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

Fort Bragg, North Carolina

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Final Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

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EXECUTIVE SUMMARY

The United States Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), at Army installations nationwide. The PA identifies areas of potential interest (AOPIs) where PFAS-containing materials were used, stored and/or disposed, or areas where known or suspected releases to the environment occurred. The SI includes multi-media sampling at AOPIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. This Fort Bragg 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.

Fort Bragg is an Army Installation covering 162,000 acres in south-central North Carolina and houses more than 50,000 active Army personnel. The primary mission of Fort Bragg is logistics, training, and serving as the mobilization deployment center for XVIII Airborne Corps, 82nd Airborne Division, and a variety of Army and Joint Special Operations Forces. The installation lies in the western North Carolina coastal plan, and has a landscape characterized as generally flat to gently rolling hills. The installation encompasses portions of Cumberland, Hoke, Harnett, and Moore counties and is adjacent to the City of Fayetteville. Other nearby towns include Spring Lake and Southern Pines.

The Fort Bragg PA/SI addresses 42 AOPIs. Sixteen of these AOPIs were identified based on previous investigations (SCFS 2016), which included sampling for PFOS, PFOA, and PFBS. Twenty-six additional AOPIs were identified for investigation in the SI phase. Sampling results from the PFC investigation conducted in 2016 and the results for the 26 AOPIs addressed during this SI were compared to risk-based screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, and PFBS. Forty of the 42 AOPIs had detections of PFOS, PFOA, and/or PFBS in either groundwater and/or soil and 37 AOPIs exceeded OSD risk screening levels. The Fort Bragg PA/SI identified the need for further study in a CERCLA remedial investigation. **Table ES-1** below summarizes the PA/SI sampling results and the results from previous investigations 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 Fort Bragg, and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes, No, ND, NS, NA)				Recommendation
	GW	SO	SW	SE	
PAAF – Outfall 303	Yes [a]	NS	NA*	NA*	Further study in Remedial Investigation

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes, No, ND, NS, NA)				Recommendation
	GW	SO	SW	SE	
PAAF – Building 750	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 741	Yes[a]	NS	NS	NS	Further study in Remedial Investigation
PAAF – Building 734/736 (Nosedock #5)	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 732	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 726	Yes[a]	NS	NS	NS	Further study in Remedial Investigation
PAAF – Building 724	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 722	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 712	Yes*	N*	NS	NS	Further study in Remedial Investigation
PAAF – Building 708 & Retention Pond	Yes*	N*	NS	NS	Further study in Remedial Investigation
SAAF – Building P7937	Yes*	N*	NS	NS	Further study in Remedial Investigation
SAAF – Building P8944	Yes[a]	No*	NS	NS	Further study in Remedial Investigation
SAAF – Building P9647 and Retention Pond	Yes*	No*	NS	NS	Further study in Remedial Investigation
SAAF – Building P3807 and Retention Pond	Yes*	No*	NS	NS	Further study in Remedial Investigation
SAAF – Building P3007	Yes[a]	No*	NS	NS	Further study in Remedial Investigation
Fire Station #8	Yes*	NS	NS	NS	Further study in Remedial Investigation
PAAF – Building 173	Yes	No	NS	NS	Further study in Remedial Investigation
PAAF – Building R-3065	Yes	No	NS	NS	Further study in Remedial Investigation
Crash Site – Green Ramp (PAAF)	Yes	No	NS	NS	Further study in Remedial Investigation
Crash Site – Taxiway M (PAAF)	Yes	Yes	NS	NS	Further study in Remedial Investigation
Fire Station #1	Yes[a]	NS	NA	NA	Further study in Remedial Investigation

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes, No, ND, NS, NA)				Recommendation
	GW	SO	SW	SE	
Fire Station #2 (SAAF)	Yes	No	Yes	NA	Further study in Remedial Investigation
Fire Station #3	Yes	No	NS	NS	Further study in Remedial Investigation
Fire Station #5	Yes	No	NS	NS	Further study in Remedial Investigation
Fire Station #7 & Foam Shed (PAAF)	Yes	Yes	NA	NA	Further study in Remedial Investigation
Former Fire Training Area #4	Yes	No	NS	NS	Further study in Remedial Investigation
Knox Street Fire Training Pits	Yes	No	NA	NA	Further study in Remedial Investigation
Joint Firefighting Training Area and Retention Pond	Yes	Yes	NA	NS	Further study in Remedial Investigation
Biosolid Application Area – Honeycutt Road	Yes	No	NS	NS	Further study in Remedial Investigation
Camp Mackall – Fire Station #4[b]	No	NS	NS	NS	No action at this time
Former WWTP	Yes	No	NA	NA	Further study in Remedial Investigation
Sicily Drop Zone – Biosolid application and Crash Site	Yes	No	NS	NS	Further study in Remedial Investigation
Original Fire Station (Building 300 - PAAF)	Yes	No	NS	NS	Further study in Remedial Investigation
Former Fire Station #1	Yes	No	NS	NS	Further study in Remedial Investigation
Former Fire Station #3	Yes	No	NS	NS	Further study in Remedial Investigation
Former Fire Station A[c]	No	No	NS	NS	Supplemental Groundwater Sampling[d]
Former Fire Station B	Yes	No	NS	NS	Further study in Remedial Investigation
Former Fire Station C	Yes	No	NS	NS	Further study in Remedial Investigation
Hush House (Building 532 – PAAF)	Yes	No	NS	NS	Further study in Remedial Investigation
Fire Station #6	No	No	NS	NS	No action at this time

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes, No, ND, NS, NA)				Recommendation
	GW	SO	SW	SE	
Range 78	NS	No	NS	NS	No action at this time
Luzon Drop Zone	No	No	NS	NS	No action at this time

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
NA – not applicable
ND – non-detect
NS – not sampled
SE – sediment
SO – soil
SW – surface water
[a] – Samples were not collected within this AOPI, which was inaccessible due to security restrictions. However, analytical results for samples collected outside the AOPI during the 2016 AFFF Survey and PFC Sampling (SCFS 2016) may represent potential impacts from this AOPI and are used to support this recommendation.
[b] – The sample at Camp Mackall was collected from the drinking water system located up and side gradient of Fire Station #4 and, therefore, may not be representative of potential contamination resulting from spills originating at the fire station. However, based on sampling conducted by Fort Bragg and during this PA/SI the drinking water system serving Fire Station #4 and other buildings along the southern portion of Camp Mackall is not impacted by PFAS constituents.
[c] – The sample location at Former Fire Station A was collected from an area upgradient of the building footprint but within a potential release area near the former fire station bay(s). Therefore, while it is concluded that no further action is required at this time, enough information may not be available to exclude the site from further investigation.
[d] – Due to the potential for downgradient PFOS, PFOA, and/or PFBS exceedances of OSD risk screening levels, supplemental groundwater sampling is recommended for this AOPI
* - Sampling was conducted during a non-CERCLA effort prior to the current SI; during the AFFF Survey and PFC Sampling activities (SCFS 2016).

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 United States Army Garrison Fort Bragg (Fort Bragg) 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 Fort Bragg 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 2016a; 2016b). 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 15 October 2019 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program is provided for reference as **Appendix A**. The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in groundwater (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). New PFBS risk screening levels were calculated using the USEPA's RSL calculator and the new PFBS toxicity value. The OSD risk screening levels for tap water (also used to evaluate groundwater) 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 **Sections 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 mulit-medial 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.

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 Fort Bragg, PA and SI development followed the process as described in **Sections 1.3.1** through **1.3.5** below. **Section 3** provides a summary of the PA activities completed, and **Section 6** provides a summary of the SI activities completed for Fort Bragg. The PA and SI processes are documented in the PA/SI Quality Control Checklist included as **Appendix B**.

1.3.1 Pre-Site Visit

First, an installation kickoff teleconference was held between applicable points of contact (POCs) from United States Army Environmental Command (USAEC), United States Army Corps of Engineers (USACE), Fort Bragg, and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred on 26 March 2018 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 Fort Bragg.

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 program 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 21 to 24 May 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 Fort Bragg. 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. Photo documentation of the preliminary locations was collected, and access limitations or advantages related to potential future sampling activities were noted.

An exit briefing was offered to installation personnel at the conclusion of the site visit to raise any items identified during the site visit, discuss any follow-up items, and review the schedule for submitting deliverables. The exit briefing was conducted on 24 May 2018 with the installation, USAEC, and USACE to discuss preliminary findings of the PA site visit.

1.3.3 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 on 29 May 2019 between the Army PA team and Fort Bragg.

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:

- regulatory involvement requirements or preferences.
- identify overlapping UXO areas and discuss approach to avoidance
- confirm the plan for IDW handling and disposal
- identify specific installation access requirements and potential schedule conflicts
- provide an updated SI deliverable and field work schedule.

A Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP) was developed and finalized in October 2019 for the USAEC PFAS PA/SI (Arcadis 2019a). 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 (herein referred to as QAPP Addendum) (Arcadis 2019b) 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 2019a) and

the approved QAPP Addendum. A Site Safety and Health Plan (SSHP) (Arcadis 2019c) 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 Fort Bragg (Arcadis 2019b) 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) 5.1.1 (DoD 2018) / 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 Fort Bragg, 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

Fort Bragg is an Army Installation covering 162,000 acres in south-central North Carolina. The installation encompasses portions of Cumberland, Hoke, Harnett, and Moore counties and is adjacent to the City of Fayetteville, North Carolina. Other nearby towns include Spring Lake and Southern Pines. Fort Bragg's training areas consist of ranges, impact areas, major drop zones, tank trails, and approximately 500 miles of fire breaks covering 154,500 acres. The site location and site layout are presented on **Figure 2-1** and **Figure 2-2**, respectively. Fort Bragg is the largest military installation in the world with more than 50,000 active-duty personnel, with a residential population of approximately 39,457 (U.S. Census Bureau 2019). Two airfields are included within the Fort Bragg installation boundary, Simmons Army Airfield (SAAF) and Pope Army Airfield (PAAF; formerly Pope Air Force Base); the latter was absorbed into Fort Bragg as part of the 2005 Base Realignment and Closure guidance and became known as PAAF in March of 2011 (Fort Bragg 2017).

