2.2 Mission and Brief Site History

FST traces its history to Camp Stewart, which was established in 1940 after Congress authorized funding for the purchase of property in coastal Georgia for the purpose of building an anti-aircraft artillery training center. On 01 July 1940, the first 5,000 acres were purchased, and additional land purchases followed. The large expanse of property was required for the firing ranges and impact areas that an anti-aircraft artillery training center required for live-fire training (IRP 1993).

FST is currently responsible for the combat training of the equivalent of two heavy divisions of the Army. This training includes soldiers stationed at FST, across Georgia, and at other locations of the southeastern U.S. The primary mission of FST is to support and assist in training the 3rd Infantry Division (Mechanized). It is also responsible for supporting non-divisional units' training for their respective combat roles. In addition, FST has an area mission to provide support and services to other agencies, Reserve forces, and installations within the prescribed area of responsibility (IRP 1993).

The 3rd Infantry Division (Mechanized) is the Army's first modular division with the following major units: 1st, 2nd, and 4th Heavy Brigade Combat Teams, 3rd Sustainment Brigade, 3rd Combat Aviation Brigade, 385th Military Police Battalion, and the Special Troops Battalion. U.S. Army Special Operations Command has two battalions at HAAF that train at FST, the 1-75th Ranger Battalion and the 3-160th Special Operations Aviation Regiment. The 3rd Heavy Brigade Combat Team operates out of Fort Benning, Georgia, but often trains at FST (IRP 1993).

A majority of FST is designated as operational range area, with 274 ranges listed in the September 2005 version of the Army Range Inventory Database Geo-database. The perimeter of the installation is mainly non-firing maneuver and training ranges. The active ranges deeper within the installation currently provide (and historically have provided) the space necessary for live-fire impact areas from tank and anti-aircraft artillery. Surrounding the impact areas are live-fire ranges designated for either small or large caliber military munitions (IRP 1993).

2.3 Current and Projected Land Use

FST encompasses approximately 280,000 acres and currently has 255 operational ranges. Military munitions related activities occur at 110 of the 255 ranges, and these 110 ranges encompass 14,592 acres. Areas not currently associated with military munitions related activities include the cantonment area (7,105 acres), which is situated centrally on the southern boundary, six historical ranges identified in the Army Range Inventory Database Geo-database (1,628 acres), and 145 operational ranges (263,592 acres) utilized as maneuver/training areas. Ranges identified as training/maneuver areas have been limited to no military munitions related activities; these include observation points, aviation facilities, and Soldier fieldcraft training sites. Historical range outline maps from 1941 through 2021 show that 218,224 acres of the installation were utilized historically for military munitions related activities, including firing fans and impact areas.

The mission of the FST complex is to sustain a quality of life and installation support at the level necessary for division, non-divisional, tenant and reserve component units to accomplish their training mission (Malcom Pirnie 2006).

Projected land use is anticipated to remain consistent with current land use.

2.4 Climate

FST has a humid, subtropical climate, with long, warm, humid summers and short, mild winters. Temperatures range from an average of 80 degrees Fahrenheit (°F) in July to 50°F in December, with an annual average of 70°F. Average annual precipitation is 50 inches, with approximately half falling from June through September. The wettest month is July, with an average rainfall of 7.6 inches, and the driest is November, with an average rainfall of 1.6 inches (U.S. Climate Data 2021). Under normal conditions, wind speed rarely exceeds 6 miles per hour; however, thunderstorms, hurricanes and tropical storms, occurring most frequently from May through September, can produce gusty surface winds of over 29 miles per hour from the northwest (Malcolm Pirnie 2006).

2.5 Topography

FST is located in the Lower Georgia Coastal Plain physiographic province, a segment of the Atlantic Coastal Plain of eastern North America. The general topography of this province is flat to gently rolling with relatively low elevations that decrease gradually to sea level at the Atlantic Ocean. The topography is marked by the presence of numerous marine terraces, many of which consist of low elongated ridges that parallel the coastline. These low ridges generally are separated by wide swampy valleys. FST rises from near sea level in the eastern portion of the installation to 183 feet above mean sea level along its western border (**Figure 2-3**). Most of the land is less than 33 feet above mean sea level with slopes of less than 3 percent (%) (The Nature Conservancy 1995).

2.6 Geology

FST is located in the Lower Coastal Plain physiographic province and is underlain by a moderately thick wedge of unconsolidated and semi-consolidated sediments that overlie carbonate rocks (limestone and dolostone of Eocene to Oligocene age) at varying depths that dip to the southeast (Cramer and Arden

1980). These sediments consist of a sandy surface layer over subsoil that may be sandy, clayey, loamy, or a combination thereof. These sediments range from approximately 50 to 180 feet thick, with low to moderate permeability (Malcolm Pirnie 2006).

2.7 Hydrogeology

There are three distinct aquifer systems in the FST region that include the surficial, the Brunswick, and the Floridan aquifer systems. The surficial aquifer consists of Miocene to post Miocene age deposits of sand, silt and clay, ranging in thicknesses from 155 to 230 feet. The Brunswick aquifer is further divided into the upper and lower Brunswick aquifers and consists of Miocene to Oligiocene-aged fine to coarse sand, silt and clay. These deposits extend between 375 and 445 feet below ground surface (bgs). Beneath the Brunswick aquifer is the Floridan aquifer system, which is considered the principal source of all water uses in the coastal area. The Floridan aquifer serves as the primary source of large groundwater withdrawals in the coastal area. This system consists of deep sequences of limestone and dolomite of the Eocene to Oligocene age. The Floridan aquifer is derived from the Oligocene series of sandy, phosphatic limestone and is underlain by the Ocala Limestone of the Eocene age (U.S. Army Toxic and Hazardous Materials Agency 1983).

According to regional aquifer and groundwater flow studies conducted by the United States Geological Survey in the Coastal Plain area (Clarke 2004), the Floridan aquifer system is under artesian conditions and is separated from the two shallow aquifer systems by confining units consisting of silty clay and dense phosphatic dolomite. These confining units occur beneath the surficial aquifer and beneath the Brunswick aquifer. Reported vertical hydraulic conductivities of the confining unit separating the surficial aquifer and the Brunswick aquifer range from $5.3x10^{-5}$ to $1.3x10^{-4}$ feet/day. The hydraulic conductivities for the confining unit separating the Brunswick and Floridan aquifer range between $2.3x10^{-3}$ and 3.0 feet/day. Recharge for the Floridan aquifer system is an area 60 - 100 miles northwest of Savannah. The directional flow of the surficial aquifer is believed to follow the flow patterns of the surface water. The surface aquifer is recharged directly from rainfall percolating through sediments. During dry months, the base flow of streams and rivers of the coastal area is maintained by discharge from the surface aquifer (U.S. Army Toxic and Hazardous Materials Agency 1983).

2.8 Surface Water Hydrology

Approximately 90,000 acres of the installation consist of designated wetlands, most of which are associated with surface streams, rivers, and ponds. FST has many surface water resources, including rivers, streams, ponds, and lakes that spread over four watershed regions (Altamaha River, Canoochee River, Ogeechee River and the Laurel View River watersheds). A majority of the installation is located within the watershed of the Canoochee River. The Canoochee River flows primarily west to east centrally through FST to its confluence with the Ogeechee River. The Ogeechee River forms part of the northeastern border of FST and is an identified recreational resource, with a boat ramp listed at Morgans Bridge at this northeastern boundary. Although most of the installation is drained by the Canoochee River Watershed, part of the northeast quadrant drains directly into the Ogeechee River. The southwest quadrant is drained by Beards Creek, which is part of the Altamaha River Watershed. The southeast quadrant drains into the Laurel View River, with Peacock Creek, Raccoon Branch, and the Jerico River leaving the installation as the headwaters of this system. Two sub-watersheds have also been identified

on FST. These sub-watersheds are associated with the Canoochee River and Ogeechee River watershed systems; however, they are physically separated from the main watershed systems on FST. Off installation, these sub-watershed systems join the main watershed systems. The four watershed regions of the Altamaha, Canoochee, Laurel View and Ogeechee rivers, along with two sub-watersheds associated with the Canoochee River and Ogeechee River watersheds, form the regions of surface water movement off installation (U.S. Army Toxic and Hazardous Materials Agency 1983).

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 FST.

2.9.1 Stormwater Management System Description

Stormwater runoff at FST drains through an extensive network of surface and subsurface conduits and culverts. The principal drainage channels flowing through improved grounds on the installation eventually discharge to the Ogeechee River.

2.9.2 Sewer System Description

The former wastewater treatment plant (WWTP) at FST operated from the 1940s until approximately 1984, when it was replaced by the current Hinesville/FST WWTP, which was built in close proximity to the footprint of the former WWTP. The Hinesville/FST WWTP receives sewage from the installation, including fire stations which may have PFAS-impacted waters. Sludge from the former FST WWTP was dewatered at the old sludge drying bed location (FST-09). The sludge drying beds were reportedly removed and backfilled in 1989. Since 1991, all biosolids from the current Hinesville/FST WWTP have been disposed of at Waste Management's Superior Landfill site in Savannah, Georgia.

2.10 Potable Water Supply and Drinking Water Receptors

FST maintains its own potable water distribution system. There are 19 water supply wells located within the installation boundary. These wells draw water from the Floridan aquifer. One well is considered inactive or closed, and one well produces non-potable water. The remaining 17 wells are used to supply water to the installation. The locations of on-site drinking water wells are shown on **Figure 2-2;** well construction details are provided in **Appendix E**.

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 FST, which along with state and county GIS provided by the installation identified several off-post public and private wells within 5 miles of the installation boundary (**Figure 2-4**). Surrounding off-post water supply wells downgradient of FST are known to be screened in the deeper Floridian Aquifer. The EDR report providing well search results is provided as **Appendix F.**

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.

FST harbors many federally and state listed threatened, endangered, or species of special concern. Based on their risk of extinction or decline,17 wildlife species and nine plant species that occur or may occur at FST have been designated a special status at the federal and/or state level (United States Fish and Wildlife Service 2019).

According to the installation's Directorate of Public Works, Environmental and Natural Resources Division, seven federally listed threatened or endangered species are known to occur on FST: the smooth coneflower *(Echinacea laevigata)*, the eastern indigo snake (*Drymarchon coralis couperi*), flatwoods salamander (*Ambystoma cingulatum*), wood stork (*Mycteria Americana*), red cockaded woodpecker (*Picoides borealis*) and the shortnose sturgeon (*Acipenser brevirostrum*).

The eastern indigo snake, federally listed as threatened, is uncommon and locally distributed on the installation. The majority of eastern indigo snake observations at FST have been at gopher tortoise burrows in sandhills. The installation's four known eastern indigo snake populations are associated with sandhills along the Canoochee River, Ogeechee River, and Beards Creek.

The frosted flatwoods salamander, federally listed as threatened, has widespread habitat on the installation and includes many areas that are not heavily used or impacted by mechanized training activities, namely isolated wetlands.

The wood stork, federally listed as threatened, is not known to nest on FST. The wood stork is known to occasionally forage in the wetlands present on FST. The eastern black rail *(Laterallus jamaicensis jamaicensis)* was federally listed as threatened in 2020, but this secretive bird has never been detected on FST. There is a small chance it could occur in longleaf flatwoods during migration.

The occurrence of the red cockaded woodpecker, federally listed as endangered, is habitat specific. There are 636 sites identified as red cockaded woodpecker clusters on FST.

The shortnose and Atlantic sturgeons, federally listed as endangered, have been seen off installation south of the confluence of the Canoochee and Ogeechee rivers. Adverse impacts on the species have not been noted. The smooth coneflower, federally listed as endangered, occurs in a small 0.10-acre patch in the northwestern part of FST (United States Fish and Wildlife Service 2019).

2.12 Previous PFAS Investigations

In 2014, under the third Unregulated Contaminant Monitoring Rule, samples were collected from three public water sources (PWS) within 5-miles of FST: drinking water wells within the FST installation boundary, Hinesville PWS, and Pooler PWS. Samples were analyzed for various parameters, including PFOS and PFOA, using USEPA Method 537. PFOS and PFOA were not detected. Additionally, the Army performed PFAS sampling in February 2014 and August 2014 at Main FST Well #3 and Main FST Well #5; PFOS and PFOA were not detected (IMCOM 2018).

In June 2016, the Army issued a guidance publication for PFAS contamination assessments (Army 2018). In response to the third Unregulated Contaminant Monitoring Rule (UCMR3), and IMCOM Operations Order 16-088, FST began initial PFAS sampling in 2016 at public water supply wells. The laboratory which analyzed samples under UCMR3 met the USEPA's UCMR3 Laboratory Approval Program application and Proficiency Testing criteria for USEPA Method 537 Version 1.1. The Army performed PFAS sampling in September 2016 at 16 wells within the FST boundary; PFOS, PFOA and PFBS were not detected (IMCOM 2018). The Army performed a similar water supply well PFAS sampling event in November 2019 and PFOS and PFOA were not detected (Fort Stewart. 2020).

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 FST, data was 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 interview, internet searches). A summary of the observations made, and data collected through records reviews (**Appendix G**), installation personnel interviews (**Appendix H**), and site reconnaissance (**Appendix I**) during the PA process for FST 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, FST fire department documents, FST directorate of public works documents, and GIS files. Internet searches were also conducted to identify publicly available and other relevant information. A list of the specific documents reviewed for FST is provided in **Appendix G**.

3.2 Personnel Interviews

Interviews were conducted during the site visit. If a previously identified interviewee was not available during the site visit, attempts were made to complete the interview via telephone before or following the site visit or by contacting an alternate interviewee identified by the installation POC.

The list of roles for the installation personnel interviewed during the PA process for FST is presented below (affiliation is with FST unless otherwise noted).

- Aviation Managers
- Environmental Restoration Section Leader
- Infrastructure Section Team Leader
- RCRA Program Manager and Environmental Spill Response POC
- Prevention and Compliance Branch Chief
- Wastewater Program Support

- Stormwater Program Support
- Water Program Manager
- Hangar Operation and Maintenance Department Personnel
- Facility Operations Branch Chief
- Fire Chief
- Assistant Fire Chief
- Captain
- Fire Inspector
- Environmental Specialists
- Pesticide Manager

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

3.3 Site Reconnaissance

Site reconnaissance and visual surveys were conducted at the preliminary locations identified at FST during the records review process, the installation in-brief meeting, and/or during the installation personnel interviews. The site reconnaissance logs are provided in **Appendix I**.

Access to existing groundwater monitoring wells, if present, was 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

FST 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 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.

AFFF was historically stored in 55-gallon and 5-gallon containers in an enclosed concrete building formerly located in the Building 7805 Area; the building was demolished in approximately 2003. Since the building was demolished, AFFF has been stored in an enclosed shed adjacent to Fire Station 03. The Army PA Team noted twenty-five 5-gallon containers of Chemguard 3% AFFF, fourteen 55-gallon containers of Buckeye 3% AFFF, and thirteen 5-gallon containers of high expansion foam in the current AFFF storage area, though these containers may have been empty or partially full. Additionally, AFFF was stored historically and currently in two tactical fire-fighting trucks in Building 1838, and in various fire trucks and/or crash trucks at Fire Station 01, Fire Station 03, and Fire Station 05. Findings from personnel interviews, site reconnaissance, and document research indicate the use of AFFF at FST has been primarily associated with FST fire department operations (Fire Station 01, Fire Station 3, Fire Station 05, Current AFFF Storage, Former AFFF Storage, Building 1838), including equipment testing and firefighter training (Wright Army Airfield (WAAF) FTA, Quarterly Crash Drill Area, Taxiway E, 33R Approach), and fire responses (Vehicle Fire 01, Vehicle Fire 02).

Documents provided by the Army indicate that 630 gallons of AFFF remain on hand at FST. Available safety data sheets and AFFF inventory sheets collected during the site visit are included in **Appendix I**.

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

Following document research, personnel interviews, and site reconnaissance at FST, other potential source types of PFAS constituents, such as metal plating facilities, WWTPs, landfills, storage

warehouses, pesticide use, prescribed burn areas, automobile maintenance shops, photo- and/or X-ray-processing facilities, laundry/water-proofing facilities, car washes, stormwater or sanitary sewer components, or areas where remediated soil was applied, were evaluated if present as preliminary locations for use, storage, and/or disposal of PFAS-containing materials.

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. The USAEC Pest Management Consultant has records of pesticides used and stored at IMCOM installations, including FST, and did not identify FST 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.

Following document research, personnel interviews, and site reconnaissance at FST, one potential PFAS source type area was identified at the Post South Central Landfill. Other potential PFAS use, storage, or disposal types were either not identified at the installation or did not prompt further research or constitute categorization as AOPIs.

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**.

4.3 Readily Identifiable Off-Post PFAS Sources

An exhaustive search to identify all potential off-post PFAS sources (i.e., not related to operations at FST) 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.

Two nearby civilian operations, Hinesville Fire Department and Hinesville Fire Station 2, could potentially be off-post PFAS sources within a 5-mile radius of FST. Hinesville Fire Department is approximately 1 mile southeast of FST; based on the high connectivity of shallow groundwater to surface water features in the region, the facility is downstream and downgradient of the installation. Hinesville Fire Station 2 is approximately 3 miles south of FST; based on the high connectivity of shallow groundwater to surface water features in the region, the facility may be upgradient of the installation since surface water runoff likely flows to Horse Creek and its tributaries. It is not known if these facilities currently or have historically used PFAS-containing Class B AFFF.

5 SUMMARY AND DISCUSSION OF PA RESULTS

The preliminary locations evaluated for potential use, storage, and/or disposal of PFAS-containing materials at FST 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, 13 areas have been identified as AOPIs. The process used for refining these areas is presented on **Figure 5-1**, below.

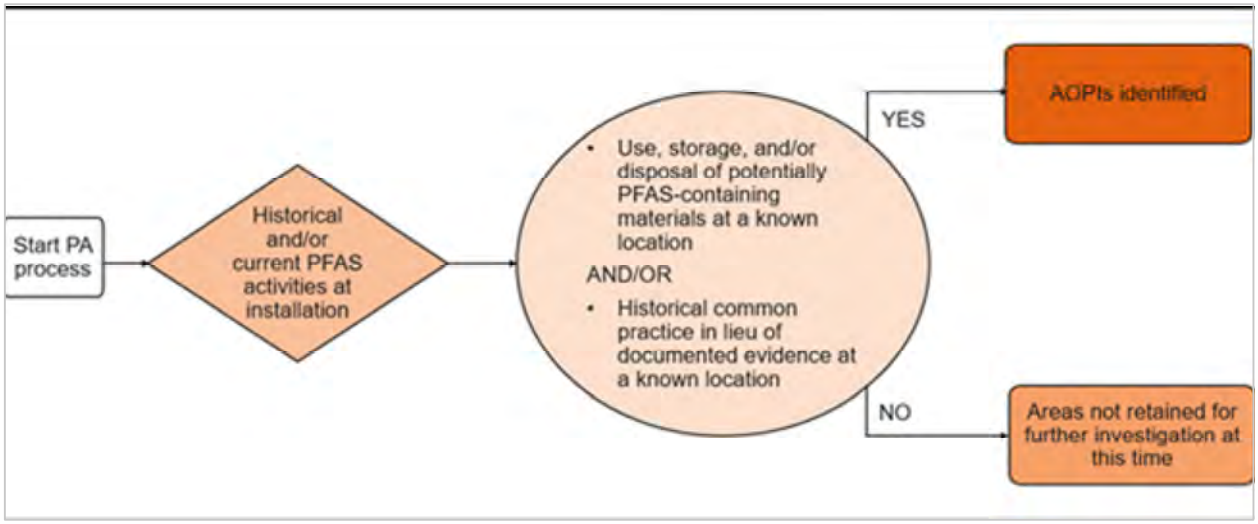


Figure 5-1: AOPI Decision Flowchart

The areas not retained for further investigation are presented in **Section 5.1**. The areas retained as AOPIs are presented in **Section 5.2**.

Data limitations for this PA/SI at FST are presented in **Section 9**.

5.1 Areas Not Retained for Further Investigation

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 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

Area Description	Dates of Operation	Relevant Site History	Rationale
Bridge Fire Location	27 March 2018	Approximately 30 gallons of high expansion foam were used to extinguish a bridge fire. Drainage would flow to Taylors Creek, a tributary of the Canoochee River.	High expansion foam (not PFAS-containing) was utilized; therefore, there is no evidence of use, storage and/or disposal of PFAS-containing materials.
Old Sludge Drying Bed Location (FST-019, SWMU 19; 13305.1014)	1960s to 1985	Sludge from the domestic sewage WWTP was dewatered at this site. These beds were reportedly removed and backfilled in 1989.	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location.

5.2 AOPIs

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

The AOPI locations at FST are shown on **Figure 5-2**. Aerial photographs of each AOPI are presented on **Figures 5-3** through **5-13** and include active monitoring wells in the vicinity of each AOPI.

5.2.1 Fire Station 01

Fire Station 01 was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to historical storage of crash trucks and/or engines that contained AFFF. Operational records documenting historical practices of nozzle testing, AFFF reservoir filling/servicing, training, and other fire department practices are incomplete.

An aerial photograph of Fire Station 01 is provided on **Figure 5-3**. According to personnel interviews (Appendix H), Fire Station 01 houses crash trucks and/or engines that contain small volumes of AFFF (i.e., 20 to 50 gallons). Fire Station 01 is near Mill Creek and vegetated areas to the west and south. Drainage at this AOPI is expected to follow Mill Creek to the southeast.