2.2 Mission and Brief Site History

The mission of Fort Bragg is to serve as the major logistics, training, and mobilization deployment center for the XVIII Airborne Corps, 82nd Airborne Division and a wide variety of Army and Joint Special Operations Forces. The installation houses Army Forces Command, Army Reserve Command, and numerous rapidly deployable military units. Fort Bragg's primary mission is the training of airborne and special operations forces. Broadly categorized, ongoing operations at Fort Bragg include general maintenance and repair, land management, utility systems operations, and commercial activities (Fort Bragg 2017).

In 1918, Congress established Camp Bragg, a 120,200-acre Army field artillery site named for the Confederate General Braxton Bragg. The location of Camp Bragg was based upon the need for a climate in which year-round training could take place. In August 1918, the War Department issued orders establishing Camp Bragg as a Field Artillery Cantonment; construction began in September of that year. By the autumn of 1919, construction was complete and the camp, including Pope Landing Field (present day PAAF), was in full operation. On 30 September 1922, Camp Bragg became a permanent Army post predesignated as Fort Bragg (Malcolm Pirnie 2007).

The population and activities at Fort Bragg grew in the 1920s and 1930s. Numerous artillery units from other installations were transferred to Fort Bragg, and the Civilian Conservation Corps had a district headquarters at Fort Bragg. At the end of the 1930s and into the 1940s Fort Bragg began preparing for wartime operations. Following the attack at Pearl Harbor, Hawaii, Fort Bragg was a major training installation for more than artillery operations. During World War II, the population at Fort Bragg peaked at approximately 159,000 personnel. In 1942, the first airborne units trained here in preparation for combat.

All five World War II airborne divisions (the 82nd, 101st, 11th, 13th, and 17th) trained in the Fort Bragg area. During the late 1940s, the 82nd Airborne Division was the only large unit on the installation and much of the installation was dormant. In the 1950s Fort Bragg's mission expanded. During the Korean War, Fort Bragg served as a training post. The Psychological Warfare Center (now the U.S. Army Special Operations Command) was established at Fort Bragg in April 1952, and Fort Bragg became the headquarters for Special Forces soldiers. SAAF was also established in 1952 (Malcolm Pirnie 2007).

More than 200,000 soldiers underwent basic combat training at Fort Bragg from 1966 to 1970. At the peak of the Vietnam War in 1968, Fort Bragg's military population rose to nearly 58,000. On 01 July 1973, Fort Bragg came under the U.S. Army Forces Command headquartered at Fort McPherson, Georgia. The modernization of Fort Bragg began in the 1990s with new construction and the demolition of World War II wooden structures (Malcolm Pirnie 2007).

Today, Fort Bragg is the world's largest airborne forces facility, with more than 45,000 military personnel. Widely known as the "home of the airborne," Fort Bragg houses the 82nd Airborne Division, assigned here in 1946 after returning from Europe, and the XVIII Airborne Corps, reactivated here in 1951. Fort Bragg is also home to the U.S. Army Parachute Team (the Golden Knights) and the Special Operations Forces (Malcolm Pirnie 2007).

2.3 Current and Projected Land Use

The largest portion of the Fort Bragg installation is the operational range area, primarily used for training operations ranging from small arms and explosives training, to jump school training activities. Two large airfields, PAAF (primarily fixed wing aircraft) and SAAF (helicopters) are located to the north and southeast of the main cantonment area, respectively. An additional airfield, Camp Mackall, is operated by Fort Bragg. This airfield is located to the west of Fort Bragg, approximately 8.5 miles from the western most installation boundary (**Figure 2-1**). The main cantonment is in the southeastern portion of the installation, and houses mixed industrial-residential areas with some recreational areas (e.g., parks and golf courses). The Fort Bragg cantonment area also contains 1,044 acres of land dedicated to recreational use that include golf courses, riding stables/areas, ball fields, stadiums, fishing lakes, polo fields, and open areas in personnel housing sections. Much of the operational range area and portions of cantonment are available for hunting and fishing through the Fort Bragg Wildlife Recreation Program. Portions of the operational range and cantonment are utilized for various recreational purposes. Four recreational areas or parks are found at Fort Bragg. Smith Lake Recreation Area is a 200-acre area located to the east of SAAF and houses a swimming beach, a cable driven water-skiing system, campgrounds and cabins, and various mountain biking and hiking trails. Hunting is prohibited at Smith Lake Recreation Area, but fishing is permitted in designated areas. Wilson Park is a small park located south of PAAF, near McFadden Pond. This park houses a picnic area, pavilions for larger gatherings, a playground and pond access for fishing. Woodland Park is the largest park on PAAF, located to the southeast of the airfield. This park offers picnic and pavilion areas, a playground area, and recreational sporting facilities (e.g., volleyball court). Flight line Park is located beyond the northeast end of the PAAF flight line. This park houses pavilions and a large playground.

Land use adjacent to Fort Bragg includes urban, rural, and mixed residential areas; commercial districts and corridors; and recreational, agricultural, and other open space areas. Based on U.S. Census data (2019), significant adjacent population centers include Spring Lake to the northeast of Fort Bragg

(population 12,119), which is classified as medium- to high-density residential development with commercial areas. Fayetteville is located to the southeast of Fort Bragg (population 210,432), which is also classified as medium to high-density residential development with commercial areas. The towns of Rockfish (population 3,523) and Raeford (population 4,926) are both located to the south of Fort Bragg and consist primarily of low-density and rural residential development. There are forestland and agricultural open space to the north and south of the installation, including preservation lands. Southern Pines (population 14,022) and Aberdeen (population 7,595) are located to the west of Fort Bragg and consist primarily of low density and rural residential development. There are also preservation lands to the east of Fort Bragg. Lakes, ponds, creeks, and rivers on Fort Bragg and in the surrounding communities are used for recreation (e.g., swimming, fishing, and water skiing) (Malcolm Pirnie 2007).

2.4 Climate

The Fort Bragg climate is classified as temperate. Summer temperatures are influenced by moist Atlantic Ocean coastal conditions, which elevate heat and humidity levels. Seasonal thunderstorm induced rainfall is common between April and September. The average annual rainfall is approximately 46 inches. Winters tend to be mild and short because the state's western mountain ranges help regulate northerly cold temperatures. The average daily July and January temperatures are 78-80 degrees Fahrenheit (°F) and 42-44°F, respectively. The average annual temperature is approximately 61°F (Malcolm Pirnie 2007).

2.5 Topography

The topography of Fort Bragg consists of flat to gently rolling hills with little topographic relief (**Figure 2-3**). The elevation of Fort Bragg ranges from approximately 150 to 550 feet above mean sea level (amsl), averaging approximately 220 feet amsl. The installation is in the Cape Fear River Basin where watershed drainage is directed to the Atlantic Coast. Surface water drainage networks across the installation include but are not limited to, natural dendritic drainage, drainage ditches, diversion structures, groundwater seeps, and forested wetlands (Malcolm Pirnie 2007).

2.6 Geology

Fort Bragg lies within the Sandhills physiographic province, a narrow band of xeric, sandy uplands stretching from the Carolinas south/southwest to Texas. In North Carolina, the Sandhills are within the inner Coastal Plain, just east of the Fall Line in a climatic Subtropical-Temperate Zone. Bedrock in this area, the Carolina Slate Belt, is composed of volcanic slate and is generally encountered at depths of 200 to 400 feet below ground surface (bgs) (Fort Bragg 2001). Overlying this bedrock are Cretaceous period sands and gravel attributed to the Cape Fear and Middendorf formations. Cape Fear formation deposits are often exposed along entrenched streams while Middendorf sands are more likely to be surficially exposed along valley slopes and eroded ridges. Piedmont streams and rivers draining into the area are thought to deposit Middendorf sands (Malcolm Pirnie 2007).

Atop the Cretaceous sands and gravels are Tertiary-period sands deposited in a shallow marine environment. Aeolian forces, acting along the Orangeburg Scarp, may have affected the most recent Tertiary sands covering much of the Sandhills uplands. This scarp runs southwest-northeast at an elevation of 200 to 230 feet amsl, representing the highest ocean advancement during Pliocene through

Pleistocene times. Aeolian sedimentation is also thought to be an important factor affecting ridges and interfluves during the Holocene. Although sand predominates throughout the Sandhills and rock outcrops are extremely rare, several sandstone outcrops occur on top of Middendorf beds; notable examples include Blues Mountain, Gaddy's Mountain, Newton Hill, and Paint Hill. Such upland formations are characterized by little soil development and prominent ferruginous sandstone occurring along narrow hilltops (Malcolm Pirnie 2007).

2.7 Hydrogeology

The local hydrology has strongly influenced the general upland topography of the Sandhills, with elevations from 270 to 500 feet amsl. Fort Bragg is heavily dissected by numerous small, dendritic drainages that cover the landscape. The origins of many of these streams can be traced to clayey sand layers that act as natural aquifers under the overlying loose sediments. When water permeates down to these clayey sands, it is channeled to outlets producing numerous small springs and intermittent streams. Groundwater flow is delineated by an east/west topographic divide. Generally, north of the divide groundwater flows to the north; likewise, to the south of the divide, groundwater flow is towards the south.

Hydrogeology at Fort Bragg consists of three primary freshwater aquifers. The primary water-bearing aquifer in the Fort Bragg area is the surficial aquifer, which is commonly unconfined. This water bearing unit ranges in thickness from 20 feet to 50 feet and consists of highly permeable sandy to gravelly soils (Advanced Sciences 1992). The depth to groundwater is variable and largely dependent on topography, ranging from approximately 1-foot bgs in low-lying areas to more than 45 feet bgs in topographically higher areas. The Black Creek Aquifer (upper Middendorf), immediately below the surficial aquifer, is unconfined and receives recharge from the surficial aquifer and extends to approximately 125 feet bgs. In some areas of Fort Bragg, a laterally extensive clay layer is present that divides the Black Creek aquifer into an upper and lower local water-bearing zones. Where this local confining layer is found, the upper Black Creek aquifer is unconfined, whereas the lower Black Creek is under confined or semi-confined conditions. Hydraulic conductivities for the upper Black Creek ranges from 0.9 to 13 feet per day, while the lower Black Creek ranges from 14 to 78 feet per day (Parsons 2008).