5.2.2 Fire Station 03 and Current AFFF Storage

Fire Station 03 and Current AFFF Storage were identified as AOPIs following document research, personnel interviews, and site reconnaissance due to AFFF leaks and spills during historical routine operations.

An aerial photograph of Fire Station 03 and the Current AFFF Storage is provided on **Figure 5-4**. Based on personnel interviews (Appendix H), a one-time AFFF leak (less than 5 gallons) occurred within the station in 2018, and minor AFFF spills (less than 2 gallons) occurred during daily routine operational checks conducted outside Station 03. There are no floor drains in Station 03. Liquids spilled within the station would likely infiltrate to the ground beneath the structure through cracks in the concrete floor. Liquids discharged outside the station or storage structure would seep to the subsurface and/or drain via overland flow towards the airfield. On-Post Public Supply Wells 6a and 6b are proximate to the AOPI.

5.2.3 Fire Station 05

Fire Station 05 was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to historical storage of AFFF. However, no known leaks or releases were documented to have occurred.

An aerial photograph of Fire Station 05 is provided on **Figure 5-5**. Fire Station 05 houses crash trucks and/or engines that contain small volumes of AFFF (i.e., 20 to 50 gallons). Drainage at this AOPI is expected to follow tributaries of Taylors Creek to the north-northwest.

5.2.4 Quarterly Crash Drill Exercise Area

The Quarterly Crash Drill Exercise Area was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to its history of AFFF usage to extinguish fuel fires.

An aerial photograph of Quarterly Crash Drill Exercise Area is provided on **Figure 5-6.** The Quarterly Crash Drill Exercise Area is a fire training area (FTA) which was used for quarterly training involving extinguishing fuel fires set to a mock aircraft using approximately 5 gallons (maximum) of AFFF per test from 1990 to 2015, according to personnel interviews (Appendix H). Drainage would primarily seep to the subsurface towards the airfield.

5.2.5 Taxiway E

Taxiway E was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to historical equipment testing utilizing AFFF.

An aerial photograph of Taxiway E is provided on **Figure 5-6.** According to personnel interviews (Appendix H), Taxiway E was used to conduct the annual flow testing and proportioning for aircraft rescue and firefighting apparatuses; approximately 50 gallons of foam were used each test. Some years, an entire foam tank was emptied to replace the foam (approximately 200 gallons discharged). Drainage would primarily seep to the subsurface towards the airfield.

5.2.6 Wright Army Airfield FTA (FST-013; SWMU 13; 13305.1010)

The WAAF FTA was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to its history of AFFF use to extinguish fuel fires. The area in which foam was used to extinguish fires likely had historical drainage to stormwater channels leading to Peacock Creek. This AOPI coincides with the IRP site FST-013 FTA at WAAF (SWMU 13).

An aerial photograph of WAAF is provided on **Figure 5-7.** WAAF FTA is a former FTA used from 1982 to 1992 where foam (unknown type and volume) was used to extinguish fuel fires. Drainage likely flows to stormwater channels located within the FTA footprint or seeps to the subsurface to the southeast.

5.2.7 33R Approach

The 33R – Approach area was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to historical storage and use of AFFF.

An aerial photograph of 33R Approach is provided on **Figure 5-8.** The 33R Approach was used for weekly operation/function checks of turrets and foam system on the aircraft rescue and firefighting apparatuses from approximately 1996 to 2010, according to personnel interviews. Approximately 1 to 5 gallons of foam were used per test. Drainage would primarily seep to the subsurface and follow tributaries of Peacock Creek to the southeast.

5.2.8 Former AFFF Storage Area

The Former AFFF Storage Area was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to historical storage and spillage of AFFF.

An aerial photograph of Former AFFF Storage Area is provided on **Figure 5-9.** The Former AFFF Storage Area AFFF drums were stored in a building which has been demolished. Minor AFFF spills reportedly occurred during product transfer between containers and/or from damaged containers. No drainage features were observed in this area; drainage in this area likely seeps to the subsurface and follows tributaries of Peacock Creek to the southeast.

5.2.9 Post South Central Landfill (FST-001; SWMU1; 13305.1001)

The Post South Central Landfill was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to historical storage and disposal of sludge from HAAF that may have contained PFAS-containing materials.

An aerial photograph of Post South Central Landfill is provided on **Figure 5-10**. Sludge from the HAAF WWTP was historically disposed of at the Post South Central Landfill, which is located within the footprint of FST. Beginning in 1991, biosolids were transported to Waste Management's Superior Landfill for disposal off-site.

5.2.10 Vehicle Fire 01

The Vehicle Fire 01 location was identified as an AOPI following notification from FST personnel after AFFF was used to extinguish a vehicle fire involving a logging truck.

An aerial photograph of Vehicle Fire 01 is provided on **Figure 5-11**. Drainage would primarily seep to the subsurface or into surface water channels around this AOPI.

5.2.11 Vehicle Fire 02

The Vehicle Fire 02 location was identified as an AOPI following notification from FST personnel after AFFF was used to extinguish a vehicle fire involving an M88 truck.

An aerial photograph of Vehicle Fire 02 is provided on **Figure 5-12**. Drainage would primarily seep to the subsurface or into surface water channels around this AOPI.

5.2.12 Building 1838

Building 1838 was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to AFFF storage. Approximately 250 gallons of AFFF are stored on two non-operational tactical firefighting trucks, the dates of relevant operations are unknown. Drainage at this AOPI would primarily be captured via storm channels on post, since the building is located in an area surrounded by developed buildings and concrete.

An aerial photograph of Building 1838 is provided on **Figure 5-13**.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at FST, an SI for PFOS, PFOA, and PFBS was conducted in accordance with CERCLA. SI sampling was completed at FST at all 13 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 2020a) 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 three soil, four groundwater, and one surface water pathways 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 October 2020 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 2020a) 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 FST. 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 2020a), 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, soil, and surface water 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.

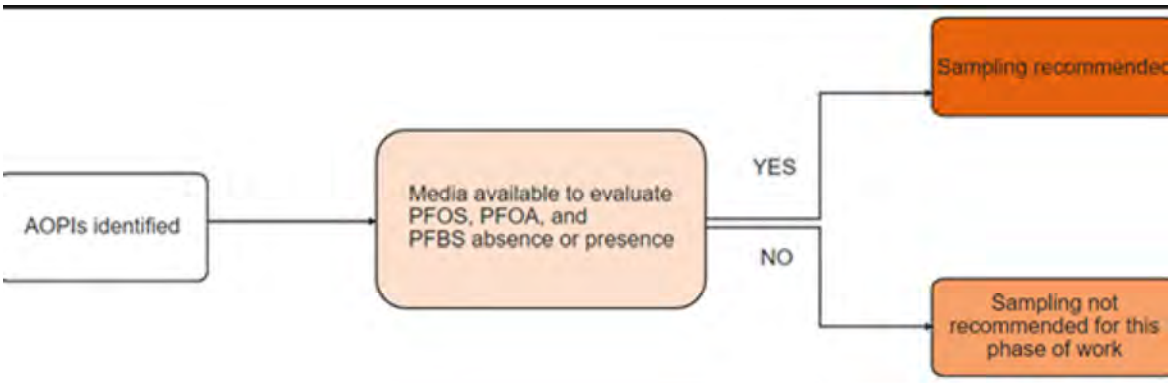


Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at FST is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2020a). Briefly, a total of 15 soil samples were planned across the AOPIs at FST. One shallow soil sample (0 to 2 feet bgs) was planned to be collected at Fire Station 01, Fire Station 03, Current AFFF Storage, Former AFFF Storage Area, Fire Station 05, Vehicle Fire 01, Vehicle Fire 02, Quarterly Crash Drill Area and Building 1838. Two shallow soil samples were planned to be collected at 33R Approach, Taxiway E and WAAF FTA (FST-013).

Additionally, 14 soil borings were planned to be advanced using a direct-push technology (DPT) drill rig for the purpose of collecting a grab groundwater sample. One boring was proposed for each of ten AOPIs at Fort Stewart: Fire Station 01, Fire Station 03, Current AFFF Storage, Fire Station 05, Vehicle Fire 01, Vehicle Fire 02, Former AFFF Storage Area, Quarterly Crash Drill Area, WAAF FTA (FST-013), and Building 1838. Two borings to groundwater were proposed at 33R Approach and Taxiway E.

A total of four groundwater samples were proposed from pre-existing monitoring wells, two at each of the following AOPIs: Post South Central Landfill (FST-001) and WAAF FTA (FST-013). 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).

Finally, a surface water sample was proposed at each of two AOPIs: Vehicle Fire 01 and Vehicle Fire 02. However, the planned grab surface water sample at Vehicle Fire 01 could not be collected due to dry surface water features at the time of sampling. The grab sample at Vehicle Fire 02 was collected from the perennial stream.

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 2020a), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2020b). 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 2020a). 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 J** and **K**, respectively.

6.3.1 Field Methods

Groundwater samples were collected using low-flow purging methods from approximately the center of the saturated screened interval at existing monitoring wells. At sampling locations where boreholes were

advanced using DPT, dual-tube drill casing was advanced using a top-down sampling method to minimize cross-contamination at depth. Depending on field conditions, either a peristaltic pump or portable bladder pump with PFAS-free disposable high-density polyethylene tubing. 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 20 minutes, whichever was sooner) before groundwater sampling to ensure a representative sample is collected and, potentially, to inform the interpretation of analytical data. Coordinates for each borehole's groundwater sampling location were recorded using a handheld global positioning system. Soil lithologic descriptions were logged during sampling activities.

Shallow soil samples were collected to evaluate PFOS, PFOA, and/or PFBS presence or absence at or downslope of potential release areas. Soil samples were analyzed for PFOS, PFOA, and PFBS; total organic carbon (TOC), pH, and grain size were analyzed in one soil sample per AOPI at which at least one soil sample was collected (i.e., these analytes were not analyzed for in every soil sample collected at an AOPI). Soil lithological descriptions were logged and documented on field forms. Soil samples were 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 15 discrete points for a total of 15 hand auger sampling points at the AOPIs. At each hand auger and DPT sampling point at each AOPI, soil samples were collected from a 2-foot interval within the top 2 feet of native soil. Coordinates for each soil sampling location were recorded using handheld global positioning system equipment.

A grab surface water sample was collected from Vehicle Fire 02. The surface water sample was collected using direct-fill methods just below the water surface and from downstream to upstream to reduce siltation in sequential samples. The surface water sample was analyzed for PFOS, PFOA, and PFBS, and field parameters (temperature, pH, specific conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential) were measured during surface water sampling to potentially inform the interpretation of analytical data. Coordinates for the surface water sampling location were recorded using handheld global positioning system equipment.

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 2020a), 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 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 2020a). The decontaminated reusable equipment from which EBs were collected include tubing, drill casing and hand augers, water-level meters, bailers, and stainless-steel trowels as applicable to the sampled media.

Source blanks were collected from the water used to decontaminate drill tooling. Analytical results for blank samples are discussed in **Section 7.4.**

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 FST 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 that did not affect DQOs are documented in Field Change Reports. The one Field Change Report required is included as **Appendix L** and is summarized below:

The proposed surface water sample at Vehicle Fire 01 AOPI could not be collected. The conditions on the ground were not as expected based on aerial photographs of the area, and the surface water features were dry at the time of sampling.

6.3.4 Decontamination

Non-dedicated reusable sampling equipment (e.g., stainless-steel trowels, 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 was collected and placed in Department of Transportation-approved 55-gallon drums, and transported to a staging area. Media in the drums were sampled to establish waste classification. Drums were transported offsite as non-hazardous waste to a licensed disposal facility. Disposable equipment and personal protective equipment were collected in bags and disposed in municipal waste receptacles. Equipment IDW includes personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, Lexan tubes, and high-density polyethylene and silicon tubing) that may come in contact with sampling media. Analytical results for IDW samples collected during the SI are discussed in **Section 7.3.** Waste manifests are included in **Appendix M**.

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 Pace South Carolina (formerly Shealy Environmental Services, Inc.), an ELAP-accredited laboratory for PFAS analysis, including PFOS, PFOA, and PFBS, by LC/MS/MS. 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, soil, and surface water samples using an analytical method that is ELAP-accredited and compliant with QSM 5.3, Table B-15 (DoD and Department of Energy 2019).

Additionally, the following general chemistry and physical characteristic analyses were completed for select soil and sediment samples in accordance with Worksheet #18 of the QAPP Addendum (Arcadis 2020a) 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 N**).

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 N**. The Level IV analytical reports are included within **Appendix N** 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 FST. Documentation generated during the data usability assessments, which were compiled into a DUSR (**Appendix N**), 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 FST 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 N**), and as indicated in the full analytical tables (**Appendix O**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and FST QAPP Addendum (Arcadis 2020a). Data qualifiers applied to laboratory analytical results for samples collected during the SI at FST 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 (since it was 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 data for this Army PFAS PA/SI. The data for the surface water sample will not be compared to the OSD residential tap water risk screening level since the surface water is likely not an expression of groundwater (i.e., springs/seeps) and surface water is not used as a drinking water source nearby. While the current and most likely future land uses of the AOPIs at FST 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 9**.

7 SUMMARY AND DISCUSSION OF SI RESULTS

This section summarizes the analytical results obtained from samples collected during the SI at FST (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 2020a). 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 through **7-3** provide a summary of the groundwater, soil, and surface water analytical results for PFOS, PFOA, and PFBS. **Table 7-4** summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix O** includes the full suite of analytical results for these media, as well as for the QA/QC samples. An overview of AOPIs at FST with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2** through **7-12** show the PFOS, PFOA, and PFBS analytical results in groundwater, soil, and surface water 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 and surface water data collected during the SI are reported in ng/L, or parts per trillion, and soil and sediment data are reported in mg/kg, or parts per million.

Field parameters measured for groundwater during low-flow purging and sample collection and for surface water during sample collection are provided in the field notes in **Appendix J** and on the field forms in **Appendix K**. Soil descriptions are provided on the field forms in **Appendix K**. 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 5 to 20 feet bgs at AOPIs where groundwater was collected.

Table 7-4 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Yes/No)
Fire Station 01	No
Fire Station 03	Yes
Fire Station 05	Yes
Current AFFF Storage	Yes
Quarterly Crash Drill Area	Yes
Wright Army Airfield	Yes
Taxiway E	Yes
Vehicle Fire 01	No
Vehicle Fire 02	No
Former AFFF Storage Area	Yes
33R Approach	Yes

AOPI Name	OSD Exceedances (Yes/No)
Post South Central Landfill	No
Building 1838	Yes

7.1 Areas of Potential Interest

7.1.1 Fire Station 01 AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Fire Station 01 (**Figure 7-2**).

7.1.1.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (15 feet bgs) at the Fire Station 01 AOPI (FST-FS1-GW-01; **Figure 7-2**).

PFOS was detected below the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location FST-FS1-GW-01 (37 BJ+ [method blank contamination, may be biased high] ng/L). PFOA was detected below the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location at FST-FS1-GW-01 (7.0 ng/L). PFBS was detected below the OSD tap water risk screening level (600 ng/L) in the groundwater grab sample location FST-FS1-GW-01 (53 ng/L). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.1.2 Soil

One soil sample was collected at the Fire Station 01 AOPI (FST-FS1-SO-01; **Figure 7-2**). PFOS, PFOA, and PFBS were not detected in this sample. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O**.

7.1.2 Fire Station 03 AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Fire Station 03.

7.1.2.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (20 feet bgs) at the Fire Station 03 AOPI (FST-FS3-GW-01; **Figure 7-3**).

PFOS was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location FST-FS3-GW-01 (360,000 J [diluted analysis, estimated] ng/L). PFOA was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location at FST-

FS3-GW-01 (23,000 J ng/L). PFBS was detected above the OSD tap water risk screening level (600 ng/L) at the groundwater grab sample location FST-FS3-GW-01 (6,200 J ng/L). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.2.2 Soil

One soil sample was collected at the Fire Station 03 AOPI (FST-FS3-SO-01; **Figure 7-3**). PFOS was detected above the OSD residential risk screening level (0.13 mg/kg) in sample FST-FS3-SO-01 (0.19 J). The PFOS concentration did not exceed the OSD industrial/commercial risk screening level (1.6 mg/kg). PFOA was detected below the OSD residential risk screening level (0.13 mg/kg) in sample FST-FS3-SO-01 (0.0024 J). PFBS was not detected in this sample. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.3 Current AFFF Storage AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Current AFFF Storage AOPI.

7.1.3.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (10 feet bgs) at the Current AFFF Storage AOPI (FST-CS-GW-01; **Figure 7-3**).

PFOS was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location FST-CS-GW-01 (52,000 B [method blank contamination] ng/L). PFOA was detected at concentrations above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location at FST-CS-GW-01 (4,700 J ng/L). PFBS was not detected in the groundwater grab sample location FST-CS-GW-01. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.3.2 Soil

One soil sample was collected at the Current AFFF Storage AOPI (FST-CS-SO-01; **Figure 7-3**). PFOA and PFBS were not detected in this sample. PFOS was detected below the OSD residential risk screening level (0.13 mg/kg) in sample FST-CS-SO-01 (0.066 mg/kg J). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.4 Fire Station 05 AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Fire Station 05.

7.1.4.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (10 feet bgs) at the Fire Station 05 AOPI (FST-FS5-GW-01; **Figure 7-4**).

PFOS was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location FST-FS5-GW-01 (26,000 J ng/L). PFOA was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location at FST-FS5-GW-01 (1,300 J ng/L). PFBS was detected above the OSD tap water risk screening level (600 ng/L) in the groundwater grab sample location FST-FS5-GW-01 (970 J ng/L). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.4.2 Soil

One soil sample was collected at the Fire Station 05 AOPI (FST-FS5-SO-01; **Figure 7-4**). PFOS was detected below the OSD residential risk screening level (0.13 mg/kg) in sample FST-FS5-SO-01 (0.011 mg/kg). PFOA was detected below the OSD residential risk screening level (0.13 mg/kg) in sample FST-FS5-SO-01 (0.0011 mg/kg). PFBS was not detected in this sample. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.5 Quarterly Crash Drill Exercise Area AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Quarterly Crash Drill Exercise Area.

7.1.5.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (10 feet bgs) at the Quarterly Crash Drill Exercise Area AOPI (FST-CDA-GW-01; **Figure 7-5**).

PFOS was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location FST-CDA-GW-01 (110,000 J- [diluted analysis, may be biased low] ng/L). PFOA was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location at FST-CDA-GW-01 (3,600 J- ng/L). PFBS was detected above the OSD tap water risk screening level (600 ng/L) in the groundwater grab sample location FST-CDA-GW-01 (5,400 J- ng/L). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.5.2 Soil

One soil sample was collected at the Quarterly Crash Drill Exercise Area AOPI (FST-CDA-SO-01; **Figure 7-5**). PFOS was detected above the OSD residential risk screening level (0.13 mg/kg) in sample FST-CDA-SO-01 (0.14 mg/kg). The PFOS concentration did not exceed the OSD industrial/commercial screening level (1.6 mg/kg). PFOA was detected below the OSD residential risk screening level (0.13 mg/kg) in sample FST-CDA-SO-01 (0.0020 mg/kg). PFBS was not detected in this sample. A summary of

PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.6 Taxiway E AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Taxiway E.

7.1.6.1 Groundwater

Two soil borings were advanced via DPT drill rig to collect shallow groundwater grab samples at first encountered groundwater (10 feet bgs at each location) at the Taxiway E AOPI (FST-TE-GW-01 and FST-TE-GW-02; **Figure 7-5**).

PFOS was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location FST-TE-GW-01 (44 ng/L). PFOS was detected below the OSD tap water risk screening level (40 ng/L) in sample FST-TE-GW-02 (37 J- ng/L). PFOA was detected above the OSD tap water risk screening level (40 ng/L) in groundwater grab samples FST-TE-GW-01 (13 ng/L) and FST-TE-GW-02 (4.7 J- ng/L). PFBS was detected below the OSD tap water risk screening level (600 ng/L) in groundwater grab samples FST-TE-GW-01 (3.1 J ng/L) and FST-TE-GW-02 (8.3 J- ng/L). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.6.2 Soil

Two soil samples were collected at the Taxiway E AOPI (FST-TE-SO-01 and FST-TE-SO-02; **Figure 7-5**). PFOS was detected below the OSD residential risk screening level (0.13 mg/kg) in sample FST-TE-SO-02 (0.0012 mg/kg). PFOS was not detected in sample FST-TE-SO-01. PFBS and PFOA were not detected in either of these samples. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.7 Wright Army Airfield FTA (FST-013; SWMU 13; 13305.1010) AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with WAAF FTA.

7.1.7.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (5 feet bgs) at the WAAF FTA AOPI (FST-WAA-GW-01; **Figure 7-6**). Two additional grab groundwater samples were collected from existing monitoring wells (FST-MW-11, 9 feet bgs, and FST-MW-18R, 6 feet bgs) at the WAAF FTA (**Figure 7-6)**.