Below the Black Creek Aquifer, generally at a depth greater than 150 feet bgs, is the Cape Fear Aquifer (Winner and Coble 1996). This aquifer consists of clays interbedded with silt and silty sands in the Fort Bragg area. The upper 10 to 15 feet of the Cape Fear aquifer is a compact, thick clay unit that serves as an aquitard and restricts vertical movement of groundwater between the overlying sediments and the Cape Fear Aquifer. There are no potable water supply wells in the Fort Bragg cantonment area that tap into the Cape Fear Formation; however, east of Fort Bragg, the Cape Fear aquifer is used for both public and industrial water supply (Parsons 2008).

A deep basement rock aquifer composed of the saprolite underlies the Cape Fear Formation, along with the fracture zones of basement rock. This saprolite-basement aquifer is generally assumed to yield little water, and there are no water supply wells known to tap solely into this aquifer.

2.8 Surface Water Hydrology

Surface waters on Fort Bragg include streams, rivers, and lakes. There are also over 25 water bodies that serve multiple purposes, ranging from wildlife habitat to recreation. Fort Bragg contains numerous surface

watercourses, varying from a few feet in width to as much as 50 feet wide during normal conditions (Malcolm Pirnie 2007).

Fort Bragg is in the Upper Cape Fear River watershed, which empties into the Atlantic Ocean and contains two separate drainage sub basins: the northern Little River and the southern Rockfish Creek. The Little River, which originates over 10 miles west-northwest of Fort Bragg, is the major water body in the northern drainage sub basin and has numerous tributaries flowing into it. The northern watershed drains to the Little River and includes Silvers Run and Cypress, Buffalo, Deer, Flat, Gibson's, Hector, Horse, James, Tank, McPherson, Little, Jumping Run, Deep, Mill, Flat, Horse, James, Tuckahoe, Polecat, and Carvers creeks. Generally, storm water in this sub basin flows from south to north. Two major streams, Cross and Rockfish creeks, form the southern drainage sub basin. Generally, storm water in this sub basin flows from north to south. The southern watershed drains to Rockfish Creek and includes Big, Cabin, Calf, Field, Gum, Patterson, Trent, and Trao branches and Beaver, Bones, Black, Cross, Jennie, Juniper, Little Cross, Little Rockfish, McDuffie, Nicholson, Piney Bottom, Puppy, Rays Mill, Stewart's, and Wolf Pit creeks (Malcolm Pirnie 2007).

Fayetteville Public Works Commission (FPWC) provides Fort Bragg's potable water from an intake located on the Cape Fear River in the City of Fayetteville. FPWC operates a backup emergency water supply reservoir, Greenville Lake, located within the Little Cross Creek and Cross Creek stream system. This reservoir is located approximately 5-miles downstream of SAAF, and drainage from SAAF could reach the reservoir.

Approximately 9,570 acres are wetlands habitat at Fort Bragg. Wetlands on Fort Bragg include lakes, river and creek-associated riparian corridors, emergent marshes, and forested wetlands. In general, most wetlands are limited to creek and river drainages. In particular, the Little River, Rockfish Creek, and their tributaries support a wide array of wetland types, including freshwater marshes, open water, and forested wetland fringes (Malcolm Pirnie 2007).

2.9 Relevant Utility Infrastructure

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

2.9.1 Stormwater Management System Description

The Fort Bragg stormwater collection system is separate from the sanitary wastewater collection system. Stormwater at Fort Bragg is collected via a vast network of infrastructure (e.g., manholes, culverts, ditches, swales, catch basins, ponds) and eventually is conveyed off-post via numerous outfalls that drain to Waters of the State (creeks and streams). Fort Bragg's stormwater discharges are authorized by the various National Pollutant Discharge Elimination System (NPDES) general permits and state stormwater permits.

At least 132 active industrial outfalls drain stormwater within the cantonment area to various receiving waters within several water sheds: Rockfish Creek, Cross Creek-Cape Fear River, Lower Drowning Creek, and Outlet Little River. The receiving waters are numerous and include: Tank, Beaver,

McPherson, Stewarts, Cross, Big Muddy, Bones, Little Cross Creeks, Little River and various retention basins (Fort Bragg 2015).

2.9.2 Sewer System Description

The former wastewater treatment plant ([WWTP]; Fort Bragg Operable Unit 7) is located just north of PAAF on Manchester Road (date of construction unknown). Effluent wastewater was discharged to the lower Little River in accordance with a NPDES permit (former Permit Number NC0003964). The WWTP was upgraded in 1991 from a trickling filter plant to an extended aeration facility. Operation of the WWTP was privatized in December 2006 to Harnett County who sub-contracted the operation of the plant to American Water Enterprises, Inc. The WWTP remained operational until 2011 to 2012 when the new Harnett County Regional Wastewater Plant and connecting sewer line was completed. Currently, the sewer system is managed by Old North Utility Services (subsidiary of American Water) and consists of over 1.5 million linear feet of sewer line and 175 sewer lift stations (Old North Utility Services 2011).

Up to thirty sludge drying beds are located within the former WWTP property. This material was historically spread in various places both on and off-installation (see Honeycutt Road and Sicily Drop Zone subsections in **Section 5**).

2.10 Potable Water Supply and Drinking Water Receptors

Historically, Fort Bragg obtained its potable water from a surface water intake located on the Little River. There are approximately 47 additional groundwater supply wells at Fort Bragg for non-potable use. Most of the wells are located on-range and are used for fire suppression and irrigation. These wells draw water from four different aquifers beneath Fort Bragg. Many of the wells on Fort Bragg draw supply water from either the surficial aquifer or the Black Creek aquifer. These wells vary in depth from 62 feet to 600 feet, and the yield is up to 170 gallons per minute depending on the aquifer. There are also seven groundwater wells in the cantonment area that are used to irrigate the golf courses. The golf course wells vary in depth from 63 feet to 164 feet. While most residents in areas surrounding Fort Bragg are tied into the municipal water supply sourced from the Cape Fear River, there are a potentially significant number of properties utilizing groundwater sources (**Figure 2-4**). Most wells in the Fort Bragg area, outside the installation boundaries, draw their water from either the surficial, Black Creek, or Cape Fear aquifers (Malcolm Pirnie 2007).

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 Fort Bragg, 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**). The EDR report providing well search results is provided as **Appendix E**. During the 2018 site visit, 11 potable groundwater wells were identified by the installation for providing potable water for range activities. These wells include: Range 30, Range 33, Range 43, Range 63, Range 74, Range 79, Pre-Ranger, Camp Mackall, Aberdeen Training Facility (ATF), U.S. Army John F. Kennedy Special Warfare Center and School, and Eureka Springs; and are presumably used as potable water sources in areas removed from the cantonment water supply.

Current Fort Bragg cantonment potable water supply is from FPWC, whose water intake is located on the Cape Fear River in the city of Fayetteville, North Carolina, approximately 5-miles southeast of the southeast Fort Bragg installation boundary. The intake location is approximately 19-miles downstream from the confluence of Little River and Cape Fear River; and approximately 2.3-miles upstream of the confluence of the Cape Fear River and the Cross and Little Cross Creek systems. Additional water supply to Fort Bragg is provided by Harnett County. The infrastructure for water transmission to Fort Bragg is maintained under a long-term contract by Old North Utility Services, a subsidiary of American States Utility Services.

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.

Specific to the Fort Bragg region, the U.S. Fish and Wildlife Service Information for Planning and Consultation identifies seven plant and animal species identified as federally endangered: Red-cockaded Woodpecker, Cape Fear Shiner, Saint Francis' Satyr Butterfly, American Chaffseed, Michaux's Sumac, Pondberry, and Rough-leaved Loosestrife. One additional animal species is classified as threatened (Atlantic Pigtoe clam). (U.S. Fish and Wildlife Service 2021)

The Fort Bragg Endangered Species Branch manages five of the previously listed federally endangered species through the management of the longleaf pine / wiregrass ecosystem. The five endangered species found on Fort Bragg are: American chaffseed, Michaux's sumac, Red-cockaded woodpecker, rough-leaved loosestrife, and Saint Francis' Satyr Butterfly (Malcolm Pirnie 2007).

Seventeen occurrences of American chaffseed on Fort Bragg represent the only known populations in North Carolina, except for a very small population just off the installation in Moore County. The Sandhills Red-cockaded woodpecker population is comprised of two distinct subpopulations; the primary gap between the two subpopulations is located between Camp Mackall and Fort Bragg. The Saint Francis' Satyr Butterfly is currently only known to exist on Fort Bragg, comprising 19 known sites in one metapopulation encompassing only a few square miles (Malcolm Pirnie 2007).

In addition to the five federally endangered species, there are 22 special concern plant species at Fort Bragg. The 1,235 plant taxa identified on Fort Bragg and Camp Mackall by The Nature Conservancy and Fort Bragg include 58 federal and/or state rare species. Of these, three are federally endangered, 22 are federal species of concern, 15 are state-listed endangered, five are state-listed threatened, and 21 are state candidates for listing. Fort Bragg, in conjunction with The Nature Conservancy, developed a biological monitoring plan for the following selected federal species of concern: Pickering's dawnflower, Georgia indigo-bush, Sandhills milkvetch, and Sandhills pyxie-moss. Fort Bragg is considered an important population center for these species (Malcolm Pirnie 2007).

Ecological receptors found in the longleaf pine ecosystem include the Red-cockaded woodpecker. Both the rough-leaf loosestrife and Michaux's sumac are found in open areas. The rough-leaf loosestrife occurs most often in the ecotone between longleaf pine uplands and the pond pine pocosins. Michaux's sumac is found in pine and scrub oak sandhill communities, which are common throughout Fort Bragg. Sensitive species are also found in the wetlands and wetland areas of Fort Bragg (Malcolm Pirnie 2007).