PFOS was detected at concentrations above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample locations FST-WAA-GW-01 (28,000 J ng/L), FST-MW-11 (18,000 J ng/L), and FST-MW-18R (16,000 J ng/L). PFOA was detected at concentrations above the OSD tap water risk screening level (40 ng/L) in samples FST-WAA-GW-01 (1,500 J ng/L), FST-MW-11 (520 J ng/L) and FST-

MW-18R (1,700 J ng/L). PFBS was detected below the OSD tap water risk screening level (600 ng/L) in the groundwater grab sample locations FST-WAA-GW-01 (96 J ng/L) and FST-MW-11 (100 J ng/L). PFBS was not detected in sample FST-MW-18R. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.7.2 Soil

Two soil samples were collected at the WAAF AOPI (FST-WAA-SO-01 and FST-WAA-SO-02; **Figure 7-6**). PFOS was detected below the OSD residential risk screening level (0.13 mg/kg) in sample FST-WAA-SO-01 (0.0077 mg/kg). PFOS was not detected in sample FST-WAA-SO-02. PFOA was detected below the OSD residential risk screening level (0.13 mg/kg) in sample FST-WAA-SO-01 (0.0015 mg/kg). PFOA was not detected in sample FST-WAA-SO-02. PFBS was not detected in these samples. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.8 33R Approach AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with 33R - Approach Area.

7.1.8.1 Groundwater

Two soil borings were advanced via DPT drill rig to collect shallow groundwater grab samples at first encountered groundwater (FST-33R-GW-01, 7 feet bgs, and FST-33F-GW-02, 4.5 feet bgs) at the 33R - Approach Area AOPI (**Figure 7-7**).

PFOS was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location FST-33R-GW-01 (470 J ng/L). PFOS was detected below the OSD tap water risk screening level (40 ng/L) in sample FST-33R-GW-02 (8.0 ng/L). PFOA was detected above the OSD tap water risk screening level (40 ng/L) at the groundwater grab sample location at FST-33R-GW-01 (390 J ng/L). PFOA was detected below the OSD tap water risk screening level (40 ng/L) in sample FST-33R-GW-02 (2.3 J ng/L). PFBS was detected below the OSD tap water risk screening level (600 ng/L) in the groundwater grab sample location FST-33R-GW-01 (65 J ng/L). PFBS was not detected in sample FST-33R-GW-02. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.8.2 Soil

Two soil samples were collected at the 33R Approach AOPI (FST-33R-SO-01 and FST-33R-SO-02; **Figure 7-7**). PFOS, PFOA, and PFBS were not detected in either of these samples. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.9 Former AFFF Storage Area AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Former AFFF Storage Area.

7.1.9.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (10 feet bgs) at the Former AFFF Storage Area AOPI (FST-FASA-GW-01; **Figure 7-8**).

PFOS was detected above the OSD tap water risk screening level (40 ng/L) in groundwater grab sample FST-FASA-GW-01 (260 J ng/L). PFOA was detected above the OSD tap water risk screening level (40 ng/L) in groundwater grab sample FST-FASA-GW-01 (170 J ng/L). PFBS was detected above the OSD tap water risk screening level (600 ng/L) in groundwater grab sample FST-FASA-GW-01 (1,600 J ng/L). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.9.2 Soil

One soil sample was collected at the Former AFFF Storage AOPI (FST-FASA-SO-01; **Figure 7-8**). PFOS, PFOA, and PFBS were not detected in this sample. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.10 Post South Central Landfill (FST-001; SWMU1; 13305.1001) AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Post South Central Landfill.

7.1.10.1 Groundwater

Two grab groundwater samples were collected from existing monitoring wells (7 and 11 feet bgs) at the Post South Central Landfill AOPI (FST-GWB-SC-M9 and FST-GWB-SC-M5; **Figure 7-9**).

PFOS, PFOA, and PFBS were not detected at either of the groundwater grab sample locations at the Post South Central Landfill AOPI. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.11 Vehicle Fire 01 AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Vehicle Fire 01 AOPI.

7.1.11.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (9 feet bgs) at the Former Vehicle Fire 01 AOPI (FST-VF1-GW-01; **Figure 7-10**).

PFOS was detected below the OSD tap water risk screening level (40 ng/L) in groundwater grab sample FST-VF1-GW-01 (2.8 J ng/L). PFOA was detected below the OSD tap water risk screening level (40 ng/L) in groundwater grab sample FST-VF1-GW-01 (2.2 J ng/L). PFBS was not detected in groundwater grab sample FST-VF1-GW-01. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.11.2 Soil

One soil sample was collected at the Vehicle Fire 01 AOPI (FST-VF1-SO-01; **Figure 7-10**). PFOS, PFOA, and PFBS were not detected in this sample. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.12 Vehicle Fire 02 AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Vehicle Fire 02.

7.1.12.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (20 feet bgs) at the Former Vehicle Fire 02 AOPI (FST-VF2-GW-01; **Figure 7-11**).

PFOS was detected below the OSD tap water risk screening level (40 ng/L) in groundwater grab sample FST-VF2-GW-01 (2.2 J ng/L). PFOA and PFBS were not detected in groundwater grab sample FST-VF2-GW-01. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.12.2 Surface Water

One grab surface water sample was collected from a nearby retention pond southwest from the Vehicle Fire 02 AOPI (FST-VF2-01-SW; **Figure 7-11**).

PFOS, PFOA, and PFBS were not detected in surface water sample FST-VF2-01-SW. A summary of PFOS, PFOA, and PFBS surface water analytical results is provided in **Table 7-3** and the full suite of analytical results is included in **Appendix O**.

7.1.12.3 Soil

One soil sample was collected at the Vehicle Fire 02 AOPI (FST-VF2-SO-01; **Figure 7-8**). PFOS, PFOA, and PFBS were not detected in this sample. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.1.13 Building 1838 AOPI

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building 1838.

7.1.13.1 Groundwater

One soil boring was advanced via DPT drill rig to collect a shallow groundwater grab sample at first encountered groundwater (10 feet bgs) at the Building 1838 AOPI (FST-B1838-GW-01; **Figure 7-12**).

PFOS was detected below the OSD tap water risk screening level (40 ng/L) in groundwater grab sample FST-B1838-GW-01 (24 ng/L). PFOA was detected above the OSD tap water risk screening level (40 ng/L) in sample FST-B1838-GW-01 (150 ng/L). PFBS was detected below the OSD tap water risk screening level (600 ng/L) in groundwater grab sample FST-B1838-GW-01 (15 ng/L). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1** and the full suite of analytical results is included in **Appendix O.**

7.1.13.2 Soil

One soil sample was collected at the Building 1838 AOPI (FST-B1838-SO-01; **Figure 7-12**). PFOS was detected below the OSD risk screening level (0.13 mg/kg) in sample FST-B1838-SO-01 (0.0023 mg/kg). PFOA was detected below the OSD risk screening level (0.13 mg/kg) in sample FST-B1838-SO-01 (0.00050 J mg/kg). PFBS was not detected in this sample. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2** and the full suite of analytical results is included in **Appendix O.**

7.2 Investigation Derived Waste

Composite samples of the purge and decontamination wastewater and excess soil cuttings were collected from the 55-gallon drums after the SI sampling. The results indicated that the waste is categorized as Non-Regulated Material (PFAS impacted) and was disposed of at ECOFLO, Inc. in Greensboro, North Carolina (USEPA ID Number NCD980842132.) The full analytical results (i.e., for all constituents analyzed) for IDW samples collected during the SI are included in Appendix O.

7.3 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 1,640 to 13,000 mg/kg. The TOC at this installation was within the range typically observed in topsoil: 5,000 to 30,000 mg/kg. The combined percentage of fines passing sieve number 200 (i.e., silt and clay) in soils at FST ranged from 8 to 27.4% with an average of 17.5%. 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, 85.5 to 97.4%, was higher than typical for sandy soil (0 to 10%). The pH of the soil was slightly acidic (4.5 to 6.9 standard units). Based on these geochemical and physical soil characteristics (i.e., low percentage of fines and TOC) observed underlying the installation during the SI, PFAS constituents are expected to be relatively more mobile at FST than in soils with greater percentages of fines and TOC. The analytical results for TOC, pH, and moisture content are included in **Appendix O**.

7.4 Blank Samples

PFOS, PFOA, and/or PFBS were not detected in any of the QA/QC samples collected during the SI work. The full analytical results for blank samples collected during the SI are included in **Appendix O**.

7.5 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2020a) were re-evaluated and updated, if necessary, based on the SI sampling results. The CSMs presented on **Figures 7-13** through **7-17** 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 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.

Following the SI sampling, the 12 AOPIs with confirmed PFOS, PFOA, and/or PFBS presence 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**).

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:

- The AOPIs are not residential or recreational sites and are wholly located within the installation boundaries. Therefore, the soil exposure pathways for on-installation residents and recreational users and for off-installation receptors are incomplete.
- 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 7-13 shows the CSM for Fire Station 01, Vehicle Fire 01, and Vehicle Fire 02 AOPIs. At these AOPIs, AFFF was historically stored in crash trucks and/or engines or was used to extinguish vehicle fires.

- PFOS, PFOA, and/or PFBS were not detected in soil, therefore the soil exposure pathway for on-installation site workers is incomplete.
- PFOS, PFOA, and/or PFBS were detected in groundwater. The AOPIs are side or downgradient of and not likely to affect drinking water wells used to supply potable water at FST. However, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete to account for potential future use of the downgradient on-post groundwater.
- Groundwater originating at these AOPIs flows off-post through the installation's southern boundary. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.
- PFOS, PFOA, and/or PFBS detected in groundwater could migrate to surface water via shallow groundwater discharge. Surface water bodies on-post are not used for drinking water. On-installation site workers and residents are not likely to otherwise contact surface water and sediment; therefore, these exposure pathways are incomplete. Recreational users could contact constituents in Peacock Creek through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for on-installation recreational users are potentially complete.
- Surface water bodies flow off-post through Peacock Creek. Surface water is not used for drinking water within 5 miles of the installation boundary. Recreational users off-post could contact constituents in surface water and sediment through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Figure 7-14 shows the CSM for Fire Station 03 and Current AFFF Storage AOPIs. AFFF was historically stored in these areas and may have been released to soil and paved surfaces during incidental releases and/or nozzle testing activities. As these AOPIs are not near surface water features, surface water and sediment pathways were not evaluated in the CSM.

- PFOS, PFOA, and/or PFBS were detected in soil 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.
- PFOS, PFOA, and/or PFBS were detected in groundwater. The AOPIs are side or downgradient of and not likely to affect drinking water wells used to supply potable water at FST. However, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete to account for potential future use of the downgradient on-post groundwater.
- Groundwater originating at these AOPIs flows off-post through the installation's southern boundary. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.

Figure 7-15 shows the CSM for Fire Station 05, WAAF FTA (FST-013), Quarterly Crash Drill Area, Taxiway E, and Building 1838 AOPIs. AFFF was historically released to soil and paved surfaces during nozzle testing, firefighter training exercises, crash/ fire response activities, or incidental releases due to AFFF storage in tactical firefighting trucks.

- PFOS, PFOA, and/or PFBS were detected in soil 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.
- PFOS, PFOA, and/or PFBS were detected in groundwater. The AOPIs are side or downgradient of and not likely to affect drinking water wells used to supply potable water at FST. However, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete to account for potential future use of the downgradient on-post groundwater.
- Groundwater originating at these AOPIs flows off-post through the installation's southern boundary. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.
- PFOS, PFOA, and/or PFBS detected in soil and groundwater could migrate to surface water via surface runoff or shallow groundwater discharge. Surface water bodies on-post are not used for drinking water. On-installation site workers and residents are not likely to otherwise contact surface water and sediment; therefore, these exposure pathways are incomplete. Recreational users could contact constituents in Peacock Creek through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for on-installation recreational users are potentially complete.
- Surface water bodies flow off-post through Peacock Creek. Surface water is not used for drinking water within 5 miles of the installation boundary. Recreational users off-post could contact constituents in surface water and sediment through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Figure 7-16 shows the CSM for 33R Approach and Former AFFF Storage Area AOPIs. AFFF was historically stored in these areas and may have been released to soil and paved surfaces during

incidental releases and/or operation/function checks of turrets and foam system on the aircraft rescue and firefighting apparatus. As these AOPIs are not near surface water features, surface water and sediment pathways were not evaluated in the CSM.

- PFOS, PFOA, and/or PFBS were not detected in soil, therefore the soil exposure pathway for on-installation site workers is incomplete.
- PFOS, PFOA, and/or PFBS were detected in groundwater. The AOPIs are side or downgradient of and not likely to affect drinking water wells used to supply potable water at FST. However, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete to account for potential future use of the downgradient on-post groundwater.
- Groundwater originating at these AOPIs flows off-post through the installation's southern boundary. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.

Figure 7-17 shows the CSM for the Post South Central Landfill AOPI. AFFF impacted soil was disposed of in this historical landfill in the 1940s.

- Soil at this AOPI was not sampled for PFOS, PFOA, and PFBS as it is unclear where the native soil begins and ends. Therefore, the soil exposure pathway for on-installation site workers remains potentially complete.
- PFOS, PFOA, and/or PFBS were not detected in groundwater. Based on these sample results, the groundwater exposure pathways (via drinking water ingestion and dermal contact) are incomplete.
- Given the low potential for runoff from landfill soil and the non-detect groundwater sample results, it is inferred PFOS, PFOA, and/or PFBS are not migrating from this AOPI to nearby surface water and sediment. Therefore, the surface water and sediment exposure pathways are incomplete.

Following the SI sampling, 12 out of the 13 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 OFF-POST PRIVATE POTABLE WELL INVESTIGATION

Based on SI sampling results, off-post private potable wells were identified as part of the PA/SI investigation at FST to determine whether there are potential off-post impacts to drinking water due to Army operations.

An off-post well survey was completed for an area 1-mile downgradient using readily available information from the Georgia water well database. County records were reviewed to identify wells that may not be included in the state database, and relevant parcels were reviewed to compile a list of property owners. Finally, available groundwater modeling reports (i.e., United States Geological Survey reports or other) were reviewed for the area.

Select off-post private potable wells may be recommended for future sampling based on the understanding of the relationship between on- and off-post hydrogeological conditions. If such wells are identified for future sampling, community outreach and notification will be coordinated between the Army PA/SI team, FST, Headquarters of the Department of the Army, and USAEC Divisions. If off-post private potable well sampling occurs, the results of the event will be presented in a letter report that will be included in a subsequent addendum.

9 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA/SI included two distinct efforts. The PA identified AOPIs at FST 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/or 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 FST. Following the evaluation, 13 AOPIs were identified.

The Army performed PFAS sampling in February 2014 and August 2014 at Main FST Well #3 and Main FST Well #5; PFAS-constituents were not detected (IMCOM 2018). The Army also performed PFAS sampling in September 2016 at 14 wells within the installation boundary for FST; PFOS, PFOA and PFBS were not detected (IMCOM 2018). The Army performed a similar water supply well PFAS sampling event in December 2019 and PFOS and PFOA were not detected (Fort Stewart 2020).

All AOPIs were sampled during the SI at FST 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 FST QAPP Addendum (Arcadis 2020a).

Twelve AOPIs had detections of PFOS, PFOA, and/or PFBS in groundwater and nine AOPIs exceeded OSD risk screening levels. The highest PFOS, PFOA, and PFBS concentrations in groundwater were observed at the Fire Station 03 AOPI at 360,000 J ng/L, 23,000 J ng/L, and 6,200 J ng/L, respectively.

Seven AOPIs had detections of PFOS and/or PFOA in soil and two AOPIs exceeded OSD risk screening levels. The highest PFOS and PFOA concentrations in soil were observed at the Fire Station 03 AOPI at 0.19 J mg/kg, and 0.0024 J mg/kg, respectively. PFBS was not detected in soil at any of the AOPIs.

One AOPI (Vehicle Fire 02) was sampled for PFOS, PFOA, and PFBS presence in surface water, but none were detected.

Following the SI sampling, 12 of the 13 AOPIs with confirmed PFOS, PFOA, and/or PFBS presence have complete or potentially complete exposure pathways. The following exposure pathways are complete or potentially complete:

- The soil exposure pathways for on-installation site workers are complete at seven AOPIs, where PFOS, PFOA and/or PFBS were detected.
- The soil exposure pathways for on-installation site workers are potentially complete at one AOPI where soil was not sampled.
- Due to a lack of land use controls off-installation and downgradient of FST, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for off-installation receptors

are also potentially complete for on-installation site workers and residents and off-installation receptors at 12 AOPIs.

- Surface water is not used for drinking water at FST, however recreational users could contact constituents in surface water and sediment via incidental ingestion and dermal contact on-installation and off-installation recreational users at eight AOPIs.
- The sediment exposure pathways (via drinking water ingestion and dermal contact) are potentially complete for on-installation and off-installation recreational users at eight 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 9-1** below summarizes the AOPIs identified at FST, PFOS, PFOA, and PFBS sampling and recommendations for each AOPI; further investigation is warranted at FST. In accordance with CERCLA, site-specific risk will be assessed during a future phase to evaluate whether remedial actions are required.

Table 9-1 Summary of AOPIs Identified during the PA, PFOS, PFOA, and PFBS Sampling at FST and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/ND/NS)			Recommendation
	GW	SO	SW	
Fire Station 01	No	ND	NS	No action at this time
Fire Station 03	Yes	Yes	NS	Further study in a remedial investigation
Current AFFF Storage	Yes	No	NS	Further study in a remedial investigation
Fire Station 05	Yes	No	NS	Further study in a remedial investigation
Quarterly Crash Drill Area	Yes	Yes	NS	Further study in a remedial investigation
Taxiway E	Yes	No	NS	Further study in a remedial investigation
Wright Army Airfield FTA (FST-013)	Yes	No	NS	Further study in a remedial investigation
33R Approach	Yes	ND	NS	Further study in a remedial investigation
Former AFFF Storage	Yes	ND	NS	Further study in a remedial investigation
Post South Central Landfill	ND	NS	NS	No action at this time
Vehicle Fire 01	No	ND	NS	No action at this time
Vehicle Fire 02	No	ND	ND	No action at this time
Building 1838	Yes	No	NS	Further study in a remedial investigation

Notes:
Light gray shading – detections greater than the OSD risk screening level

GW – groundwater
ND – non-detect
NS – not sampled
SO – soil
SW – surface water

Data collected during the PA (**Sections 3** through **5**) and SI (**Sections 6** and **7**) 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 FST are discussed below.

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.

An off-post well survey was completed for an area 1-mile downgradient using readily available information from the Georgia water well database. County records were reviewed to identify wells that may not be included in the state database, and relevant parcels were reviewed to compile a list of property owners. Available groundwater modeling reports (i.e., United States Geological Survey reports or other) were reviewed for the area. On location surveys or sampling were not conducted. Finally, the available PFOS, PFOA, and PFBS analytical data for drinking water is limited to results from on-post drinking water well sources, not residential wells or aquifers other than where drinking water wells are screened.

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.

Available PA/SI data, including PFOS, PFOA, and PFBS, is listed in **Appendix O**, which were analyzed per the selected analytical method.

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

10 REFERENCES

Arcadis. 2018. Accident Prevention Plan: A-E Services, PFASs Contamination in the Cleanup/Restoration Programs at Active Army Installations – Nationwide. Prepared for USACE, Baltimore District. March.

Arcadis. 2019. Final Programmatic Uniform Federal Policy Quality Assurance Project Plan, USAEC PFAS PA/SI, Active Army Installations, Nationwide, USA. October.

Arcadis. 2020a. Final UFP QAPP Addendum, Revision 0, USAEC PFAS PA/SI, Fort Stewart, GA. October.

Arcadis. 2020b. Final Site Safety and Health Plan, Revision 0, USAEC PFAS PA/SI, Fort Stewart, GA. October.

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

Department of Defense (DoD). 2017. Fact Sheet: Detection and Quantitation – What Project Managers and Data Users Need to Know. October.

DoD and Department of Energy. 2019. Consolidated Quality Systems Manual for Environmental Laboratories, Version 5.3, May.

DoD. 2019. Environmental Data Quality Working Group: Final General Data Validation Guidelines. November 4.

DoD. 2020. Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-15. May 1.

Fort Stewart. 2020. Email from A. Stevenson (Fort Stewart) to S. Bostian (Arcadis) re: December 2019 PFOS and PFOA sampling results. 05 March 2020.

IMCOM. 2018. PFOA and PFOS Water System Testing. August.

Installation Restoration Program. 1993. Army National Guard. Preliminary Assessment Report for National Guard Training Center, Georgia Army National Guard, Fort Stewart, Georgia. July.

Interstate Technology Regulatory Council. 2017. History and Use of Per-and Polyfluoroalkyl Substances (PFAS). November. Available online at: https://pfas-1.itrcweb.org/wp-content/uploads/2017/11/pfas_fact_sheet_history_and_use__11_13_17.pdf.

Interstate Technology Regulatory Council. 2020. Section 3.1 Firefighting Foams. Updated April 14. Available online at: https://pfas-1.itrcweb.org/3-firefighting-foams/#3_1

Malcolm Pirnie, Inc. 2006. Draft Final Operational Range Phase I Qualitative Assessment Report Fort Stewart Fort Stewart, Georgia, October.

The Nature Conservancy. 1995. Health Care Facilities Waste Management Study No. 37-08-2593-95 Fort Stewart, Georgia, February.

Office of the Secretary of Defense (OSD). 2019. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. October.

OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.