2.12 Previous PFAS Investigations

Previous (i.e., pre-PA) PFAS investigations relative to Fort Bragg, including both those conducted and not conducted by the Army, are summarized to provide full context of available PFAS data for Fort Bragg. However, only data collected by the Army will be used to make recommendations for further investigation. PFAS sampling has been conducted at Fort Bragg on several occasions. The first, in response to the third Unregulated Contaminant Monitoring Rule (UCMR3) and IMCOM Operations Order 16-088, Fort Bragg personnel sampled supplied water from FPWC. This sampling was performed three times between 2013 and 2014. When comparing results from the systems sampled under UCMR3 to the OSD risk screening levels, as outlined in **Section 6.5**, there were no detections above the OSD risk screening levels.

In 2015 to 2016, fire suppression systems that use, or have used, aqueous film forming foam (AFFF) at Fort Bragg, PAAF, and SAAF were inventoried (SES Construction and Fuel Services, LLC [SCFS] 2015 and SCFS 2016). A subset of the locations identified as having AFFF fire suppression systems was selected for soil, groundwater, surface water, and sediment sampling and analysis for perfluorinated chemicals (PFCs), and sampling was conducted by SCFS contractors. Groundwater sample results showed PFAS impacts at both PAAF and SAAF, with PFOS, PFOA, and PFBS concentrations greater than the OSD risk screening levels. A summary of the groundwater results is provided in **Table 2-1**; and the groundwater, soil, surface water, and sediment sampling results are discussed in detail in **Section 7**. **Appendix F** presents the 2016 Fort Bragg PFC Sampling Report. In brief, 18 groundwater samples, 28 soil samples, one surface water sample, and one sediment sample were collected during this 2015 to 2016 PFC investigation. The highest groundwater detection of PFOS (72,000 ng/L), PFOA (2,500 ng/L), and PFBS (2,000 ng/L) identified were associated with SAAF Building P7937. The highest soil PFOS (0.89 mg/kg), PFOA (0.014 mg/kg), and PFBS (0.0067 mg/kg) concentrations were also associated with SAAF Building P7937.

In response to the UCMR3 in 2014 and IMCOM Operations Order 16-088, public water supply systems serving populations greater than 10,000 were tested for PFAS. In the areas around Fort Bragg, six primary zip codes were sampled under UCMR3. Two areas (zip codes 28387 and 28376) constituting the towns of Southern Pines and Raeford along the installation boundary northwest and southwest of Fort Bragg returned no detections of PFAS compounds. One area (zip code 28327, Carthage, North Carolina), located approximately 5-miles northwest of Fort Bragg, was identified with PFOS and PFOA exceedances of greater than 70 ng/L. Three areas, within 5-miles of Fort Bragg and to the east (zip codes 27546, 28390, and 28301) corresponding to the towns of Lillington, Spring Lake, and the City of Fayetteville were identified as water supply systems with PFAS compounds above minimum reporting limits.

In late 2016, Fort Bragg Directorate of Public Works (DPW) sampled 11 groundwater wells at the installation (**Figure 2-2**). These wells included: Range 30, Range 33, Range 43, Range 63, Range 74, Range 79, Pre-Ranger, Camp Mackall, ATF, U.S. Army John F. Kennedy Special Warfare Center and School, and Eureka Springs, and are presumably used as a potable water source in areas far removed from the garrison water supply. Of these 11 wells, three (Range 74, Pre-Ranger, and Eureka Springs) returned detections of PFAS though none exceeded the OSD risk screening level in 2016. Results are provided in **Table 2-1**, and detections ranged from 9.52 ng/L (Range 74; PFOS only) to 48.3 ng/L (Pre-Ranger; combined PFOS and PFOA). Resampling of these wells occurred in 2020, and the sample collected from the Pre-Ranger site did exceed OSD risk screening levels, with a combined PFOS and

PFOA concentration of 95 ng/L. In 2021, a potable water well associated with Fire Station 8 was sampled and yielded PFOS and PFOA exceedances above OSD risk screening levels, 1,100 ng/L and 54 ng/L, respectively. PFOS and PFOA concentrations at Pre-Ranger remain elevated above OSD risk screening levels in samples collected in 2021.

The entry point of FPWC water at Fort Bragg was again sampled in late 2016, and no detections of PFOS, PFOA, or PFBS were identified (**Table 2-1**).

Table 2-1. Historical PFOS, PFOA, and PFBS Analytical Results

Well/Site Identifier	Date	Media (Sampling Depth [ft bgs])	Method	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)
UCMR3						
69558-EP001-EPTDS from Fayetteville Water	17-Jul-13	Water	USEPA Method 537, QSM Version 1.1	<0.04	<0.02	<0.09
69558-EP001-EPTDS from Fayetteville Water	15-Jan-14	Water	USEPA Method 537, QSM Version 1.1	<0.04	<0.02	<0.09
69558-EP001-EPTDS from Fayetteville Water	9-Apr-14	Water	USEPA Method 537, QSM Version 1.1	<0.04	<0.02	<0.09
2016 – PFC Report[1]						
PAAF – Building 708 & Retention Pond Site 1-SB01-GW-019	14-Oct-15	Groundwater (20-24)	USEPA Method 537, QSM Version NA	**50**	**75**	**190**
PAAF – Building 708 & Retention Pond Site 1-SB02-GW-018	14-Oct-15	Groundwater (20-24)	USEPA Method 537, QSM Version NA	**80**	**62**	**570**
PAAF – Building 708 & Retention Pond Site 1-SB03-GW-012	15-Oct-15	Groundwater (15-19)	USEPA Method 537, QSM Version NA	**1,600**	**150**	**30**
PAAF – Building 708 & Retention Pond Site 1-323MW-1	16-Oct-15	Groundwater NA	USEPA Method 537, QSM Version NA	**450**	**430**	**140**
PAAF – Buildings 722 & 724 Site 2-SB01-GW-019	14-Oct-15	Groundwater (16-20) *	USEPA Method 537, QSM Version NA	**1,600**	**100**	**91**
PAAF – Buildings 722 & 724 Site 2-SB02-GW-019	14-Oct-15	Groundwater (16-20) *	USEPA Method 537, QSM Version NA	**3,100**	**330**	**170**
PAAF – Buildings 722 & 724 Site 2-18M17	16-Oct-15	Groundwater NA	USEPA Method 537, QSM Version NA	**260**	**100**	**30**
PAAF – Buildings 734 & 736 Site 2-SB03-GW-019	14-Oct-15	Groundwater (16-20) *	USEPA Method 537, QSM Version NA	**3,000**	**1,300**	**740**
PAAF – Buildings 734 & 736 Site 2-SB04-GW-015	14-Oct-15	Groundwater (16-20) *	USEPA Method 537, QSM Version NA	**430**	**210**	**110**
PAAF – Outfall 303 Site 3-SW01-001	15-Oct-15	Surface water	USEPA Method 537, QSM Version NA	**420**	**30**	**20**
PAAF – Building 750 Site 3-SB01-GW-019	15-Oct-15	Groundwater (16-20) *	USEPA Method 537, QSM Version NA	**2,900**	**74**	**30**
SAAF – Building P3807 Site 4-SB04-GW-037	15-Oct-15	Groundwater (40-44)	USEPA Method 537, QSM Version NA	**110**	**25**	**20**
SAAF – Building P3807 Retention Pond Site 4-SB06-GW-034	15-Oct-15	Groundwater (35-39)	USEPA Method 537, QSM Version NA	**130**	**280**	**38**
SAAF – Building P3807 Retention Pond Site 4-SB07-GW-032	15-Oct-15	Groundwater (35-39)	USEPA Method 537, QSM Version NA	**730**	**34**	**130**
SAAF – Building P7937 Site 5-SB01-GW-009	16-Oct-15	Groundwater NA	USEPA Method 537, QSM Version NA	**2,700**	**220**	**1.7**
SAAF – Building P7937 Site 5-SB02-GW-012	16-Oct-15	Groundwater (15-19)	USEPA Method 537, QSM Version NA	**72,000**	**2,500**	**2,000**
SAAF – Building P9647 Site 5-SB05-GW-028	16-Oct-15	Groundwater (30-34)	USEPA Method 537, QSM Version NA	**17,000**	NA	NA
SAAF – Building P9647 and Retention Pond Site 5-SB06-GW-028	15-Oct-15	Groundwater (30-34)	USEPA Method 537, QSM Version NA	**37**	**7**	**120**
2016 – Fort Bragg – Groundwater Well Sampling						
Range 30	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	<3.2	<3.2	<6.0
Range 33	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	<3.2	<3.2	<6.0
Range 43	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	<3.1	<3.1	<5.8
Range 63	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	<3.1	<3.1	<5.8
Range 74	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	<3.1	**9.52**	<5.8
Range 79	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	<3.2	<3.2	<6.0
Pre-Ranger[2]	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	**22.7**	**25.6**	<6.0
Camp Mackall	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	<3.1	<3.1	<5.8
ATF Well #2	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	<3.1	<3.1	<5.8
U.S. Army John F. Kennedy Special Warfare Center and School	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	<3.2	<3.2	<6.0
Eureka Springs	1-Dec-16	Drinking Water	USEPA Method 537, QSM Version NA	**15.3**	**2.62 J**	<6.3