U.S. Army Toxic and Hazardous Materials Agency. 1983. Installation Assessment of Headquarters 24th Infantry Division and Fort Stewart, GA. Report No. 334, October.

USACE. 2005. Environmental Quality: Guidance for Evaluating Performance-Based Chemical Data, Engineer Manual 200-1-10, CEMP-RA/CECW-E, June 30.

USACE. 2012. Environmental Quality: Conceptual Site Models, Engineer Manual 200-1-12, CEMP-CE, December 28.

USEPA. 1991. Guidance for Performing Preliminary Assessments Under CERCLA. EPA/540/G-91/013. September. Available online at: https://semspub.epa.gov/work/11/157081.pdf.

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

USEPA. 2021. Human Health Toxicity Values for Perfluorobutane Sulfonic Acid (CASRN 375-73-5) and Related Compound Potassium Perfluorobutane Sulfonate (CASRN 29420-49-3). EPA/600/R-20/345F. Center for Public Health and Environmental Assessment, Office of Research and Development, Washington DC. April.

United States Climate Data. 2021. Climate online database. URL: https://www.usclimatedata.com/climate/savannah/georgia/unisted-states/usga1191

United States Fish and Wildlife Service. 2019. Endangered Species Program online database. URL: http://www.fws.gov/endangered/

USGS. 2004. Hydraulic Properties of the Floridian Aquifer System and Equivalent Clastic Units in Coastal Georgia and Adjacent Parts of South Carolina and Florida. October.

ACRONYMS

°F	degrees Fahrenheit
%	percent
AFFF	aqueous film-forming foam
AOPI	area of potential interest
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
DPT	direct-push technology
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
FST	Fort Stewart
FTA	fire training area
GIS	geographic information system
GW	groundwater
HAAF	Hunter Army Airfield
IDW	investigation-derived waste
IMCOM	Installation Management Command
installation	United States Army installation
IRP	Installation Restoration Program
LC/MS/MS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
LOQ	limit of quantitation
mg/kg	milligrams per kilogram (parts per million)

ND	non-detect
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
PWS	Public Water Sources
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RSL	Regional Screening Level
SI	site inspection
SO	soil
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
SW	surface water
TGI	technical guidance instruction
TOC	total organic carbon
U.S.	United States
UCMR3	third Unregulated Contaminant Monitoring Rule
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency

UXO	unexploded ordnance
WAAF	Wright Army Airfield
WWTP	wastewater treatment plant

TABLES

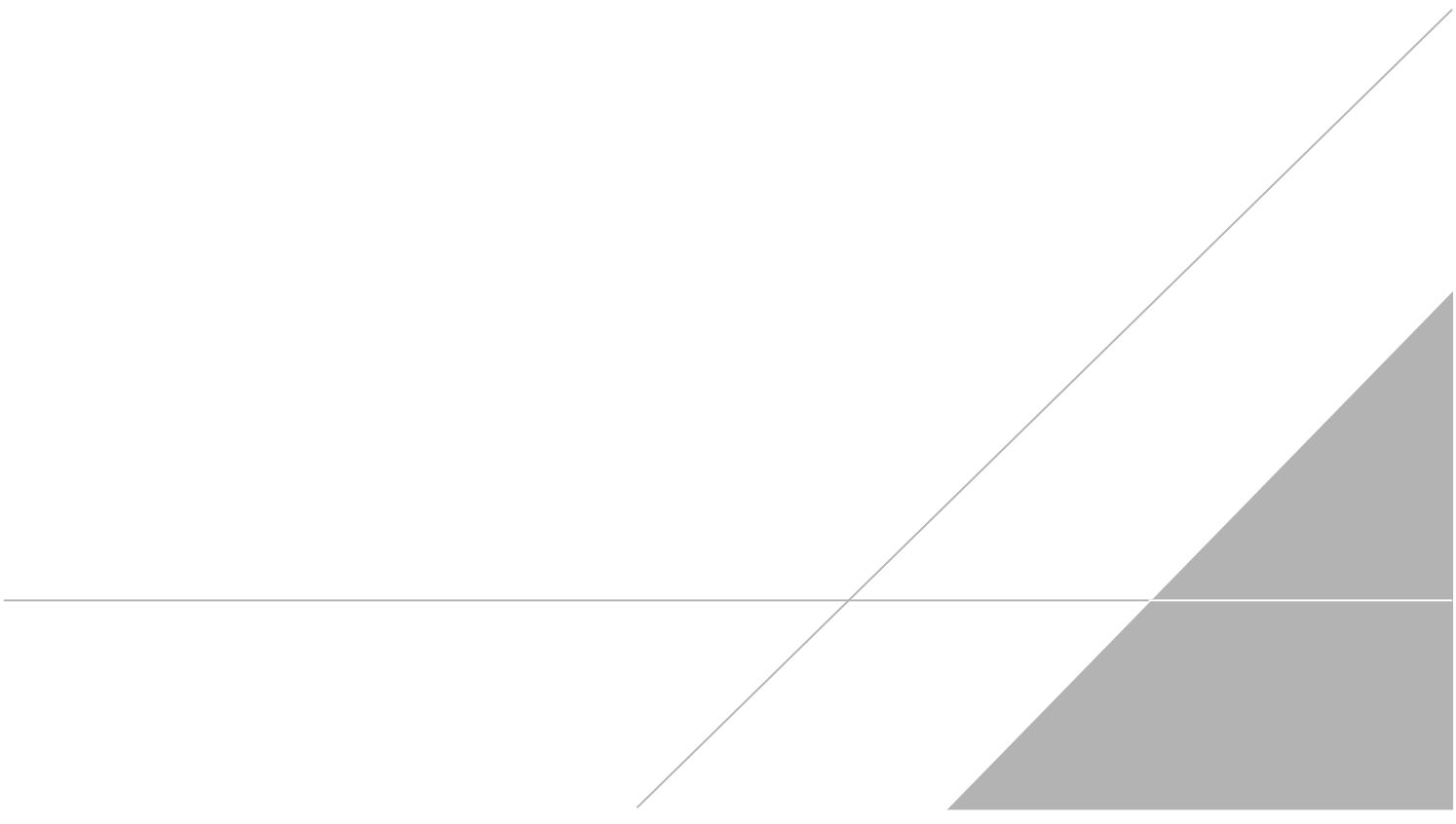


Table 6-1 - Monitoring Well Construction Details
USAEC PFAS PA/SI
Fort Stewart, Georgia

Area of Potential Interest	Well ID	Depth to Water (ft btoc)	Well Diameter (inches)	Well Placed In Service Date	Well Construction Material	Total Well Depth (ft bgs)	TOC Elevation (ft amsl)	Screened Interval (ft bgs)	Dedicated Equipment (Y/N)
Post South Central Landfill (FST-001)	GWB-SC-M5	10.62	2	Unknown	PVC	38.1	Unknown	28 - 38	N
	GWA-SC-M9	6.93	2	Unknown	PVC	13.80	Unknown	5 - 13	N
Wright Army Airfield FTA (FST-013)	FST-MW-11	8.94	2	7/1/2003	PVC	18.0	49.66	5.1 - 15.1	N
	FST-MW-18R	6.04	2	5/29/2008	PVC	17.0	47.05	2.6 - 12.6	N

Notes:
-- = not available
AOPI = area of potential interest
amsl = above mean sea level
bgs = below ground surface
btoc = below top of casing
ft = feet
FTA - fire training area
ID = identification
N = no
PVC = polyvinyl chloride
TOC = top of casing
Y = yes

Sources:
Calendar Year 2019 Corrective Action Plan, SWMU 13, Former Fire Training Area at Wright Army Airfield

Table 7-1 - Groundwater PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Stewart, Georgia

ARCADIS Design & Consultancy for natural and built assets

Associated AOPI	Location	Sample ID / Parent Sample ID	Sample Date	Analyte	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
				OSD Tapwater Risk Screening Level	40		40		600	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Post South Central Landfill (FST-001)	FST-GWB-SC-M5	FST-GWB-SC-M5-101520	10/15/2020	N	3.6	U	3.4	U	3.4	U
Post South Central Landfill (FST-001)	FST-GWB-SC-M9	FST-GWB-SC-M9-101520	10/15/2020	N	3.8	U	3.8	U	3.8	U
Wright Army Airfield FTA (FST-013)	FST-MW-11	FST-MW-11-101420	10/14/2020	N	**18,000**	J	**520**	J	**100**	J
Wright Army Airfield FTA (FST-013)	FST-MW-18R	FST-MW-18R-101420	10/14/2020	N	**16,000**	J	**1,700**	J	190	U
Wright Army Airfield FTA (FST-013)	FST-WAA-01	FST-WAA-GW-01-101420	10/14/2020	N	**28,000**	J	**1,500**	J	**96**	J
33R Approach	FST-33R-01	FST-33R-GW-01-101320	10/13/2020	N	**470**	J	**390**	J	**65**	J
33R Approach	FST-33R-02	FST-33R-GW-02-101320	10/13/2020	N	**8.0**		**2.3**	J	3.6	U
Building 1838	FST-B1838-01	FST-B1838-GW-01-101420	10/14/2020	N	**24**		**150**		**15**	
Current AFFF Storage	FST-CS-01	FST-CS-GW-01-101320	10/13/2020	N	**52,000**	B	**4,700**	J	700	U
Former AFFF Storage Area	FST-FASA-01	FST-FASA-GW-01-101220	10/12/2020	N	**260**	J	**170**	J	**1,600**	J
Fire Station 01	FST-FS1-01	FST-FS1-GW-01-101220	10/12/2020	N	**37**	BJ+	**7.0**		**53**	
		FST-FD-GW-01-101220 / FST-FS1-GW-01-101220	10/12/2020	FD	**37**	J+	**7.5**		**51**	
Fire Station 03	FST-FS3-01	FST-FS3-GW-01-101320	10/13/2020	N	**360,000**	J	**23,000**	J	**6,200**	J
Fire Station 05	FST-FS5-01	FST-FS5-GW-01-101220	10/12/2020	N	**26,000**	J	**1,300**	J	**970**	J
Quarterly Crash Drill Area	FST-CDA-01	FST-CDA-GW-01-101420	10/14/2020	N	**110,000**	J-	**3,600**	J-	**5,400**	J-
Taxiway E	FST-TE-01	FST-TE-GW-01-101420	10/14/2020	N	**44**		**13**		**3.1**	J
Taxiway E	FST-TE-02	FST-TE-GW-02-101320	10/13/2020	N	**37**	J-	**4.7**	J-	**8.3**	J-
Vehicle Fire 01	FST-VF1-01	FST-VF1-GW-01-101520	10/15/2020	N	**2.8**	J	**2.2**	J	3.7	U
Vehicle Fire 02	FST-VF2-01	FST-VF2-GW-01-101220	10/12/2020	N	**2.2**	J	3.6	U	3.6	U

Notes:
1. Bolded values indicate the result was detected greater than the limit of detection.
2. Grey 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:
-- = not applicable
AFFF = aqueous film-forming foam
AOPI = Area of Potential Interest
FTA = fire training area
FD = field duplicate sample
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier

Qualifier	Description
BJ+	Method blank contamination; the result may be biased high.
J-	Result reported from a secondary dilution. The extracted internal standard recovery was greater than 400%; result may be biased low.
J	The analyte was positively identified; however the associated numerical value is an estimated concentration only
J+	The result is an estimated quantity; the result may be biased high.
J-	The result is an estimated quantity; the result may be biased low.
U	The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytcal Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Stewart, Georgia

Associated AOPI	Location	Sample ID / Parent Sample ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	1.6		1.6		25	
				OSD Residential Risk Screening Level	0.13		0.13		1.9	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Wright Army Airfield FTA (FST-013)	FST-WAA-01	FST-WAA-SO-01-101420	10/14/2020	N	**0.0077**		**0.0015**		0.00088	U
Wright Army Airfield FTA (FST-013)	FST-WAA-02	FST-WAA-SO-02-101420	10/14/2020	N	0.00082	U	0.00082	U	0.00082	U
33R Approach	FST-33R-01	FST-33R-SO-01-101320	10/13/2020	N	0.00086	U	0.00086	U	0.00086	U
33R Approach	FST-33R-02	FST-33R-SO-02-101320	10/13/2020	N	0.0010	U	0.0010	U	0.0010	U
Building 1838	FST-B1838-01	FST-B1838-SO-01-101420	10/14/2020	N	**0.0023**		**0.0005**	J	0.00097	U
Current AFFF Storage	FST-CS-01	FST-CS-SO-01-101320	10/13/2020	N	**0.066**	J	0.0057	U	0.0057	U
Former AFFF Storage Area	FST-FASA-01	FST-FASA-SO-01-101220	10/12/2020	N	0.0011	U	0.0011	U	0.0011	U
Fire Station 01	FST-FS1-01	FST-FD-SO-01-101220 / FST-FS1-SO-01-101220	10/12/2020	FD	0.00091	U	0.00091	U	0.00091	U
		FST-FS1-SO-01-101220	10/12/2020	N	0.0010	U	0.0010	U	0.0010	U
Fire Station 03	FST-FS3-01	FST-FS3-SO-01-101320	10/13/2020	N	**0.19**	J	**0.0024**	J	0.0044	U
Fire Station 05	FST-FS5-01	FST-FS5-SO-01-101220	10/12/2020	N	**0.011**		**0.0011**		0.0011	U
Quarterly Crash Drill Area	FST-CDA-01	FST-CDA-SO-01-101420	10/14/2020	N	**0.14**		**0.002**		0.0012	U
Taxiway E	FST-TE-01	FST-TE-SO-01-101420	10/14/2020	N	0.0012	U	0.0012	U	0.0012	U
Taxiway E	FST-TE-02	FST-TE-SO-02-101320	10/13/2020	N	**0.0012**		0.00094	U	0.00094	U
Vehicle Fire 01	FST-VF1-01	FST-VF1-SO-01-101520	10/15/2020	N	0.00088	U	0.00088	U	0.00088	U
Vehicle Fire 02	FST-VF2-01	FST-VF2-SO-01-101220	10/12/2020	N	0.0010	U	0.0010	U	0.0010	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 commercial/industrial scenario (OSD. 2021), (Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.).
3. Grey shaded values indicate the result was detected greater than or equal to the OSD risk screening level for the residential scenario. Italicized values indicate the result was detected greater than the OSD risk screening level for the industrial/commercial and residential scenario.

Acronyms/Abbreviations:
AFFF = aqueous film-forming foam
AOPI = area of potential interest
FD = field duplicate sample
FTA = fire training area
ID = identification
mg/kg = milligrams per kilogram (parts per million)
N = primary sample
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier

Qualifier	Description
E	The reported result is above the limit of the calibration range.
J	The analyte was positively identified; however the associated numerical value is an estimated concentration only
J-	The result is an estimated quantity; the result may be biased low.
U	The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).

Table 7-3 - Surface Water PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Stewart, Georgia

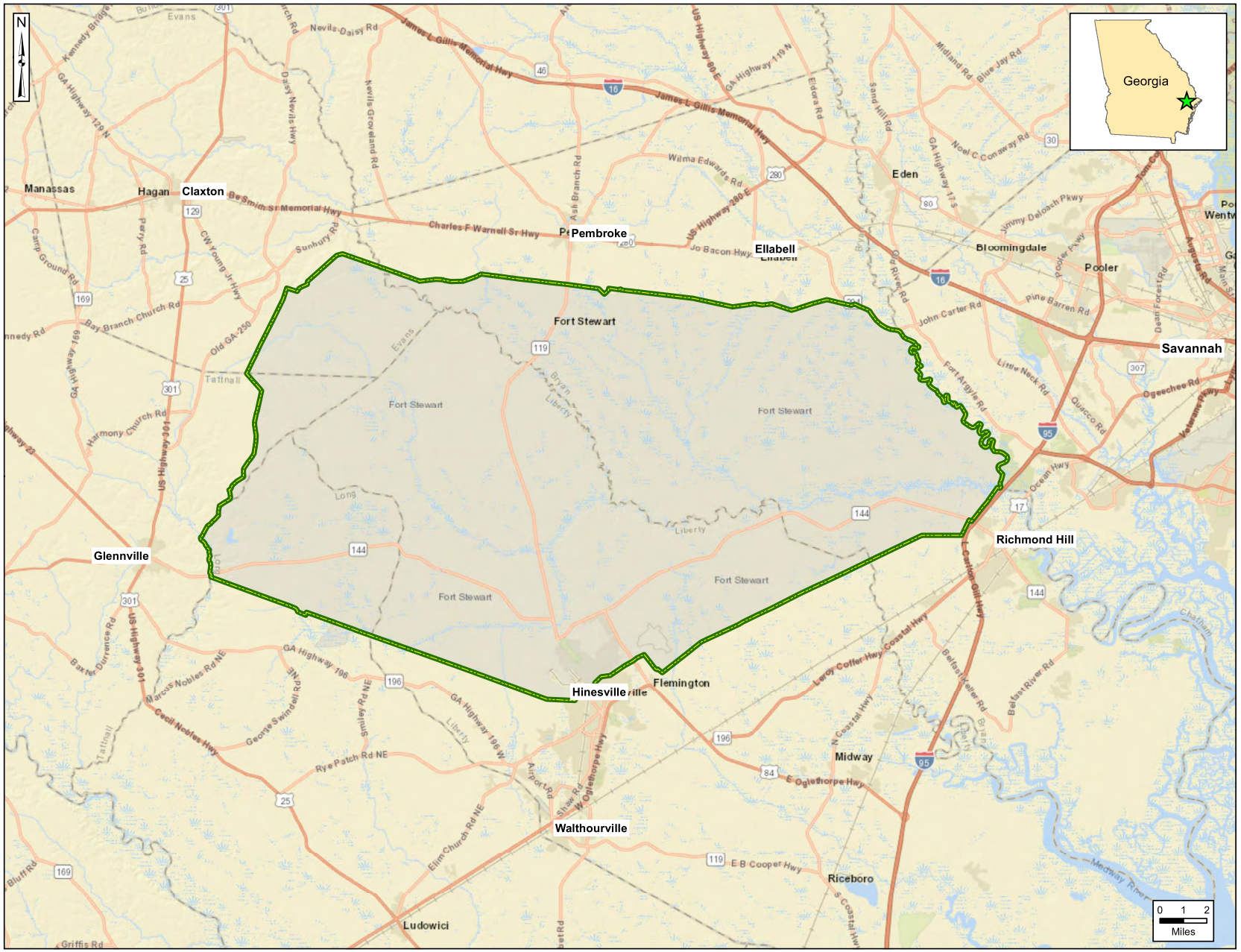
Associated AOPI	Location	Sample ID / Parent Sample ID	Sample Date	Analyte	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
				OSD Tapwater Risk Screening Level	40		40		600	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Vehicle Fire 02	FST-VF2-01	FST-VF2-SW-01-101220	10/12/2020	N	3.6	U	3.6	U	3.6	U

Notes:
1. Bolded values indicate the result was detected greater than the limit of detection.
2. Grey 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:
-- = not applicable
AOPI = Area of Potential Interest
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier

Qualifier	Description
U	The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).

FIGURES



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

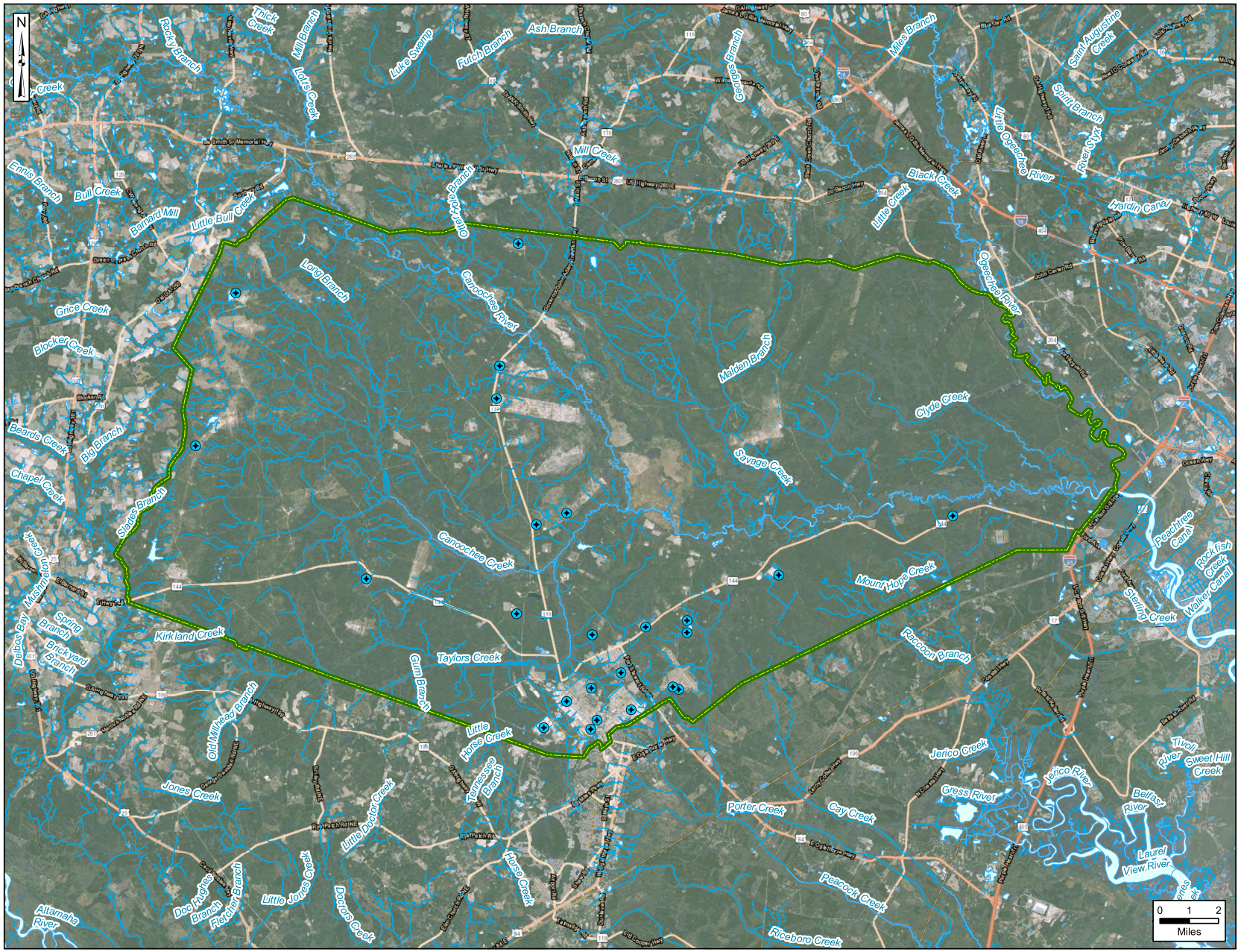
Figure 2-1
Site Location

Legend

Installation Boundary

Data Sources:
USAEC, GIS Data, 2005
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

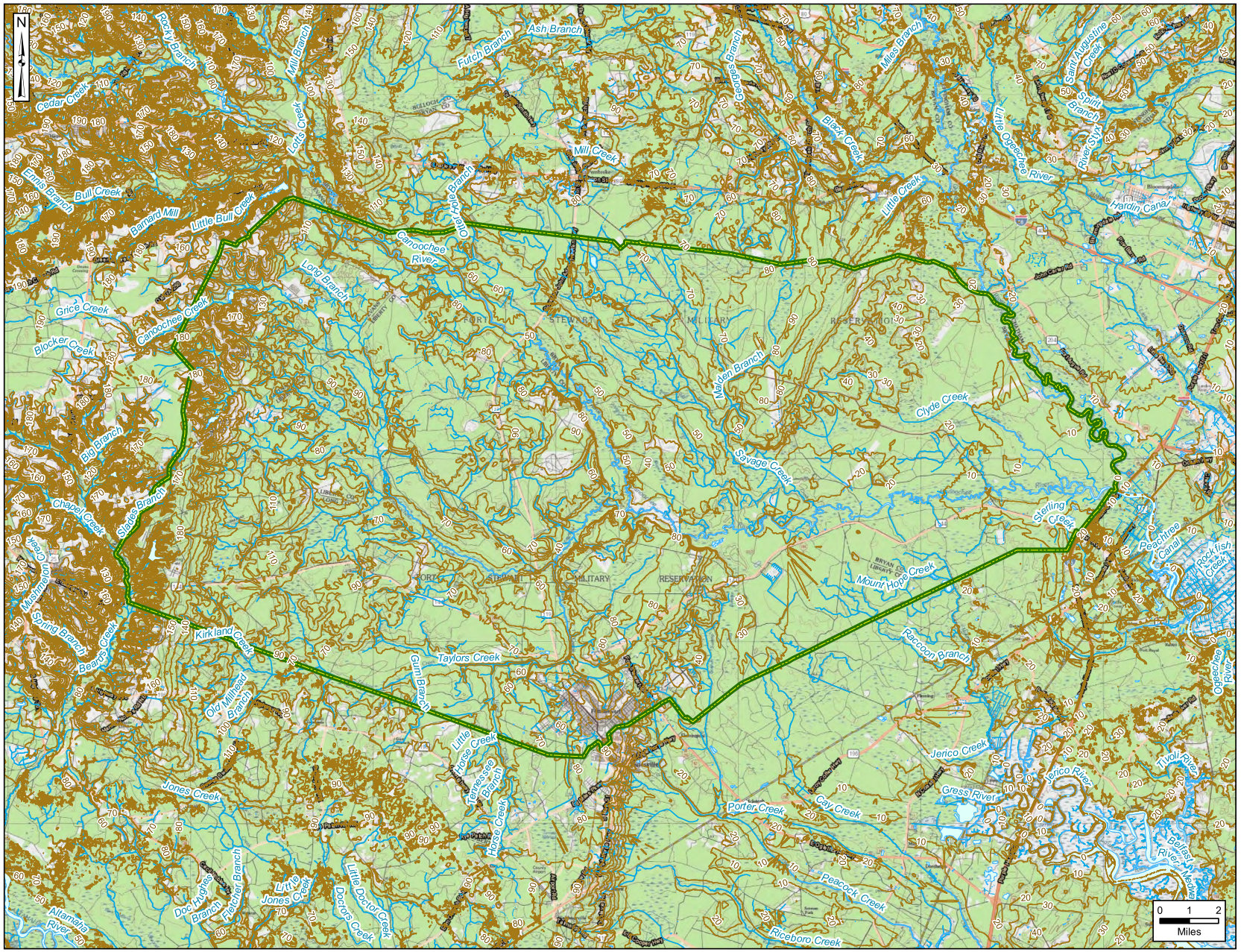
Figure 2-2
Site Layout

Legend

- Installation Boundary
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Installation Drinking Water Well

Data Sources:
USAEC, GIS Data, 2005
Fort Stewart, Wells, 2018
USGS, NHD Data, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

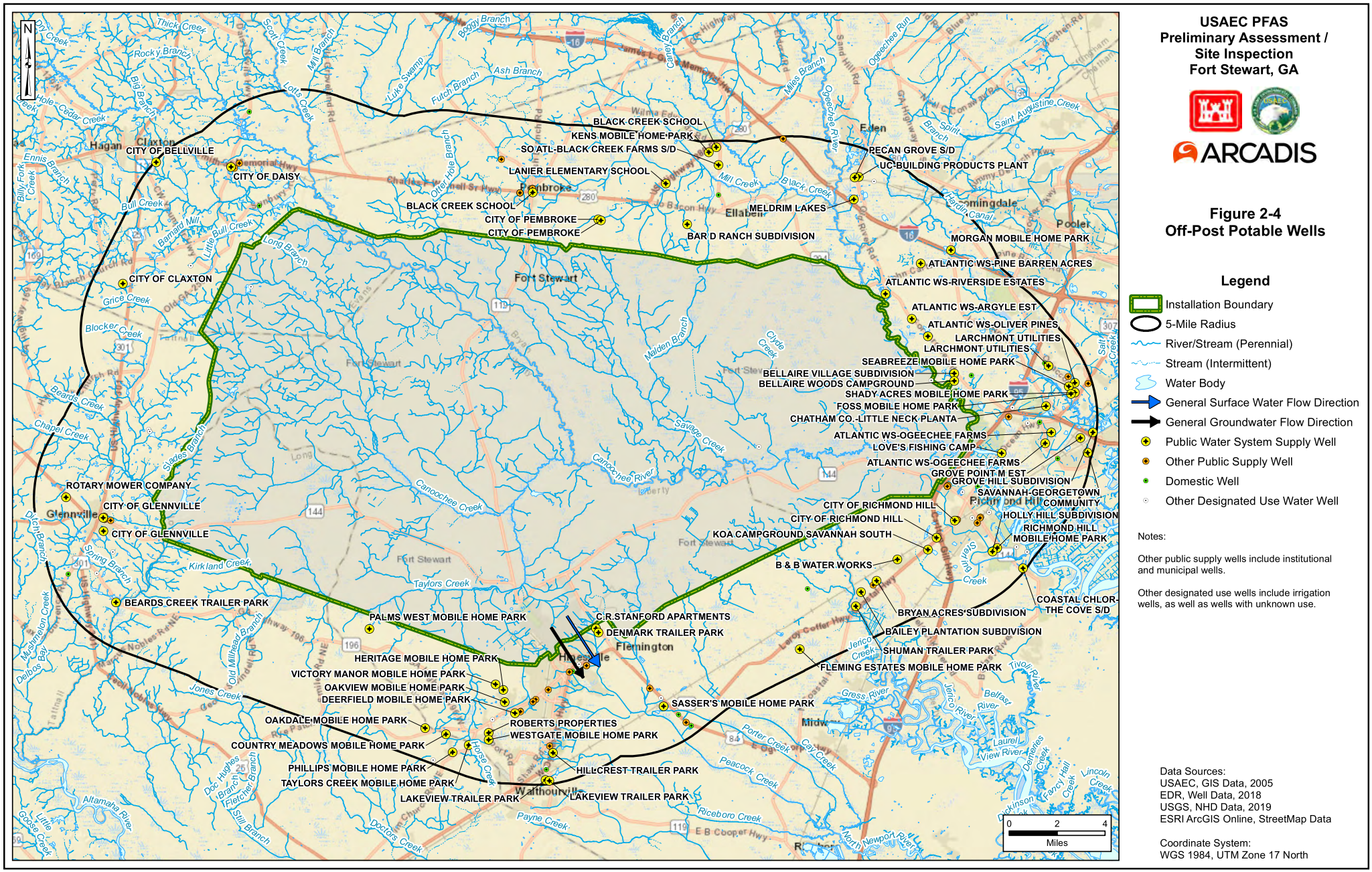
Figure 2-3
Site Topography

Legend

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

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
ESRI ArcGIS Online, USA Topo Maps

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 2-4
Off-Post Potable Wells

Legend

- Installation Boundary
- 5-Mile Radius
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- General Surface Water Flow Direction
- General Groundwater Flow Direction
- Public Water System Supply Well
- Other Public Supply Well
- Domestic Well
- Other Designated Use Water Well

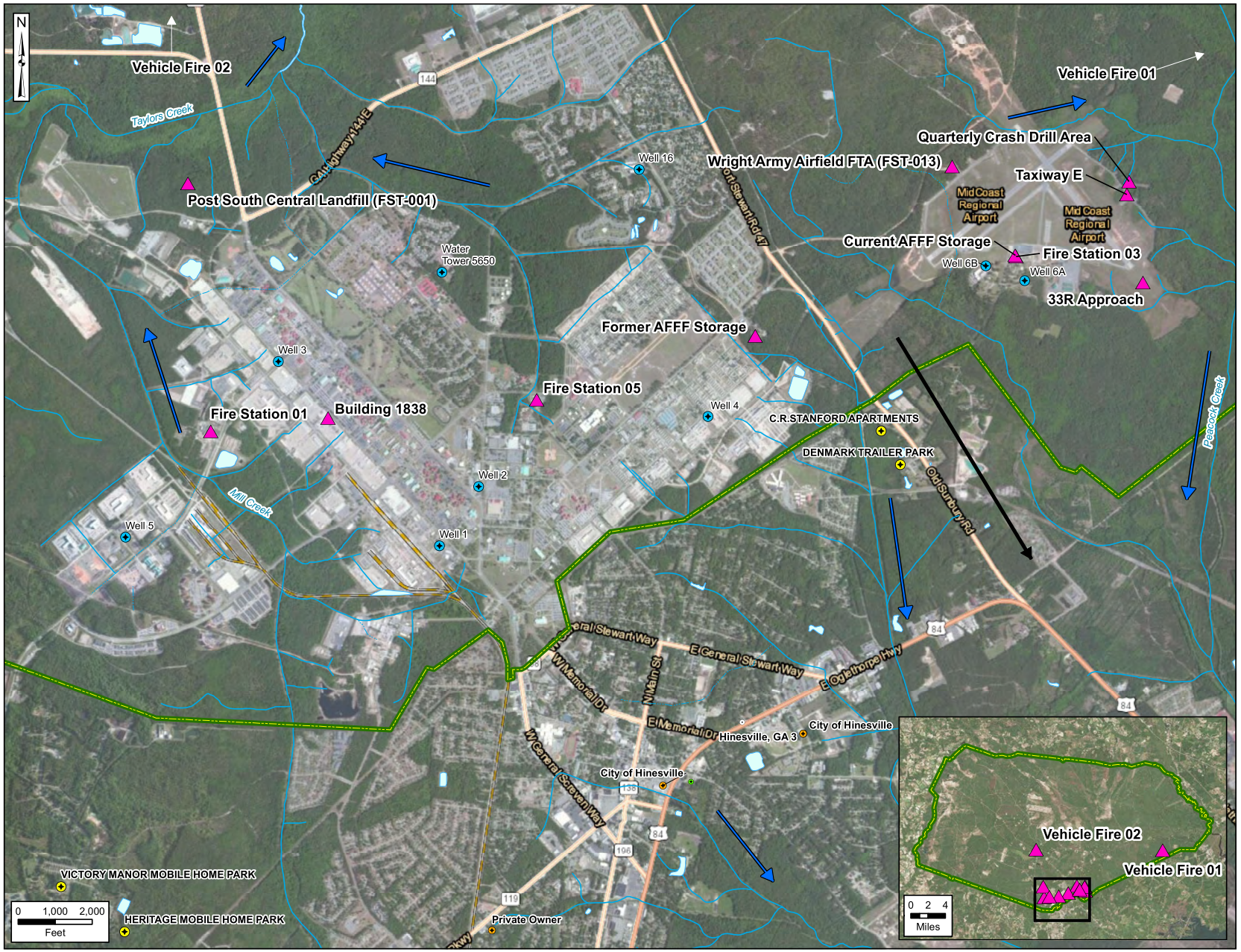
Notes:

Other public supply wells include institutional and municipal wells.

Other designated use wells include irrigation wells, as well as wells with unknown use.

Data Sources:
USAEC, GIS Data, 2005
EDR, Well Data, 2018
USGS, NHD Data, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-2
Aerial Photo of AOPIs at Fort Stewart

Legend

- Installation Boundary
- AOPI Location
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Surface Water Flow Direction
- Shallow Groundwater Flow Direction
- Installation Drinking Water Well
- Public Water Supply System Well
- Other Public Supply Well
- Domestic Well
- Other Designated Use Water Well

AFFF = aqueous film-forming form
AOPI = area of potential interest
FTA = fire training area

Notes:

Other public supply wells include institutional and municipal wells.

Other designated use wells include irrigation wells, as well as wells with unknown use.

Data Sources:
USAEC, GIS Data, 2005
Fort Stewart, Well Data, 2018
EDR, Well Data, 2018
USGS, NHD Data, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-3
Aerial Photo of
Fire Station 01 AOPI

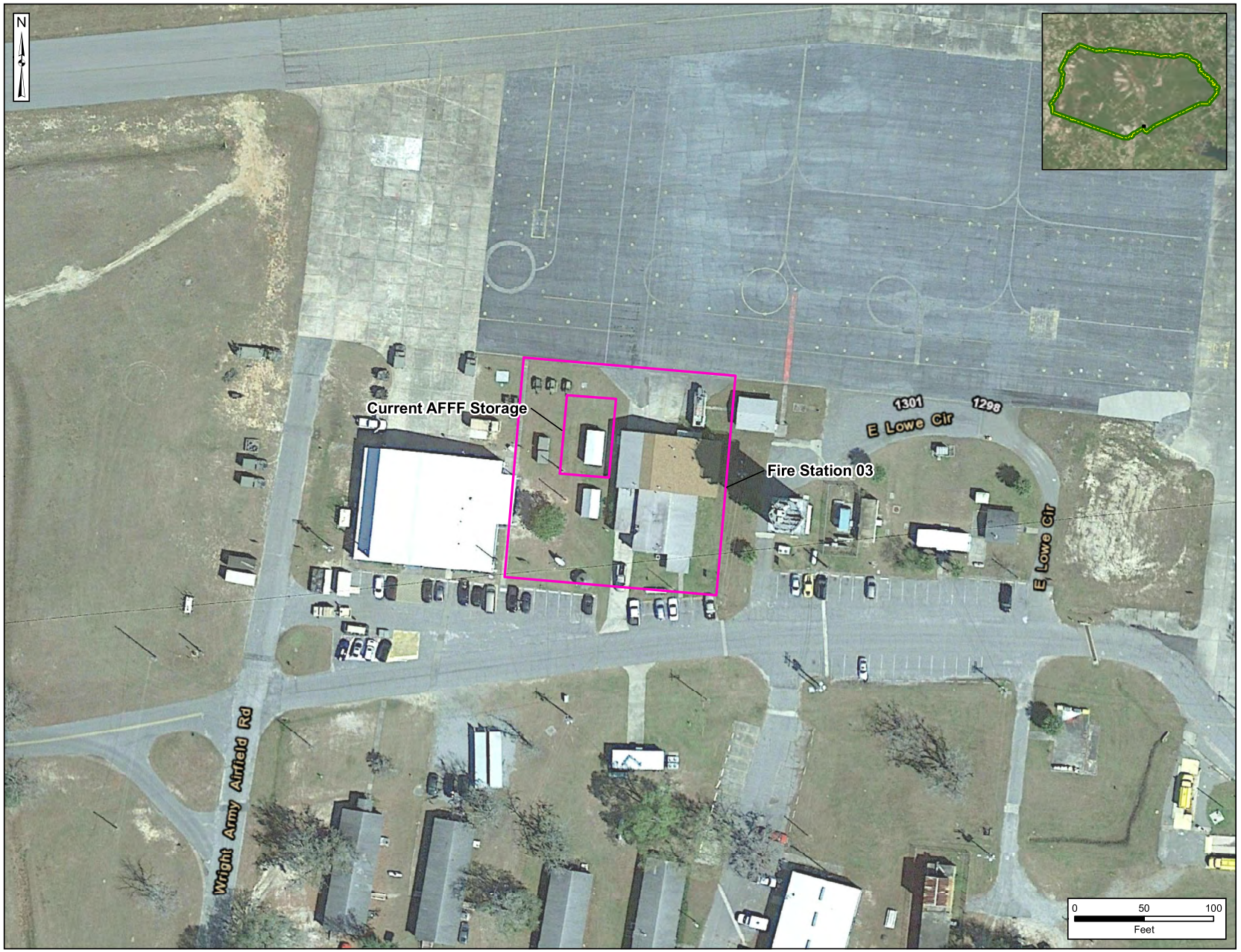
Legend

- Installation Boundary
- AOPI

AOPI = area of potential interest

Data Sources:
USAEC, GIS Data, 2005
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-4
Aerial Photo of
Fire Station 03 and
Current AFFF Storage AOPIs

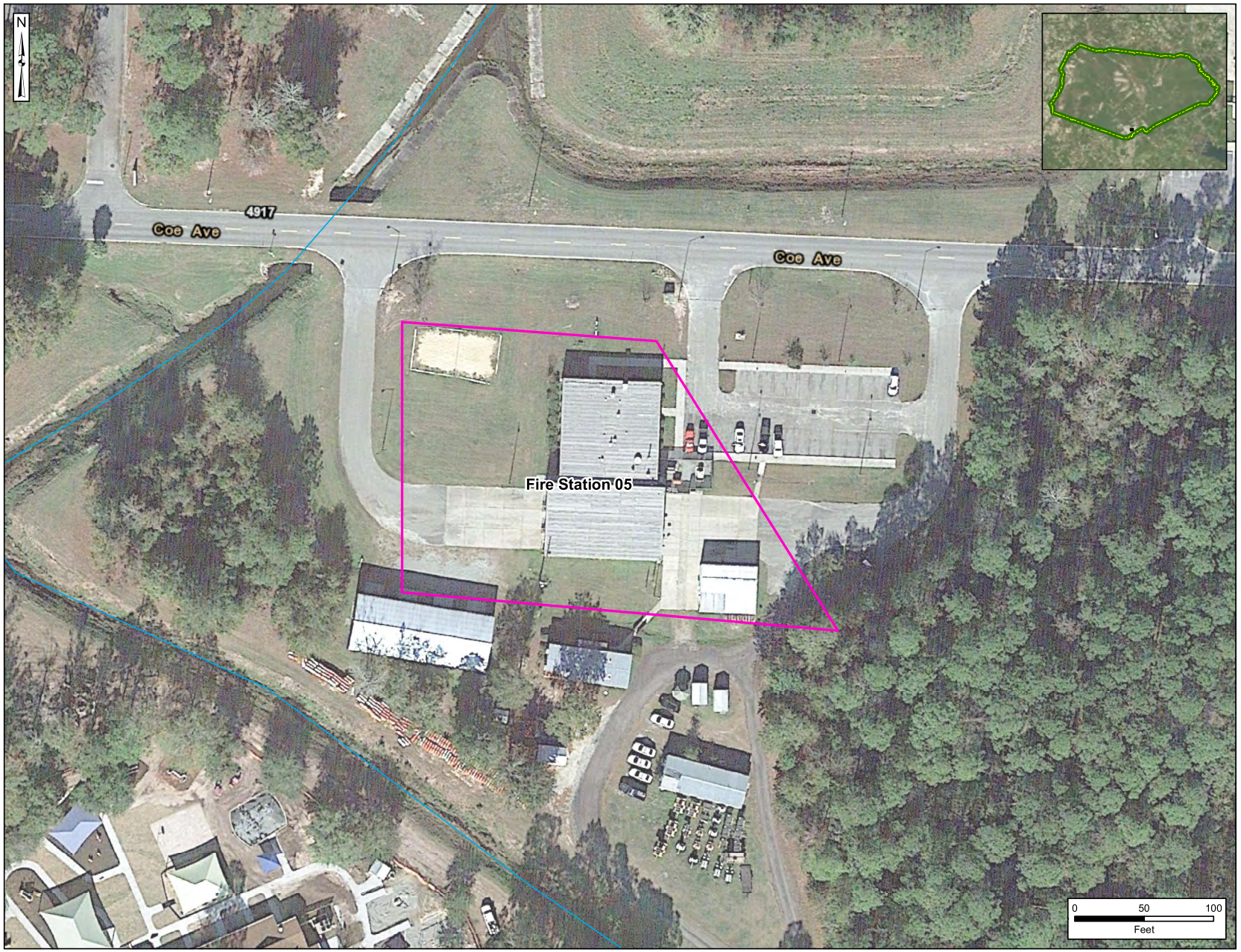
Legend

- Installation Boundary
- AOPI

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

Data Sources:
USAEC, GIS Data, 2005
Google Earth, Aerial Imagery, 2013

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-5
Aerial Photo of
Fire Station 05 AOPI