Well/Site Identifier	Date	Media (Sampling Depth [ft bgs])	Method	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)
2016 – Fort Bragg – FPWC Entry Point Sample						
Fort Bragg ATF (Entry Point)	28-Dec-16	Water	USEPA Method 537, QSM Version NA	<2.0	<2.0	NA
2019 – Fort Bragg – Groundwater Well Sampling						
Eureka Springs	17-Dec-18	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.7	**4.6**	<1.7
Pre Ranger	17-Dec-18	Drinking Water	USEPA Method 537 QSM Version 1.1	**10**	**12**	**2**
Range 74	17-Dec-18	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.8	**6.6**	**7.3**
Eureka Springs	11-Mar-19	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.7	**4.8**	<1.7
Pre Ranger	11-Mar-19	Drinking Water	USEPA Method 537 QSM Version 1.1	**5**	**6.7**	<1.7
Range 74	11-Mar-19	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.8	**6.6**	**4.9**
Eureka Springs	17-Jun-19	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.7	**5.4**	<1.7
Pre Ranger	17-Jun-19	Drinking Water	USEPA Method 537 QSM Version 1.1	**9.6**	**11**	**2.4**
Range 74	17-Jun-19	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.7	**5.2**	**3.2**
2020 – Fort Bragg – Groundwater Well Sampling						
Range 30	13-Jan-20	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.7	<1.7	<1.7
Range 33	13-Jan-20	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.7	<1.7	<1.7
Range 43	13-Jan-20	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.7	<1.7	<1.7
Range 63	13-Jan-20	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.7	<1.7	<1.7
Range 79	13-Jan-20	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.8	<1.8	<1.8
Camp Mackall	13-Jan-20	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.8	<1.8	<1.8
ATF Well #2	13-Jan-20	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.8	<1.8	**3.5**
Pre Ranger	13-Jan-20	Drinking Water	USEPA Method 537 QSM Version 1.1	**26**	**32**	**6**
USAJFK	13-Jan-20	Drinking Water	USEPA Method 537 QSM Version 1.1	<1.8	<1.8	<1.8
Range 74	25-Feb-20	Drinking Water	USEPA Method 537.1 version 1.0	<1.7	**5.8**	**3.5**
Eureka Springs	25-Feb-20	Drinking Water	USEPA Method 537.1 version 1.0	<1.7	**5.8**	<1.7
ATF Well #2	25-Feb-20	Drinking Water	USEPA Method 537.1 version 1.0	<1.8	<1.8	<1.8
2021 – Fort Bragg – Groundwater Well Sampling						
Range 30	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.8	<1.8	<1.8
Range 33	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.8	<1.8	<1.8
Range 43	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.8	<1.8	<1.8
Range 63	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.7	<1.7	<1.7
Range 74	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.7	**7.4**	**1.7**
Range 79	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.7	<1.7	<1.7
ATF #1	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.8	<1.8	**7.4**
ATF #2	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.8	<1.8	<1.8
Eureka Springs	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.7	**7.1**	<1.7

Well/Site Identifier	Date	Media (Sampling Depth [ft bgs])	Method	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)
Eureka Springs #2	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.8	<1.8	<1.8
Fire Station 8	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	**1,100**	**54**	**56**
Camp Mackall	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.7	<1.7	<1.7
Pre-Ranger	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	**43**	**42**	**7.4**
USAJFK	1-Jun-21	Drinking Water	USEPA Method 537 QSM Version 1.0	<1.7	<1.7	<1.7

Notes:

NA – Not available; unknown if non-detect or not an analyte
Bold entries indicate a detection above the laboratory level of detection
Shading indicates detection of PFOS, PFOA, or PFBS exceed OSD risk screening levels of 40 ng/L, 40 ng/L, or 600 ng/L, respectively. (Screening levels are discussed in detail in Section 6).
All samples listed in this table, other than those in the UCMR3 subsection, were the U.S. Army.
< - less than
ng/L – nanograms per liter
mg/kg – milligrams per kilogram
* - Indicates an assumed screened interval based on the reported depth of the boring.
1 – 2016 PFC Report (SCFS 2016), only groundwater results are reported in this table, soils were also sampled as part of this PFC investigation.
2 – Exceedance above OSD risk screening level was detected in 2020, reportedly 95 ng/L of combined PFOS and PFOA. The breakdown of this detection is unknown as the laboratory analytical results have not been provided.

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 Fort Bragg, 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 interviews, internet searches). Based on the evaluation, all but two preliminary locations were categorized as AOPIs. A summary of the observations made, and data collected through records reviews (**Appendix G**), installation personnel interviews (**Appendix H**), and site reconnaissance (**Appendix J**) during the PA process for Fort Bragg 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, Fort Bragg fire department documents, Fort Bragg DPW 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 Fort Bragg 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 the installation personnel interviewed during the PA process for Fort Bragg is presented below (affiliation is with Fort Bragg unless otherwise noted)

- Water Management Section Chief, DPW/Environmental Branch
- Environmental Division Chief, DPW/ Environmental Branch
- Chief, DPW Environmental Compliance Branch
- IRP Manager (former), DPW/ Environmental Branch
- IRP Manager (current), DPW/ Environmental Branch

- Chief, Fire Department
- Assistant Chief of Operations, Fire Department
- Assistant Chief of Training, Fire Department
- Range Operations Officer
- Integrated Pest Management Coordinator, DPW
- Environmental Protection Specialist, DPW
- Public Affairs Officer
- Solid Waste/Recycling Manager, DPW/ Environmental Compliance Branch
- Hazardous Waste Manager/Spill Response, DPW/ Environmental Compliance Branch
- Air Quality Manager, DPW/ Environmental Compliance Branch
- Air Force Chief of Airfield PAAF, United States Air Force PAAF
- Army Chief of Airfield Division for PAAF and SAAF, DPW/Operations Management Division (retired as of 2020)
- Environmental Technician, contracted by Fort Bragg
- DPW/ Operations Management Division – Airfield Maintenance Subcontractor
- Fire Suppression System Maintenance Subcontractors (BFPE International – Baltimore Fire Protection & Equipment)
- Aviation Safety Manager, SAAF

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 Fort Bragg during the records review process, the installation in-brief meeting, and/or during the installation personnel interviews. These areas were classified as an area not retained for further investigation at this time or an AOPI based on a combination of information collected (e.g., records reviewed, personnel interviews, internet searches) as described in **Sections 5**.1 and **5.2**, respectively. A photo log from the site reconnaissance is provided in **Appendix I**; photos were used to assist in verification of qualitative data collected in the field. The site reconnaissance logs are provided in **Appendix J**.

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

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

Fort Bragg 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 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 percent (%) 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.

As identified in the current assets file and confirmed during site visit interviews with fire department personnel, Fort Bragg stores a large volume of AFFF. The type of AFFF product used at Fort Bragg has likely varied historically, but current products in use are Ansul Jet X 2.5%, Tyco Chemguard C2, National Foam Aero-Lite Water 3%, Buckeye High Expansion Foam 2.2%, National Foam Centurion 3%/6% (alcohol resistant AFFF), Chemguard 3%, and Phos-Chek 3% AFFF Mil-Spec. These foams are in used in AFFF fire suppression systems, in emergency response vehicles, and during training activities. As of the PA site visit in 2018, the total estimated AFFF volume at Fort Bragg between hangars, on-board vehicles, and in storage is 14,210 gallons of AFFF concentrate.

The reported volume as of 2016 was 4,340 gallons of AFFF concentrate within hangar suppression systems (IMCOM 2016). A secondary check, combining information received during interviews and an additional IMCOM data call, indicates the hangar volume totals of up to 8,710 gallons (hangar inventory provided in **Table 4-1**). It is assumed that, while the hangar suppression system tanks largely contain newer fluorine-free foams (e.g., high expansion [HI-EX] and alcohol resistant-foams), they would have historically held PFAS-containing foam products. Presently, the total AFFF storage on fire response vehicles (e.g., engines, crash trucks, and foam trailer) and at fire stations totals approximately 4,215 gallons (**Table 4-2**).

Aside from fire suppression systems, fire truck onboard storage, and minor fire station storage, AFFF is currently stored in the Hush House (Building 532), and installation personnel were confident that no spill or release had occurred at this location. At least 1,285 gallons of various AFFF was in storage during the PA site visit in 2018. Previously, AFFF was stored in small quantities at each respective fire station, with

bulk storage at the Foam Shed (Building 254) near Fire Station #7 at PAAF. AFFF drums have also been previously stored at Pope Airfield Headquarters (Building 560).

Table 4-1. Summary of Hangar AFFF Inventory, from IMCOM Data Call (IMCOM 2016).

Hangar	Volume (gallons)	Current Product	Notes
750	500	Ansul: Jet X 2.75%	Bladder and foam replaced January 2016
741	500	Ansul: Jet X 2.75%	Bladder and foam replaced June 2016
736	300	Unknown	None available
734	300	Unknown	None available
732	300	Unknown	None available
726	300	Unknown	None available
724	300	Unknown	None available
722	300	Ansul: Jet X 2.75%	Ansul bladder tank decommissioned September 2017; unknown initial fire suppression system installation date
712	1,000	Ansul: Jet X 2.75%	Unknown fire suppression system installation date
708	600	National Foam: Aero-lite water 3.0%	(Southside) Bladder and foam replaced October 2017 (Northside) Plastic Tank
P-7937	600	Tyco: Chemguard C2	Renovated in 2017
P-8944	600	Tyco: Chemguard C2	None available
P-9647	1,310	Tyco: Chemguard C2	Renovated in 2017
P-3007	600	Buckeye: High Expansion Foam 2.2%	Renovated in 2016
P-3807	600	Buckeye: High Expansion Foam 2.2%	Renovated in 2016

Hangar	Volume (gallons)	Current Product	Notes
R-3065	600	Tyco: Chemguard C2	Renovated in 2017
Total	**8,710**		

Fort Bragg houses 10 permanently manned fire stations supporting the Fort Bragg mission. A summary of these fire stations detailing location and vehicle assets is provided in **Table 4-2**. Fire Stations #1 through #8 currently house, or have historically housed, PFAS-containing AFFF. Fire Stations #9 and #10 were discovered during the site visit and either constructed recently or under construction during the site visit. Fire Stations #9 and #10 have reportedly never housed PFAS-containing foams and were not retained as AOPIs. Historically, several additional fire stations have supported activities at Fort Bragg. The first fire station serving PAAF (Original Fire Station; Building 300) was closed in 1979 and retrofitted to house an ambulance. The first Fort Bragg fire station (former Fire Station #1) was decommissioned in circa-1975. The former Fire Station #3 was closed in 2004. Three additional fire stations were in operation during World War II (WWII) but were decommissioned in circa-1975. In addition to the emergency fire services on-post, mutual aid agreements for firefighting support are held with surrounding municipalities including City of Fayetteville, Cumberland County, Town of Spring Lake, Harnett County, Moore County, Hoke County, Scotland County, Town of Hope Mills, and Richland County.

Table 4-2. Summary of Fire Station and Engines/Truck AFFF Inventory

Fire Station Identifier	Location	Engines/Crash Trucks/AFFF Equipment with AFFF	Volume of AFFF (gallons)
Fire Station #1	Intersection of Honeycutt Road and Knox Street	1 - Engine	25
Fire Station #2	Supports SAAF – End of Parham Boulevard	1 - Engine 2 - Crash Trucks	40 210 each = 420 total
Fire Station #3	Intersection of Longstreet Road and Manhay Road	1 - Engine	30
Fire Station #4	Southside of Camp Mackall Airfield	2 - Crash Trucks On-Site Storage	200 each = 400 total 25
Fire Station #5	North of intersection of Yadkin Road and Canopy Road	1 - Engine	60
Fire Station #6	North of installation serving Linden Oaks (base housing); north of intersection of Camel Road and Linden Oaks Parkway	1 - Engine	40

Fire Station Identifier	Location	Engines/Crash Trucks/AFFF Equipment with AFFF	Volume of AFFF (gallons)
Fire Station #7	Supports PAAF – Off of Boxcar Street	1 - Engine 8 - Crash Trucks	25 4 with 500 each = 2,000 total 4 with 130 each = 520 total
Fire Station #8	Intersection of Morganton Road and Manchester Road/Raeford Vass Road	1 - Engine 1 - Crash Truck in storage	60 (prior to 2019; now carries alcohol resistant-foam)
Fire Station #9	Supports Camp Mackall - South of the intersection of Special Forces Way and Glider Road.	1 - Engine	40 (alcohol resistant-foam)
Fire Station #10	Off Chicken Road, near intersection of D Street and Africa Lion Way Construction completed after PA site visit	1 - Engine	30 (alcohol resistant-foam)
Hush House; Building 532	Northeast end of PAAF	2 - Reserve Engines 1 - Foam Trailer Storage	30 each = 60 total Capacity of 500 (likely empty) 1,285 (alcohol resistant and military specification)
		Total AFFF/Foam Volume in Vehicles and in storage (maximum):	**5,560**

Notes:
Data for fire station AFFF volumes provided by the installation.
Data for Hush House storage collected during site reconnaissance.

For emergency preparedness, firefighter training is conducted regularly at Fort Bragg. Installation/fire department personnel are or have been trained on the use of AFFF at several locations within Fort Bragg. Since 1994, only small volumes (less than 1 to 2 gallons) of AFFF have been used at Fort Bragg during training activities for nozzle and proportioner testing/adjustment (per the Fire Department Chief). Prior to 1994, AFFF training occurred at an unknown frequency at the Knox Street Fire Training Pits near Fire Station #1. During the site visit, Fire Department personnel indicated that the Knox Street Fire Training

Pits had been used for AFFF training approximately 25% of the time during weekly training activities prior to 1994, and no foam training occurred post 1994.

Fire Training Area #4 (IRP Identifier: FT001), was a fire training area on PAAF, located southwest of the intersection of Hurst Drive and Aldish Road. The naming convention used for this Fire Training Area (i.e., #4) suggests that there have been at least three previous Fire Training Areas. No information regarding other Fire Training Areas, other than those identified in this report, was uncovered during the PA research or site visit. The site was approximately 6 acres and consisted of an unlined pit that was in operation from the 1950s through 1989. As part of Base Realignment and Closure, on 21 September 2010 the Army took ownership of PAAF including the area of Fire Training Area #4 (FT001). Limited information was provided by the United States Air Force outside of the standard administrative record, so historical activities at Fire Training Area #4 remain unknown.

The Joint Firefighting Training Area (JFTA) is the newest firefighter training facility at Fort Bragg. JFTA is located off Hurst Drive, south of PAAF. The facility consists of a mock-plane outfitted with a liquid propane fire system for firefighting training. A retention pond collects water from training exercises. According to fire department personnel, the training site is only used for water-based training; however, accidental discharge of foam systems has reportedly occurred.

Several instances of AFFF use were reported during personnel interviews. A few accidental discharges were noted for SAAF, but information regarding location was not available. Major and potentially major AFFF use was noted for several other instances at Fort Bragg and PAAF.

The largest AFFF response to have occurred at Fort Bragg was the Romeo 6/Green Ramp crash at PAAF on 23 March 1994. Neighboring Cumberland County, Spring Lake, and Hope Mills Fire Departments assisted on response as part of the standing mutual aid agreement. In total five trucks were able to extinguish the flames within 50 minutes (Condon-Rall 1996). An unknown volume of AFFF was deployed during the Green Ramp Response. The entire tarmac of Green Ramp has since been removed and replaced.

According to the former Airfield Manager at PAAF and SAAF, in 1997 an aircraft experienced landing gear failure at PAAF. The plane came to rest towards the south side of the runway, just north of Taxiway M. The former Airfield Manager recalled that the Fire Department deployed AFFF. A review of aviation crash records indicated two separate incidents at PAAF in the 1990s involving the EC-130 airframe and fitting the description provided by the former Airfield Manager. On 29 May 1992, an EC-135J experienced a long landing resulting in failed landing gear, a collapsed undercarriage, and a broken fuselage. On 02 September 1997, a Boeing EC-135C was heavily damaged during a heavy landing, causing the nose wheel to collapse (Aviation Safety Network [ASN] 2020). There is no supporting evidence of foam use for either of these incidents, but it is assumed to have occurred based on the former Airfield Manager's account of events.

Several other aircraft accidents have occurred at Fort Bragg, specifically at Sicily Drop Zone (SDZ) west of main cantonment. On 01 July 1987, a C-130 crashed during a routine training exhibition, in the tree line along the southern end of SDZ. On 09 August 1989, another C-130 crashed at SDZ and the fuel cells reportedly ruptured. It took firefighters approximately one hour to extinguish the wreckage. For each incident, an unknown volume of foam was deployed.

During personnel interviews, skidder (logging) fires were mentioned, and the stated fire response was with non-PFAS containing alcohol resistant foam. No further information regarding date, location, or volume of foam was obtained other than it was approximately two to three fires over an 8-month period.

During the SI field activities, an older model crash truck was being moved for maintenance. While moving, the truck released foam from the undercarriage. The total volume released was likely less than 1 gallon. Conveyance of this release was towards the grassy area north of Fire Station #7 but was contained to the paved area.

In 2021 historical Fire Reports were provided, through follow-up interviews with the Fort Brag Fire Department via Fort Bragg DPW, where foam products may have been used. These reports are provided in **Appendix F**. Reporting of foam use was not required until after 2016, therefore it cannot be determined if foam was utilized in most of these Fire Reports. Further, the completeness of these Fire Reports is unknown and may only represent a portion of fire responses where foam may have been utilized.

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

Following document research, personnel interviews, site reconnaissance at Fort Bragg, metal plating operations, pesticide use, installation storage warehouses, prescribed burn areas, automobile maintenance shops, photo-processing facilities, laundry/water-proofing facilities, car washes, stormwater or sanitary sewer components, remediated soil application areas, and the WWTP were also identified as preliminary locations for use, storage, and/or disposal of PFAS-containing materials. A summary of information gathered in the PA for each of these preliminary locations is described below. Specific discussion regarding areas not retained for further investigation is presented in **Section 5.1** and specific discussion regarding areas retained as AOPIs is presented in **Section 5.2**.

Potential PFAS use associated with metal plating activities may be relevant to Army installations. However, installation personnel indicated that they were not aware of any current or historical metal plating activities. Given the interviewees limited knowledge of metal plating history, metal plating activities cannot be confirmed. The only metal work that was confirmed was steel bluing, but that process no longer occurs on the installation.

During a telephonic interview with the IMCOM Pest Management Consultant, it was noted that products containing Sulfluramid (i.e., associated with insecticides) may have contained PFAS and were phased out in 1996. During the PA records review, the IMCOM Pest Management Consultant provided records of potentially PFAS-containing pesticides and insecticides used at and/or stored at Army installations, and did/did not identify Fort Bragg as an installation having used or stored PFAS-containing pesticides/insecticide. Additionally, the PA team reviewed available pesticide use inventory documentation provided by the installation and did not identify PFAS-containing pesticide use, storage, or disposal.

Interviews with various Fort Bragg personnel associated with automobile maintenance shops, car washes, photo-processing operations, and prescribed burn activities, did not identify use of PFAS-containing materials. For instance, it could not be confirmed that car washes at Fort Bragg utilized PFAS-containing products. As these operations could not be positively identified as utilizing PFAS-containing materials, these locations were not retained for further investigation.

The former WWTP was discussed in depth during the PA site visit with personnel of DPW. Several locations of potential AFFF release, such as the catchment or retention basins associated with several airfield hangars were identified as being pumped and disposed of at the WWTP when the plant was in operation. Therefore, the sludge or biosolid drying beds at the WWTP were identified as potentially impacted by PFAS. Much of the information regarding these biosolid applications was limited to personnel accounts.

Following the records research and site visit, several AOPIs related to the former WWTP and associated biosolids were identified. For instance, biosolids were used for regrading activities at several locations at Fort Bragg. Installation personnel also indicated that biosolids were transported off-installation, but details related to this transport and application were limited. Additional information regarding the WWTP and biosolid application areas is provided in **Section 5**.

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 Fort Bragg) 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.

During the mid-1990s, Fort Bragg Fire Department responded to an off-installation fire at Harnett-Cumberland Oil Company as part of a mutual-aid agreement with surrounding counties. Additionally, several documented military aircraft crashes occurred off-installation; information regarding these accidents is limited or absent. Fort Bragg Fire Department personnel stated that no AFFF was deployed at these off-installation aircraft crashes as fires had self-extinguished upon arrival.

Nakayama et al. (2007) analyzed 100 samples for PFOS, PFOA, PFBS, and seven additional PFAS-compounds from 80 locations throughout the Cape Fear River Basin in North Carolina. Of the eleven highest combined PFAS detections, eight were collected from areas upstream of the confluence of Little and Cape Fear Rivers. The eleventh highest detection was identified at this confluence, approximately 20 miles downgradient of PAAF, and represented the highest recorded PFOS detection (132 ng/L). These data indicate that there is one or more sources of PFAS upgradient of Fort Bragg. No approach was made by the authors to identify and attribute various potential sources of these PFAS impacts (Nakayama et al. 2007).