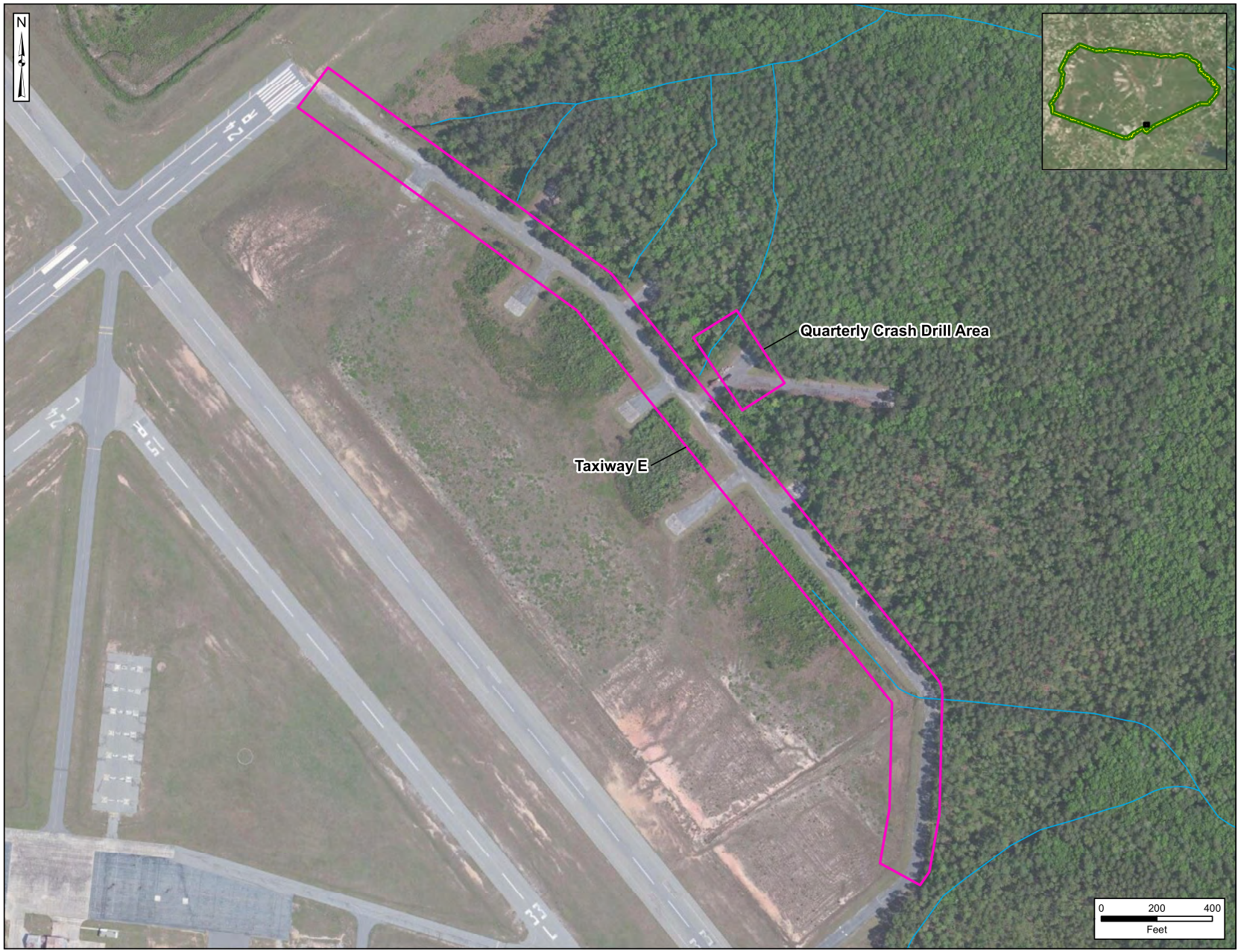
Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)

AOPI = area of potential interest

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
Google Earth, Aerial Imagery, 2015

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-6
Aerial Photo of
Quarterly Crash Drill Area and
Taxiway E AOPIs

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)

AOPI = area of potential interest

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-7
Aerial Photo of
Wright Army Airfield FTA
(FST-013) AOPI

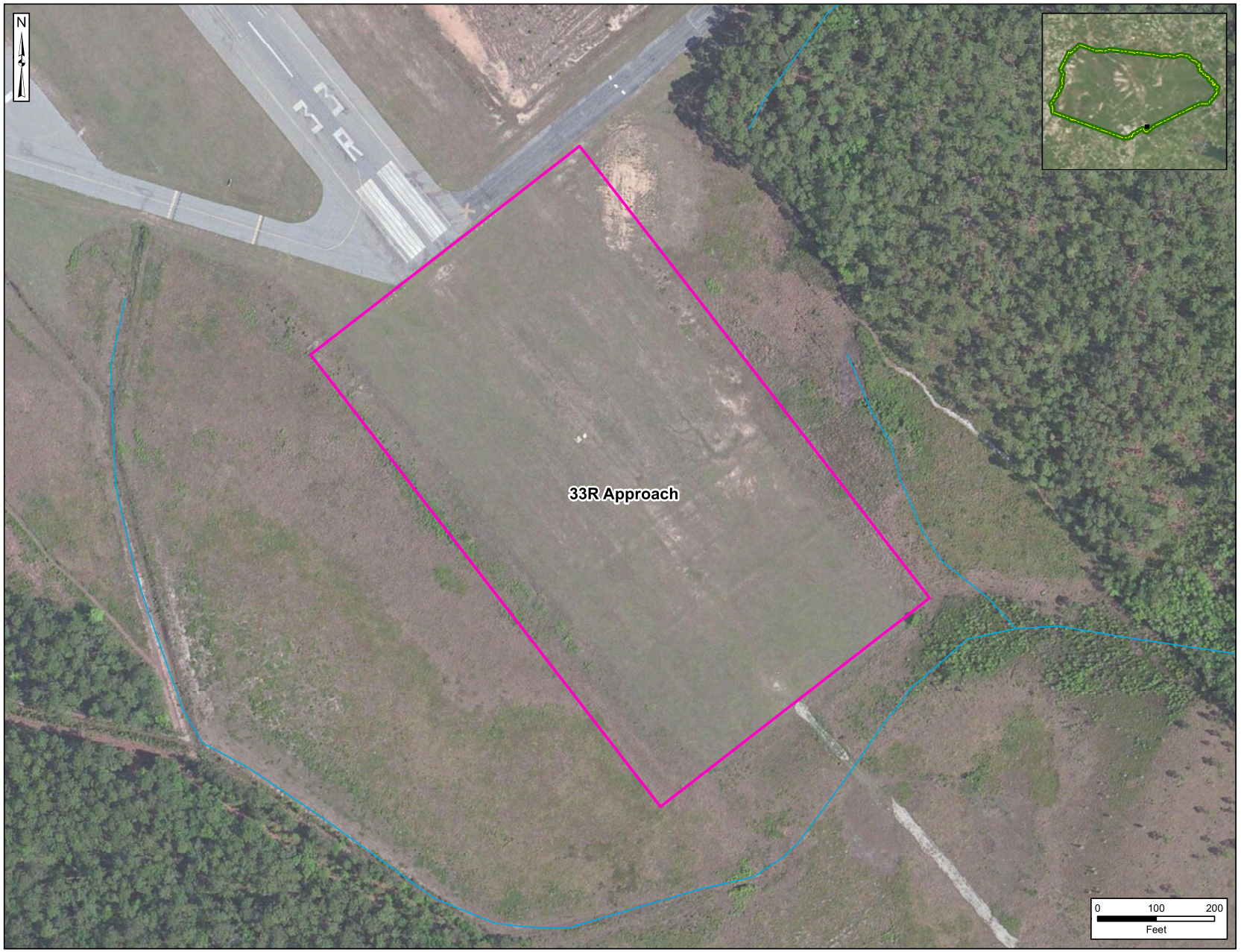
Legend

- Installation Boundary
- AOPI
- Monitoring Well

AOPI = area of potential interest
FTA = fire training area

Data Sources:
USAEC, GIS Data, 2005
Fort Stewart, Well Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-8
Aerial Photo of
33R Approach AOPI

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)

AOPI = area of potential interest

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-9
Aerial Photo of
Former AFFF Storage AOPI

Legend

- Installation Boundary
- AOPI

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

Data Sources:
USAEC, GIS Data, 2005
Google Earth, Aerial Imagery, 2015

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-10
Aerial Photo of
Post South Central Landfill
(FST-001) AOPI

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Monitoring Well

AOPI = area of potential interest

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
Fort Stewart, Well Data, 2020
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-11
Aerial Photo of
Vehicle Fire 01 AOPI

Legend

- Installation Boundary
- AOPI
- Stream (Intermittent)

AOPI = area of potential interest

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-12
Aerial Photo of
Vehicle Fire 02 AOPI

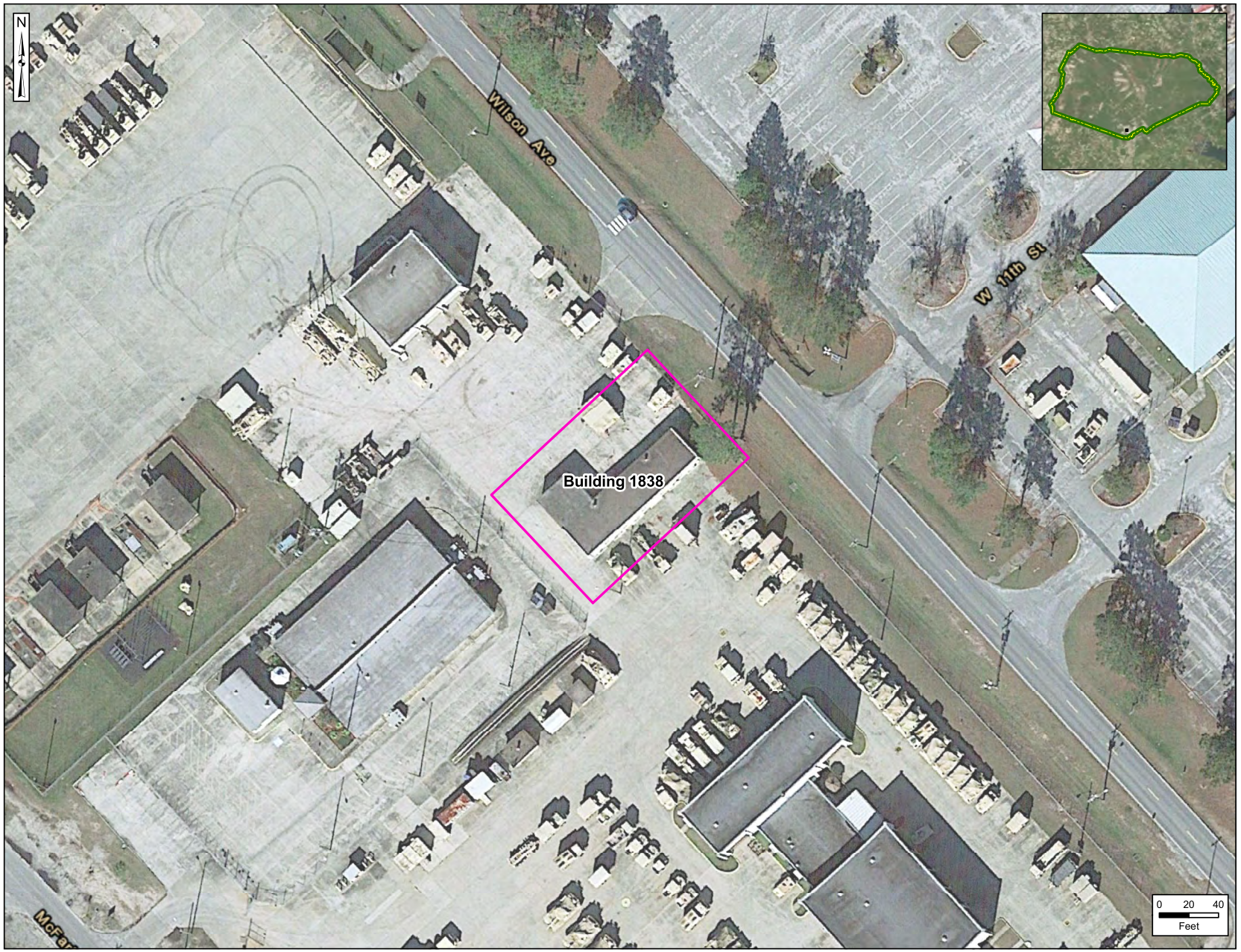
Legend

- Installation Boundary
- AOPI

AOPI = area of potential interest

Data Sources:
USAEC, GIS Data, 2005
Google Earth, Aerial Imagery, 2015

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 5-13
Aerial Photo of
Building 1838 AOPI

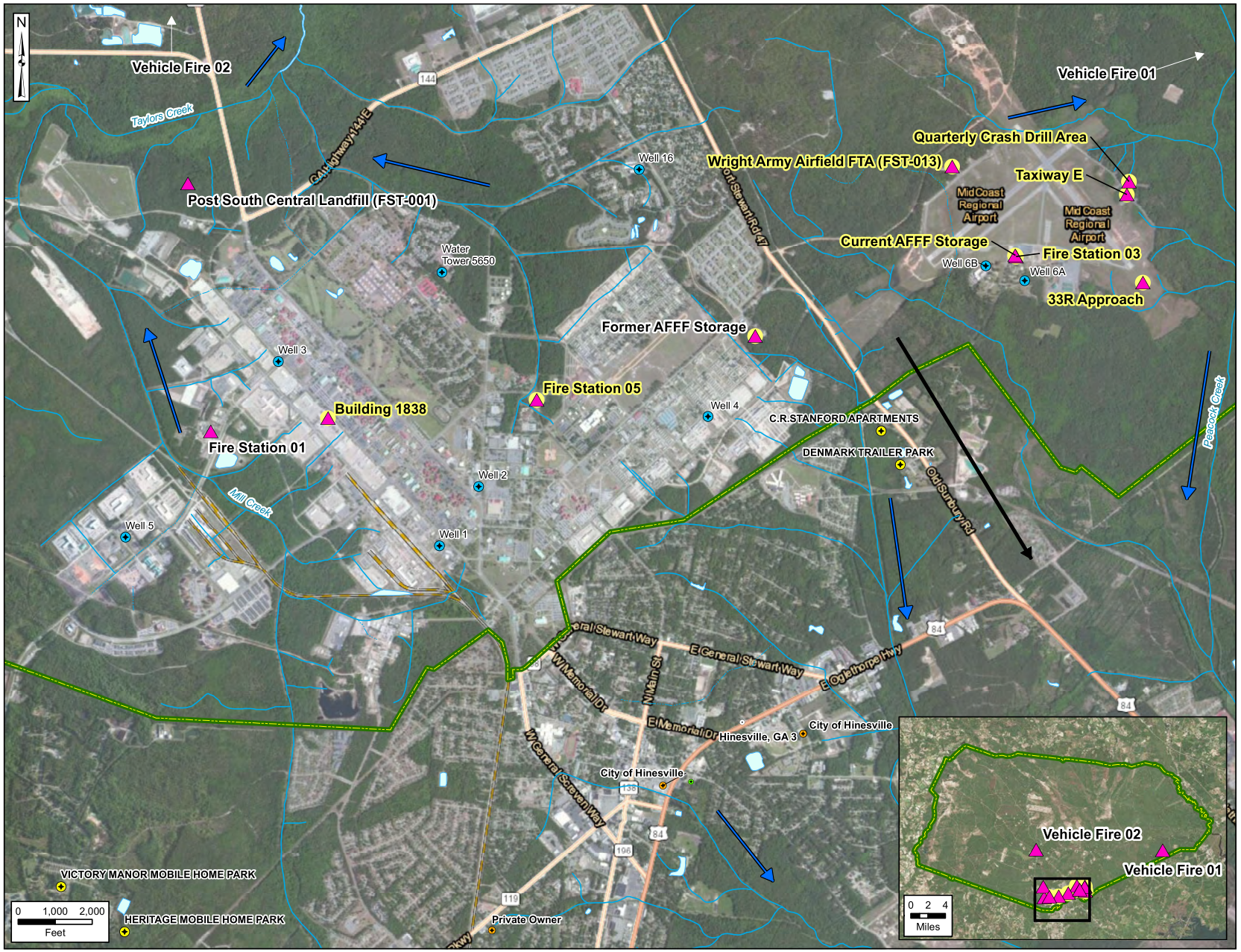
Legend

- Installation Boundary
- AOPI

AOPI = area of potential interest

Data Sources:
USAEC, GIS Data, 2005
Google Earth, Aerial Imagery, 2015

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

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

Legend

- Installation Boundary
- AOPI Location
- AOPI with OSD Risk Screening Level Exceedance
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Surface Water Flow Direction
- Shallow Groundwater Flow Direction
- Installation Drinking Water Well
- Public Water Supply System Well
- Other Public Supply Well
- Domestic Well
- Other Designated Use Water Well

AFFF = aqueous film-forming form
AOPI = area of potential interest
FTA = fire training area
OSD = Office of the Secretary of Defense

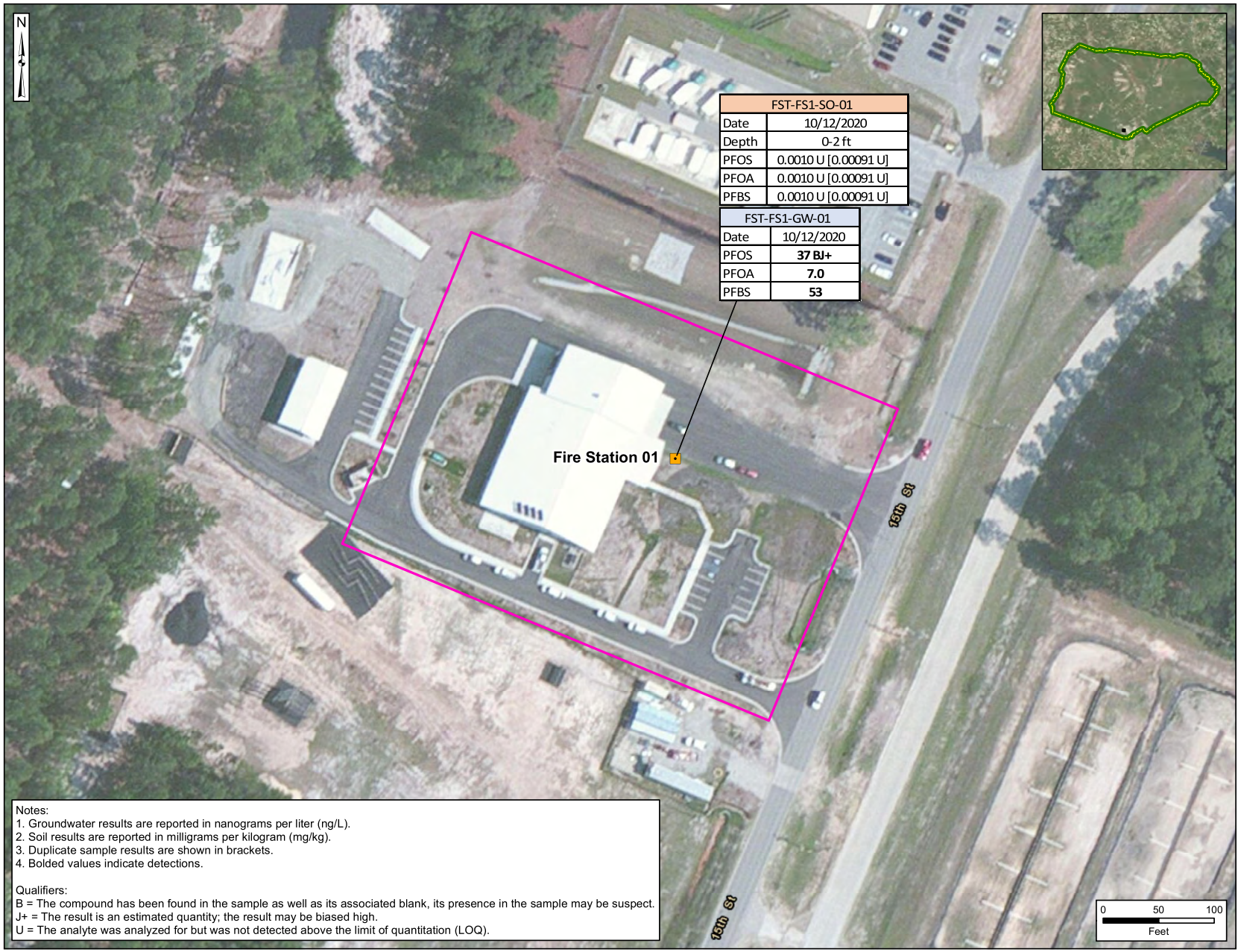
Notes:

Other public supply wells include institutional and municipal wells.