5 SUMMARY AND DISCUSSION OF PA RESULTS

The areas evaluated for potential use, storage and/or disposal of PFAS-containing materials at Fort Bragg 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, 42 have been identified as AOPIs. The process used for refining these areas is presented on **Figure 5-1**, below.

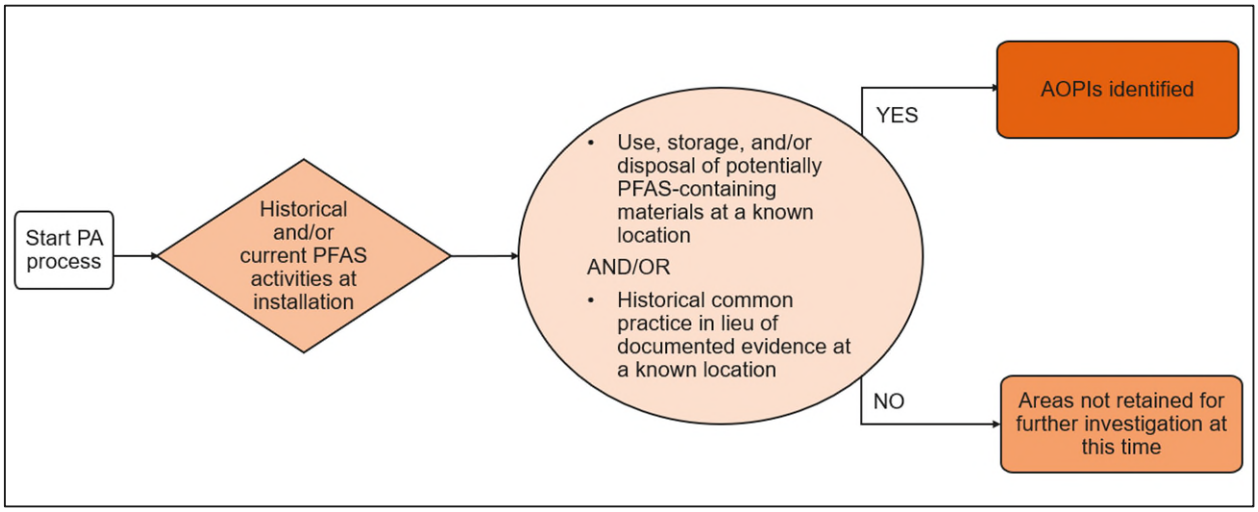

Figure 5-1: AOPI Decision Flowchart

There were two areas initially identified that were not retained for further investigation, as discussed in **Section 5.1**. The areas retained as AOPIs are presented in **Section 5.2**.

Data limitations for this PA/SI at Fort Bragg 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. Fire Station #9 was not retained as this fire station was new and reportedly only stored PFAS-free alcohol-resistant firefighting foam. Fire Station #10 was not retained as this facility was under construction during the Army PFAS team site visit.

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

Area Description	Dates of Operation	Relevant Site History	Rationale
Fire Station #9	Circa 2017 to Present	alcohol resistant -AFFF only	Reportedly only used/stored PFAS-free foams

Area Description	Dates of Operation	Relevant Site History	Rationale
Fire Station #10	2018 to Present	alcohol resistant-AFFF only	Not active/open during Site Visit and reportedly only used/stored PFAS-free foam only

5.2 AOPIs

Overviews for each AOPI identified during the PA process are presented in this section. Fourteen AOPIs overlap with Fort Bragg IRP sites and/or Headquarters Army Environmental System (HQAES) sites. The AOPI, overlapping IRP site identifier, HQAES number, and current site status are discussed within each AOPI subsection presented below. At the time of this PA, 15 of the Fort Bragg IRP sites had historically been investigated for the possible presence of PFAS constituents.

In total, 42 AOPIs were identified during the PA process at Fort Bragg. Sixteen AOPIs were sampled for PFAS constituents separately from the SI activities and 26 AOPIs were sampled during the SI. The 16 AOPIs sampled during separate investigations are presented in **Section 5.2.1** and the 26 AOPIs sampled as part of the SI are presented in **Section 5.2.2**. The AOPI locations are shown on **Figure 5-2**. Aerial photographs of each AOPI that also show the approximate extent of potential impacts associated with the use, storage, and/or disposal of PFAS compounds are presented on **Figures 5-3** through **5-29,** and include active monitoring wells in the vicinity of each AOPI.

5.2.1 AOPIs Sampled Separately from SI Activities

Through a PFC investigation in 2015 to 2016, hangars with AFFF fire suppression systems at PAAF and SAAF were inventoried, and a subset of these buildings were sampled for PFAS constituents (SCFS 2016). Fifteen hangars or locations proximal to the hangars were sampled directly or indirectly (by proximity to a sampled location) in 2015 and 2016. Additionally, one fire station (Fire Station #8) was sampled by the installation in 2021. Therefore, a total of 16 AOPIs were recognized and sampled separately from the SI activities. A description of each of these AOPIs is provided in the subsections below. The PFOS, PFOA, and PFBS analytical results are discussed **Section 7**.

5.2.1.1 PAAF Outfall 303

The PAAF Outfall 303 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to this outfall serving as the primary discharge point of surface water conveyance at PAAF. The outfall is located to the northwest of PAAF and consists of a large concrete culvert with two large diameter discharge pipes. The surrounding area is heavily vegetated. Surface water from PAAF flows through concrete piping to the northwest and through Outfall 303. After passing through the concrete culvert, discharge water is conveyed through an unlined stream system and discharges to the Little River. Therefore, all AFFF releases at PAAF (due to past accidental releases, emergency fire responses, or training operations) could potentially impact this outfall (SCFS 2016). The outfall does not drain to a surface water body that is currently being used as a drinking water source. The contribution of groundwater to the outfall is unknown but presumed to be minimal given the concrete construction details

of the outfall. Additionally, a remedial system was previously in operation at FTBR-308 (Blue Ramp JP-4 Fuel Spill Site) that discharged water treated by an oil-water separator and air stripper to the unnamed tributary adjacent to Building 742 and the Outfall 303 associated stream. The location of PAAF Outfall 303 is shown on **Figure 5-3**. The current/future land use is and will remain industrial.

5.2.1.2 PAAF Building 750

The PAAF Building 750 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of an AFFF fire suppression system with reported historical releases. The building is used to wash aircraft and has floor drains that flow to a lift station and a metals treatment system on the southwest side of the building. AFFF released inside the building would flow through the drains to the metals treatment system and into the sanitary sewer system. Based on information obtained, there have been several releases from PAAF Building 750 and/or neighboring buildings in the past. Exact dates, volume, and suppressant type are largely unknown. Currently, the hangar is outfitted with a 500-gallon HI-EX foam suppression system using Ansul Jet-X (2.75%). The location of PAAF Building 750 is shown on **Figure 5-3**. The current/future land use is and will remain industrial.

One release, as documented by SCFS (2016), occurred on 30 September 2015. The release was presumed to be a HI-EX foam. This release reportedly traveled to the lift station on the southwest side of PAAF Building 750 into a holding tank for the metal treatment system and overflowed onto the grass and concrete surface adjacent to the tank on the southwest side of the building. The release also traveled through sewer piping to a manhole on the northwest side of PAAF Building 750 where it was released to the grass-covered area around the manhole. Sampling results associated with the PFC investigation (SCFS 2016) are presented on **Figure 5-3**.

As part of the IRP, PAAF Building 750 is located within the boundary of the Building 761 Underground Storage Tank Investigation (CCFTBR0315 / 37225.1175). This IRP site received no further action (NFA) status from the North Carolina Department of Environmental Quality (NCDEQ) in 2013 for non-PFAS related constituents (Fort Bragg 2017).

5.2.1.3 PAAF Building 741

The PAAF Building 741 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of a fire suppression system with documented historical releases. Currently, Building 741 is an aircraft hangar on the northwest side of PAAF. The integrated fire suppression system currently utilizes HI-EX foam, but previously used AFFF. There are no floor drains in Building 741; AFFF released from inside the hangar could flow outside the building onto concrete- and grass-covered areas and eventually would drain to Outfall 303. Like the neighboring PAAF Building 750, releases are confirmed to have occurred. Exact dates, volumes, and suppressant type(s) are unknown. The location of PAAF Building 741 is shown on **Figure 5-3**.

As part of the IRP, PAAF Building 741 is located within the boundary of the Blue Ramp JP-4 Spill Site [FTBR-308-F-P (SS007) / 37225.1115]. Quarterly free-product vacuum recovery of non-PFAS related constituents were previously performed within FTBR-308 (Fort Bragg 2017). As of 2019, vacuum recovery events had ended, and absorbent socks are being used to remove contaminants.

5.2.1.4 PAAF Building 734/736 (Nosedock #5)

The PAAF Building 734/736 (Nosedock #5) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of fire suppression systems and known release(s). The two hangars are currently outfitted with HI-EX foam but previously used AFFF. AFFF released from the fire suppression systems would flow through floor drains and underground piping into two shared vaults on the southeast side of the buildings. From these vaults, the release flows into the sanitary sewer system. Information provided by Fort Bragg personnel confirmed that past release(s) had impacted the grass and concrete-covered areas southeast of the buildings. The location of PAAF Building 734/736 is shown on **Figure 5-4**. The current/future land use is and will remain industrial.

As part of the IRP, Buildings 734 and 736 are located within the boundary of the Blue Ramp JP-4 Spill Site [FTBR-308-F-P (SS007) / 37225.1115]. Quarterly free-product vacuum recovery of non-PFAS related constituents were previously performed within FTBR-308 (Fort Bragg 2017). As of 2019, vacuum recovery events had ended and absorbent socks are being used to remove contaminants.