Other designated use wells include irrigation wells, as well as wells with unknown use.

Data Sources:
USAEC, GIS Data, 2005
Fort Stewart, Well Data, 2018
EDR, Well Data, 2018
USGS, NHD Data, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
3. Duplicate sample results are shown in brackets.
4. Bolded values indicate detections.

Qualifiers:
B = The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
J+ = The result is an estimated quantity; the result may be biased high.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 7-2
Fire Station 01
PFOS, PFOA, and PFBS Analytical Results

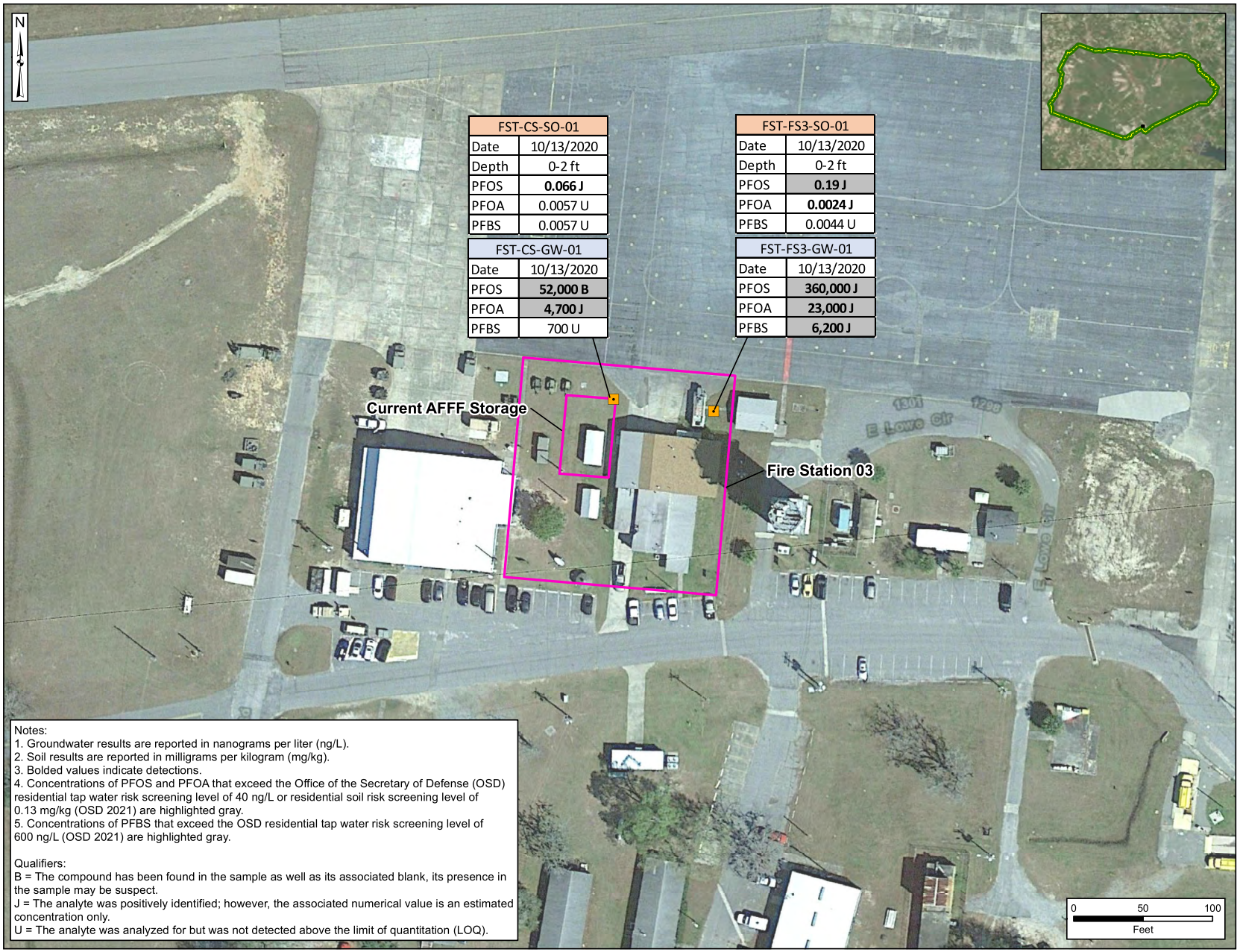
Legend

- Installation Boundary
- AOPI
- Shallow Soil and Grab Groundwater Sampling Location

AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
USAEC, GIS Data, 2005
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
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 or residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
5. Concentrations of PFBS that exceed the OSD residential tap water risk screening level of 600 ng/L (OSD 2021) are highlighted gray.

Qualifiers:
B = The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
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).

USAEC PFAS Preliminary Assessment / Site Inspection Fort Stewart, GA

ARCADIS

Figure 7-3
Fire Station 03 and Current AFFF Storage PFOS, PFOA, and PFBS Analytical Results

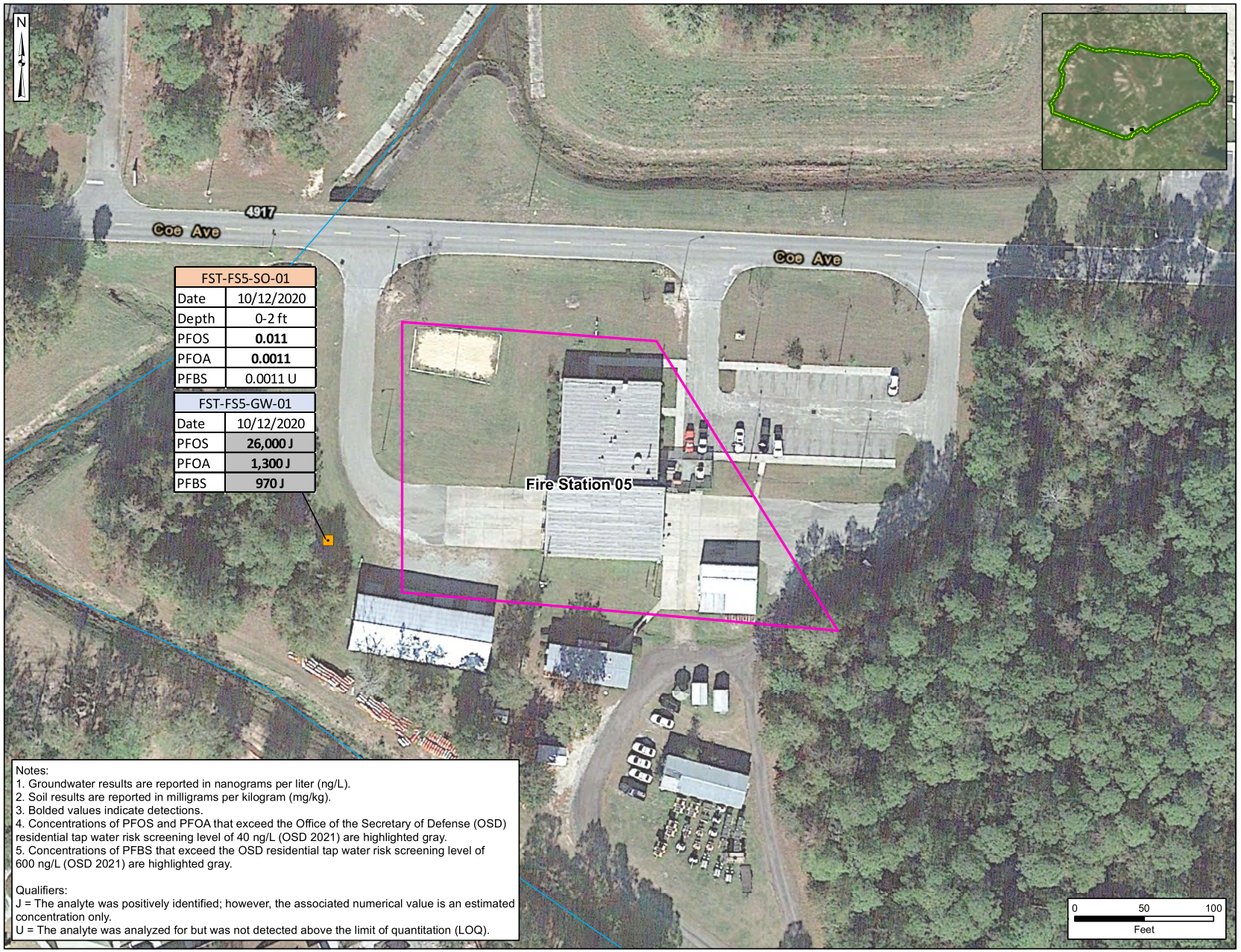
Legend

- Installation Boundary
- AOPI
- Shallow Soil and Grab Groundwater Sampling Location

AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
USAEC, GIS Data, 2005
Google Earth, Aerial Imagery, 2013

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
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.
5. Concentrations of PFBS that exceed the OSD residential tap water risk screening level of 600 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).

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 7-4
Fire Station 05
PFOS, PFOA, and PFBS Analytical Results

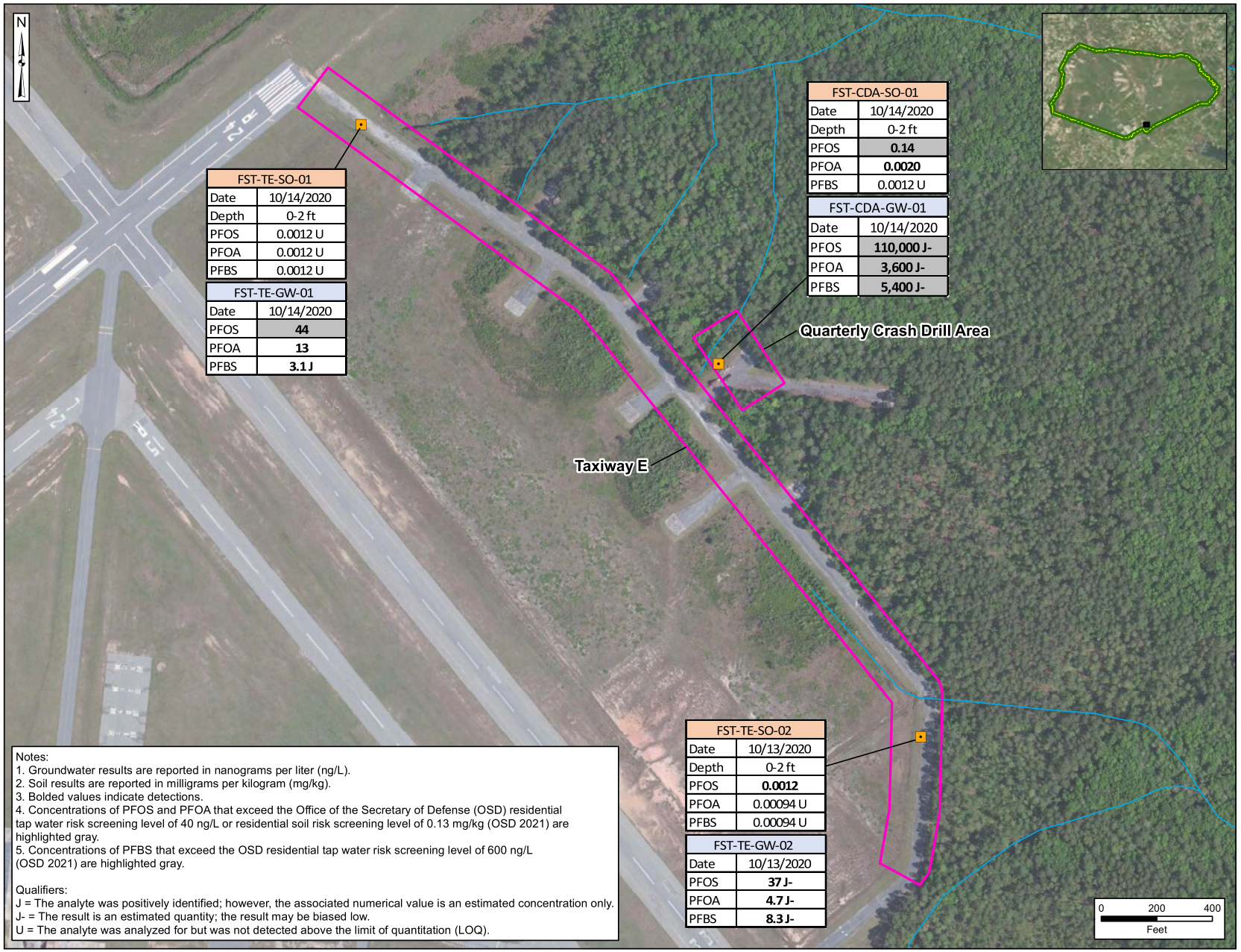
Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Shallow Soil and Grab Groundwater Sampling Location

AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
Google Earth, Aerial Imagery, 2015

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
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 or residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
5. Concentrations of PFBS that exceed the OSD residential tap water risk screening level of 600 ng/L (OSD 2021) are highlighted gray.

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

USAEC PFAS Preliminary Assessment / Site Inspection Fort Stewart, GA

ARCADIS

Figure 7-5
Quarterly Crash Drill Area and Taxiway E
PFOS, PFOA, and PFBS Analytical Results

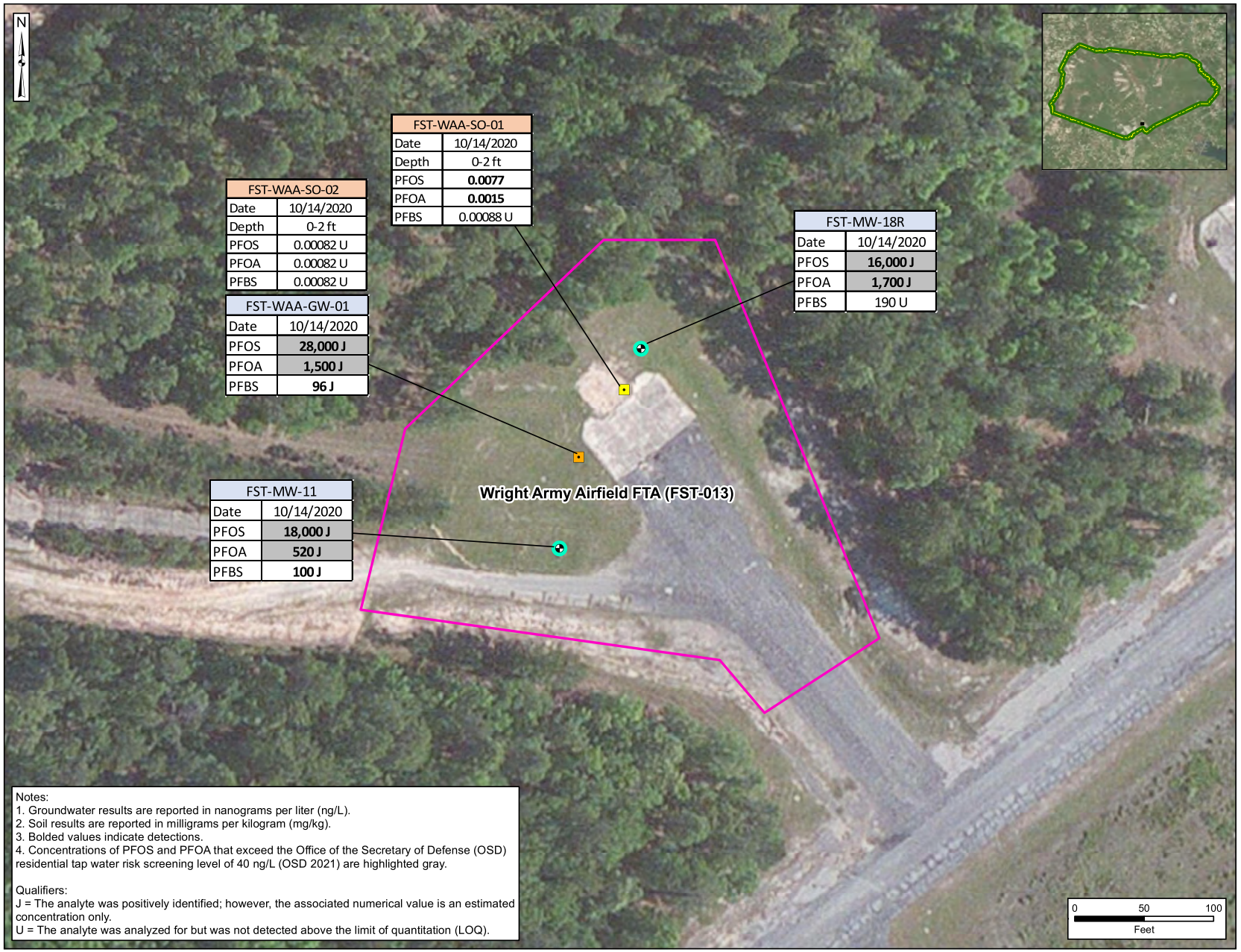
Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Shallow Soil and Grab Groundwater Sampling Location

AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
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:
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).

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 7-6
Wright Army Airfield FTA (FST-013)
PFOS, PFOA, and PFBS Analytical Results

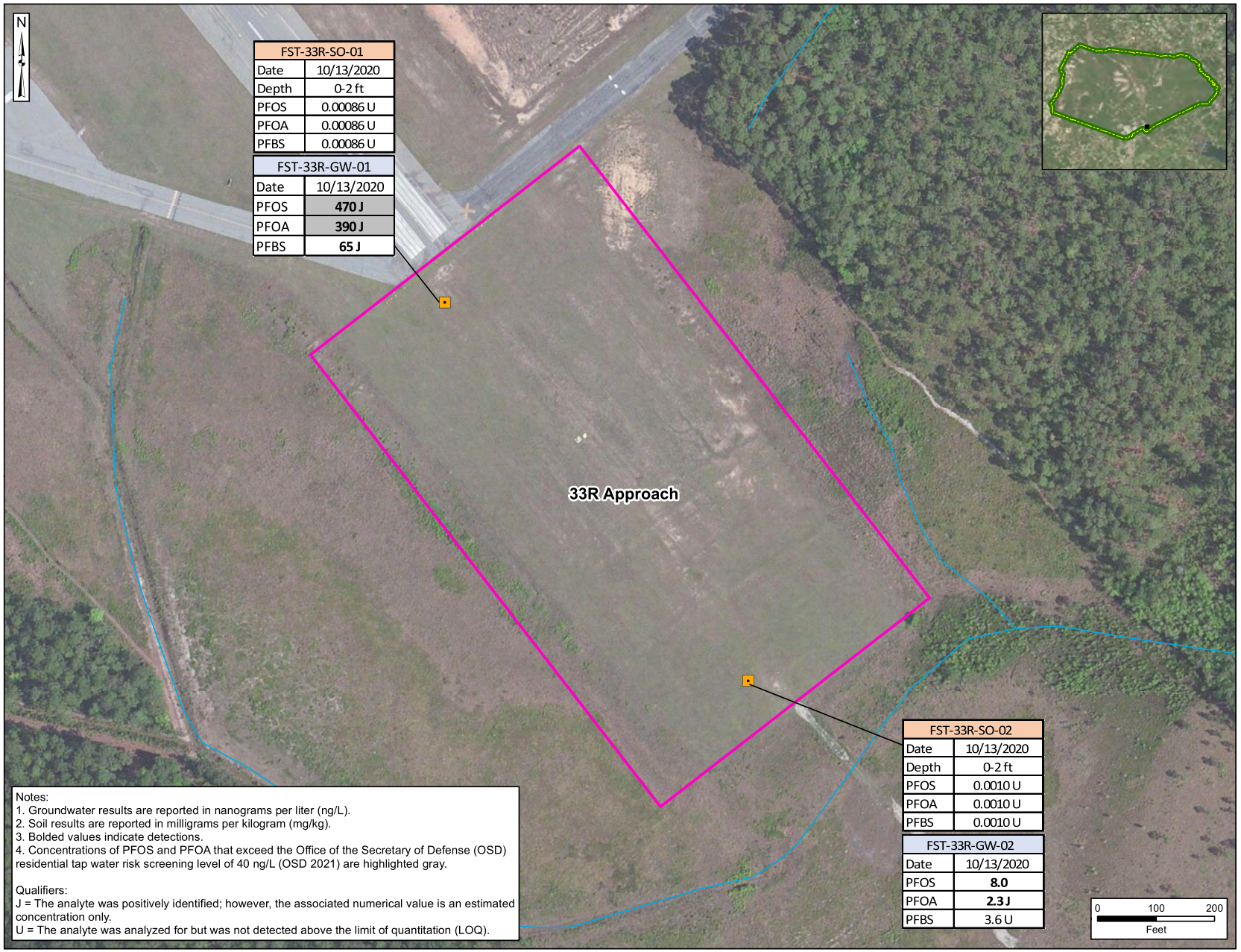
Legend

- Installation Boundary
- AOPI
- Monitoring Well
- Groundwater Sampling Location - Existing Well
- Shallow Soil Sampling Location
- Shallow Soil and Grab Groundwater Sampling Location

AOPI = area of potential interest
ft = feet
GW = groundwater
FTA = fire training area
MW = monitoring well
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
USAEC, GIS Data, 2005
Fort Stewart, Well Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
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:
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).

USAEC PFAS Preliminary Assessment / Site Inspection Fort Stewart, GA

ARCADIS

Figure 7-7
33R Approach
PFOS, PFOA, and PFBS Analytical Results

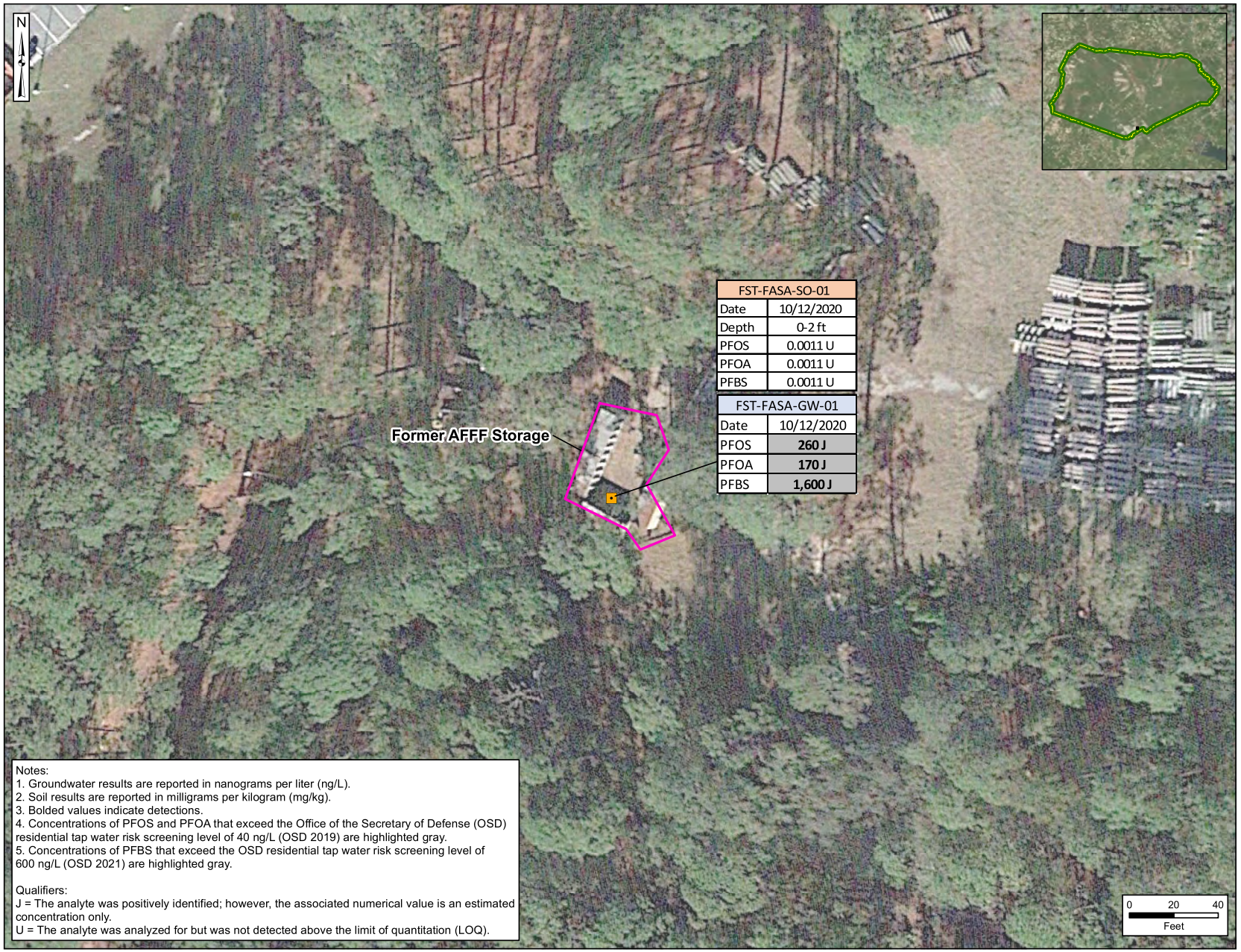
Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Shallow Soil and Grab Groundwater Sampling Location

AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
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 2019) are highlighted gray.
5. Concentrations of PFBS that exceed the OSD residential tap water risk screening level of 600 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).

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 7-8
Former AFFF Storage
PFOS, PFOA, and PFBS Analytical Results

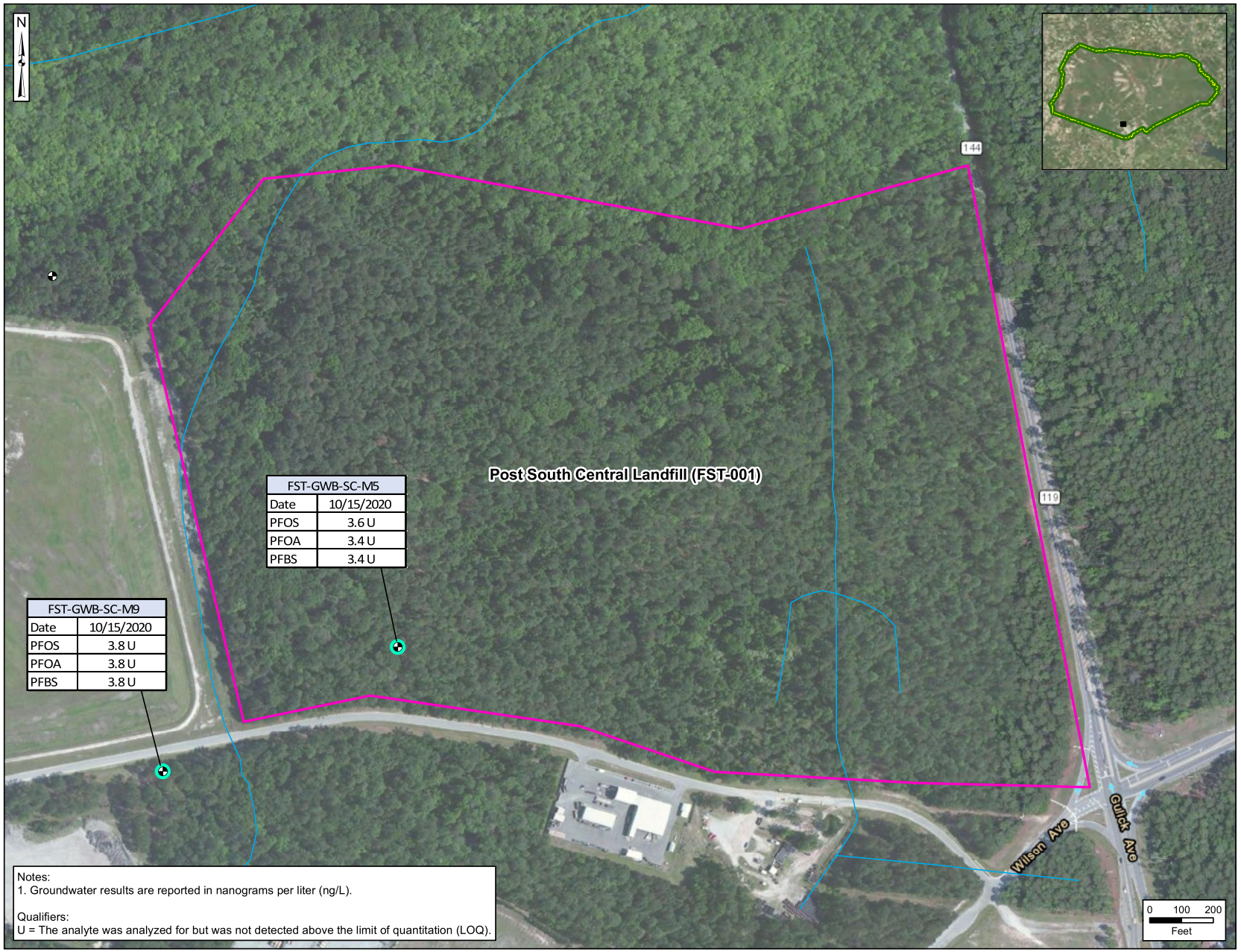
Legend

- Installation Boundary
- AOPI
- Shallow Soil and Grab Groundwater Sampling Location

AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
USAEC, GIS Data, 2005
Google Earth, Aerial Imagery, 2015

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).

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

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 7-9
Post South Central Landfill (FST-001)
PFOS, PFOA, and PFBS Analytical Results

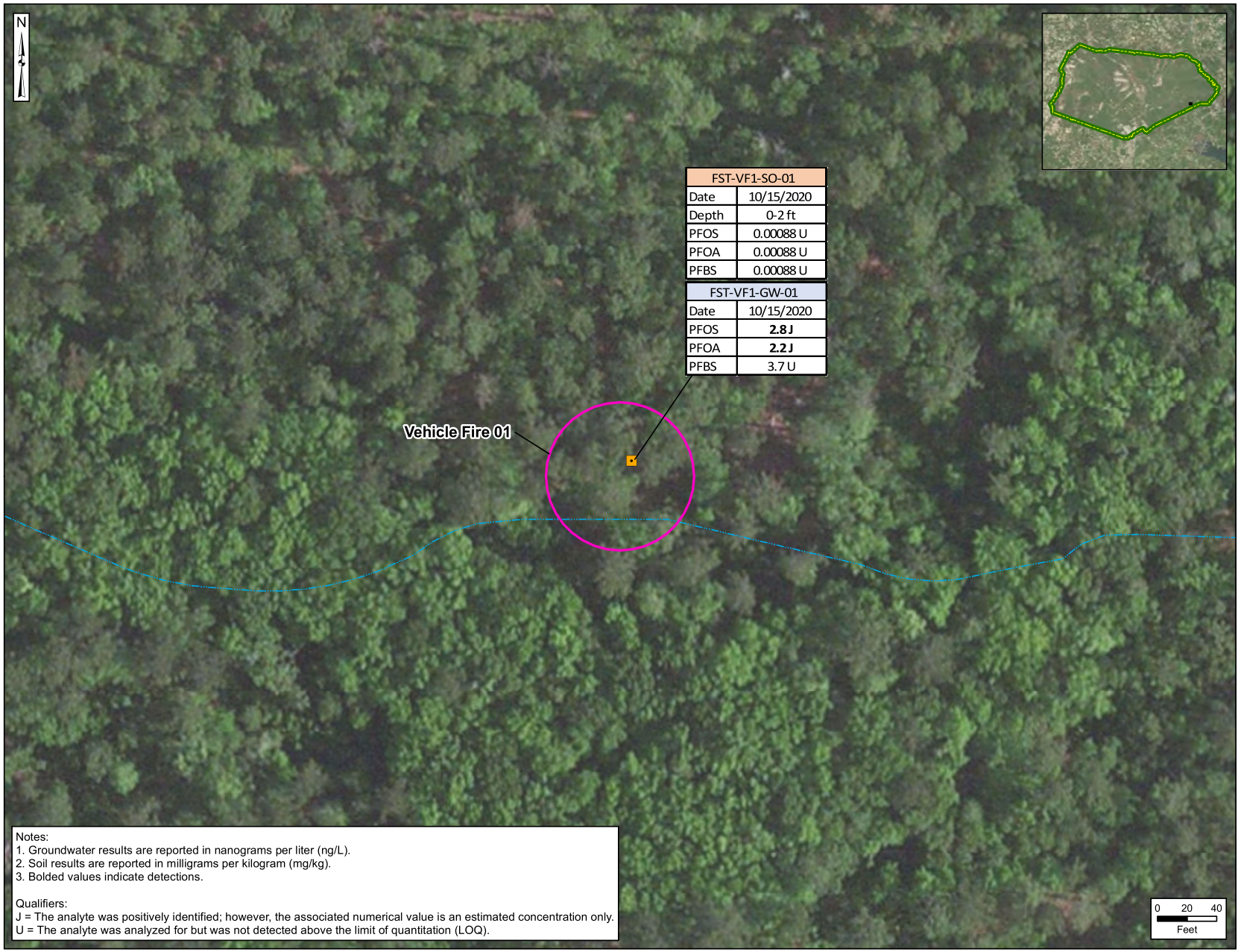
Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Monitoring Well
- Groundwater Sampling Location - Existing Well

AOPI = area of potential interest
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
Fort Stewart, Well Data, 2020
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
3. 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).

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 7-10
Vehicle Fire 01
PFOS, PFOA, and PFBS Analytical Results

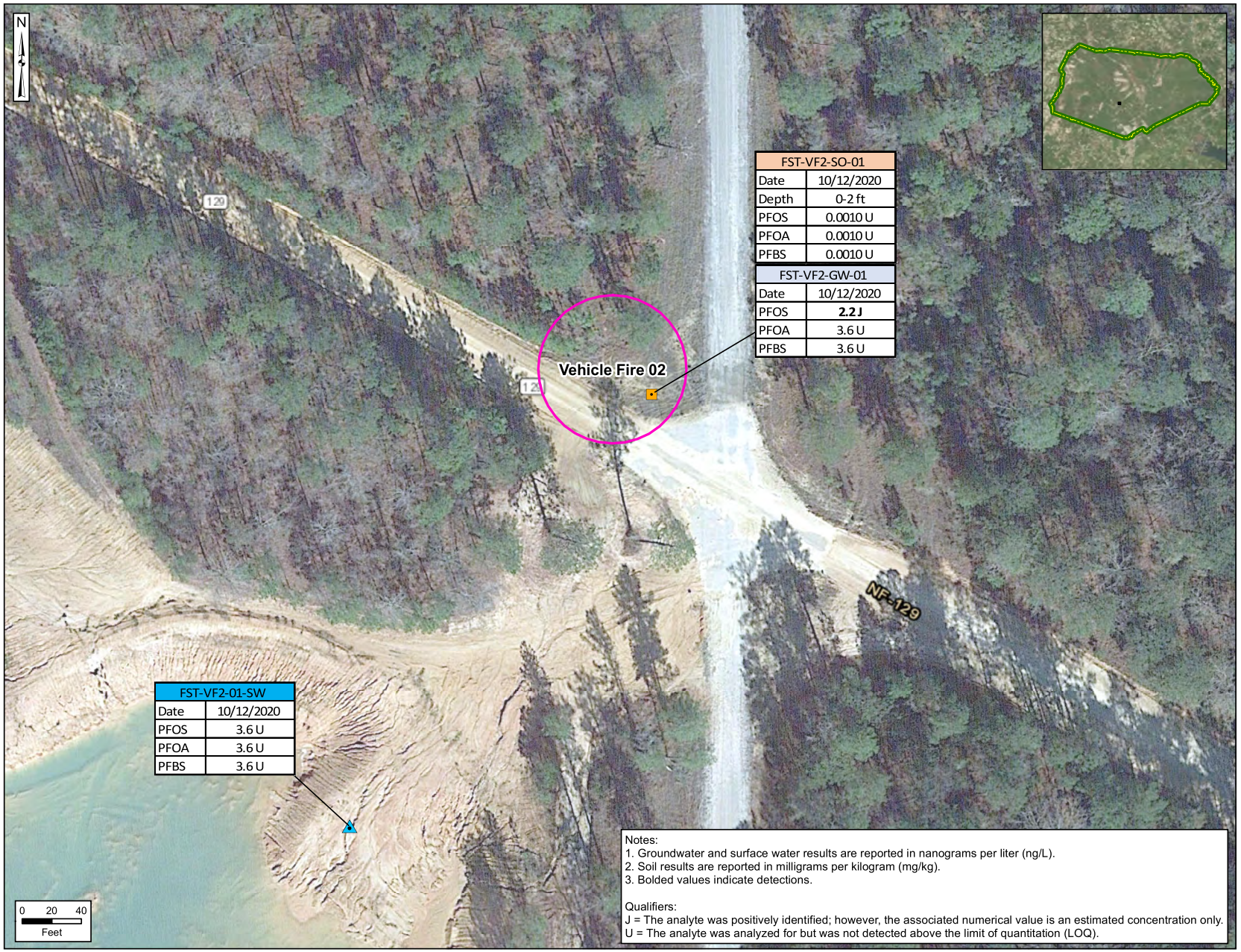
Legend

- Installation Boundary
- AOPI
- Stream (Intermittent)
- Shallow Soil and Grab Groundwater Sampling Location

AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
USAEC, GIS Data, 2005
USGS, NHD Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater and surface water results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
3. 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).

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 7-11
Vehicle Fire 02
PFOS, PFOA, and PFBS Analytical Results

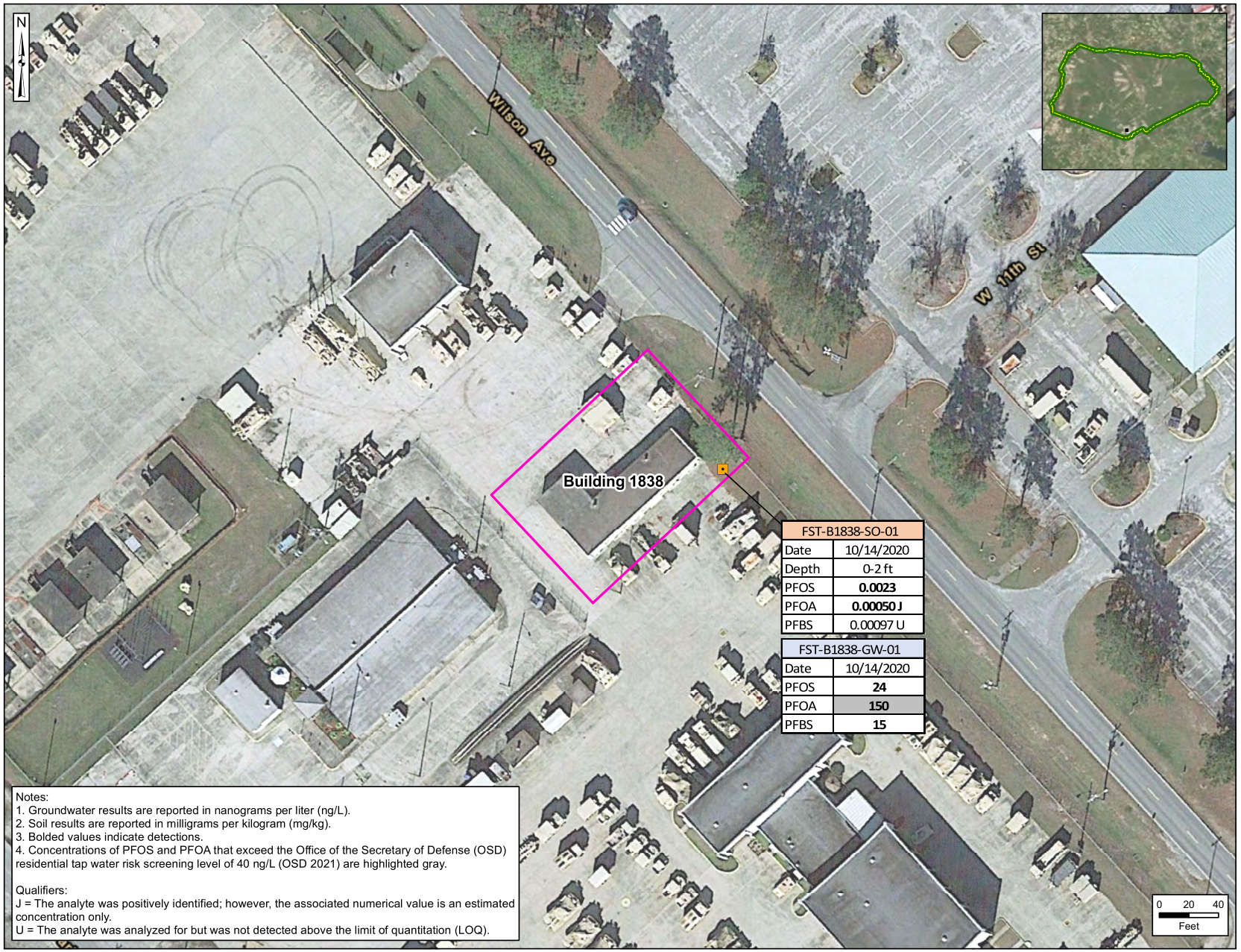
Legend

- Installation Boundary
- AOPI
- Shallow Soil and Grab Groundwater Sampling Location
- Surface Water Sampling Location

AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil
SW = surface water

Data Sources:
USAEC, GIS Data, 2005
Google Earth, Aerial Imagery, 2015

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
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:
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).

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Stewart, GA

ARCADIS

Figure 7-12
Building 1838
PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI
- Shallow Soil and Grab Groundwater Sampling Location

AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
USAEC, GIS Data, 2005
Google Earth, Aerial Imagery, 2015

Coordinate System:
WGS 1984, UTM Zone 17 North

Arcadis U.S., Inc.

7550 Teague Road

Suite 210

Hanover, Maryland 21076

Tel 410 987 0032

Fax 410 987 4392

www.arcadis.com