5.2.1.5 PAAF Building 732

The PAAF Building 732 is identified as an AOPI following records research showing confirmed soil and groundwater impacts in the vicinity of the building (SCFS 2016). There are no recorded AFFF releases, but the AFFF inventory indicates a 300-gallon AFFF tank associated with Building 732. The presence of a current AFFF suppression system is not known, and the hangar is reportedly outfitted with a water sprinkler system. Without a confirmed robust history for Building 732, it cannot be eliminated as a potential source of AFFF release. The location of PAAF Building 732 is shown on **Figure 5-4**. The current/future land use is and will remain industrial.

5.2.1.6 PAAF Building 726

The PAAF Building 726 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to presence of a 300-gallon AFFF suppression system (SCFS 2016). No AFFF releases are confirmed to have occurred. Release, however, is possible; there is an incomplete history of site practices or releases from the fire suppression system. The location of PAAF Building 726 is shown on **Figure 5-4**. The current/future land use is and will remain industrial.

5.2.1.7 PAAF Building 724

The PAAF Building 724 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of a 300-gallon AFFF fire suppression system (SCFS 2016). No AFFF releases are confirmed to have occurred. Release, however, is possible; there is an incomplete history of site practices or releases of the fire suppression system. The location of PAAF Building 724 is shown on **Figure 5-4**. The current/future land use is and will remain industrial.

5.2.1.8 PAAF Building 722

The PAAF Building 722 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of an AFFF fire suppression system (SCFS 2016). There are no

recorded releases of AFFF from the building that have flowed onto the grass- and concrete-covered areas outside the building. In 2013, the system was tested by BFPE International contractors, the released AFFF was contained within the hangar and captured by floor drains within the building that flow into two vaults on the southeast side of the building. These floor drains are designed to flow into wastewater pipes on the southeast side of the building, to an oil-water separator on the south corner of Building 736 (SCFS 2016). In the event of an AFFF release, a valve shuts that diverts flow to the vaults on the southeast side of the building and then into the sanitary sewer system. The location of PAAF Building 722 is shown on **Figure 5-4**. The current/future land use is and will remain industrial.

5.2.1.9 PAAF Building 712

The PAAF Building 712 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of a 1,000-gallon AFFF suppression system (SCFS 2016). No AFFF releases are confirmed to have occurred. Release, however, is possible; based on historical practices or releases for neighboring hangars. The location of PAAF Building 712 is shown on **Figure 5-5**. The current/future land use is and will remain industrial.

5.2.1.10 PAAF Building 708 and Retention Pond

The PAAF Building 708 and Retention Pond is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to confirmed hangar suppression system releases and confirmed soil and groundwater impacts (**Figure 5-5**) (SCFS 2016). There are no recorded AFFF releases where AFFF was released to the area outside of the hangars.

AFFF releases within Building 708 are collected by floor drains to wastewater pipes and an oil-water separator. In the event of an AFFF release, a valve in the piping is triggered that diverts wastewater flow from the pipes to a geotextile-lined retention pond approximately 500-feet northwest of the building. Trees and shrubs growing within the retention pond basin observed during site reconnaissance indicates the lining of the retention pond may be compromised.

PAAF Building 708 and Retention Pond is collocated with two active IRP sites, the Silver Ramp Spill Site, and the Underground Storage Tank (FTBR-311 [SS020] / 37225.1118 and CCFTBR0323 / 37225.1181, respectively). FTBR-311 achieved NFA in 2008 and land use controls (LUCs) are in place; CCFTBR0323 has a completed site assessment as of August 2015 and is undergoing additional investigative phases (Fort Bragg 2017).

5.2.1.11 SAAF Building P7937

The SAAF Building P7937 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of a 600-gallon AFFF fire suppression system and the confirmed presence of PFAS compounds (SCFS 2016). The suppression system is currently outfitted with HI-EX foam, and according to personnel interviews this change over from AFFF to HI-EX occurred sometime in 2016/2017. One major AFFF release is reported because of tornado damages sustained in 2011, where the AFFF tanks were empty upon inspection of damage. The fire suppression system was tested in 2012, and the release was captured by floor drains and did not flow outside of the building. Accidental releases of AFFF from the southwestern hangars have been reported (SCFS 2016). It is unknown if these releases

flowed outside of the buildings during these accidental releases. The location of SAAF Building P7937 is shown on **Figure 5-6**. The current/future land use is and will remain industrial.

5.2.1.12 SAAF Building P8944

The SAAF Building P8944 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of a 600-gallon AFFF fire suppression system and the confirmed presence of PFAS compounds (SCFS 2016). The suppression system is currently outfitted with HI-EX foam, and according to personnel interviews this change over from AFFF to HI-EX occurred sometime in 2016/2017. Like SAAF Building P7937, the 2011 tornado caused the AFFF tank to empty. The fire suppression system was tested in 2012, and the release was captured by floor drains and did not flow outside of the building. Accidental releases of AFFF from the southwestern hangars have been reported (SCFS 2016). It is unknown if these releases flowed outside of the buildings during these accidental releases. The location of SAAF Building P8944 is shown on **Figure 5-6**. The current/future land use is and will remain industrial.

5.2.1.13 SAAF Building P9647 and Retention Pond

The SAAF Building P9647 and retention pond is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of a 1,310-gallon AFFF fire suppression system and the confirmed presence of PFAS compounds (SCFS 2016). The suppression system is currently outfitted with HI-EX foam, and this change over occurred likely sometime in 2016/2017. AFFF tanks were empty upon inspection of damage incurred by the 2011 tornado. The fire suppression system was tested in 2012, and the release was captured by floor drains and did not flow outside of the building. Accidental releases of AFFF from the southwestern hangars have been noted (SCFS 2016). It is unknown if these accidental releases flowed outside of the buildings. The location of SAAF Building P9647 and Retention Pond is shown on **Figure 5-6**. The current/future land use is and will remain industrial.

5.2.1.14 SAAF Building P3807 and Retention Pond

The SAAF Building P3807 and retention pond is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of an AFFF fire suppression system and the confirmed presence of PFAS compounds (SCFS 2016). The suppression system is currently outfitted with HI-EX foam, and this change over occurred likely sometime in 2016/2017. One major release is noted because of tornado damages sustained in 2011, where the AFFF tanks were empty upon inspection of damage. Accidental releases of AFFF from the southwestern hangars have been noted (SCFS 2016). It is unknown if these accidental releases flowed outside of the buildings. It was noted during interviews that the retention pond has historically captured AFFF releases and was pumped out by a vacuum truck and the contents disposed off-installation. The disposal site was not provided. The location of SAAF Building P3807 and Retention Pond is shown on **Figure 5-7**. The current/future land use is and will remain industrial.

5.2.1.15 SAAF Building P3007

The SAAF Building P3007 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the presence of an AFFF fire suppression system and the confirmed presence of PFAS compounds (SCFS 2016). The suppression system is currently outfitted with HI-EX foam, and this change over occurred likely sometime in 2016/2017. One major release from tornado damages sustained in 2011, where the AFFF tanks were empty upon inspection of damage. Accidental releases of AFFF from the southwestern hangars have been noted (SCFS 2016). It is unknown if these releases flowed outside of the buildings during these accidental releases. The location of SAAF Building P3007 is shown on **Figure 5-7**. The current/future land use is and will remain industrial.

5.2.1.16 Fire Station 8

Fire Station #8 is identified as an AOPI following personnel interviews, due to historical presence of firefighting vehicles with onboard AFFF systems. Currently, the fire station houses a fire engine and a P-19 Aircraft Rescue and Fire Fighting vehicle (i.e., crash truck), each carrying 60-gallons and 130-gallons of foam concentrate, respectively. Since 2019, the fire engine has contained alcohol-resistant AFFF, and the crash truck contains Phos-Chek Mil 3% AFFF (C-6 foam). Prior to 2019, other foam concentrates were utilized. The building was constructed and opened in 1937 as Ranger Station #2, and the Fort Bragg Fire Department took ownership in 2015. No releases or spills of AFFF were identified. The location of Fire Station #8 is shown on **Figure 5-8**. The current/future land use is and will remain industrial.

5.2.2 AOPIs Sampled During the SI

The following 26 AOPIs with no previous PFAS sampling were identified during the PA process. A description of each AOPI is provided in the subsections below.

5.2.2.1 PAAF Building 173

The PAAF Building 173 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the former presence of an AFFF fire suppression system. This hangar is currently outfitted with a HI-EX fire suppression system. No AFFF releases are confirmed to have occurred, however, release has not been ruled out as historical practices are not fully known. The location of PAAF Building 173 is shown on **Figure 5-9**. The current/future land use is and will remain industrial.

5.2.2.2 PAAF Building R-3065

The PAAF Building R-3065 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to presence of an AFFF fire suppression system with a 600-gallon tank. No AFFF releases are confirmed to have occurred, however, release has not been ruled out as historical practices are not fully known. The location of PAAF Building R-3065 is shown on **Figure 5-10**. The current/future land use is and will remain industrial.

5.2.2.3 PAAF Green Ramp Crash Site

The PAAF Green Ramp Crash Site is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the documented large-volume release of AFFF in response to a major aircraft incident. On 23 March 1993, an F-16D Fighting Falcon and a C-130E Hercules collided in mid-air. After the pilots ejected, the F-16D continued and crashed between two parked C-130s on Green Ramp. Momentum carried debris from the F-16D into the right wing of a parked C-141, puncturing the fuel tanks. The total volume of AFFF was used to combat the fires associated with this aircraft accident is unknown but is assumed to be in excess of 1,000 gallons. The location of the PAAF Green Ramp Crash Site is shown on **Figure 5-11**. The current/future land use is and will remain industrial.

As part of the IRP, Green Ramp is located along the northern boundary of the Former Fragmentation Field (FTBR-008-R-1 / 37225.1256). No active remediation efforts are underway for FTBR-008-R-1 and LUCs are in place. IRP site FTBR-304 (Alias: 3rd Aerial Port Squadron Spill / 37225.1111) is also adjacent to the Green Ramp Crash Site. The last remedial actions were completed in 2012 and the site is currently under monitored natural attenuation for contaminants of concern (chlorinated solvents).

5.2.2.4 PAAF Taxiway M Crash Site

The PAAF Taxiway M Crash Site is identified as an AOPI following personnel interviews and site reconnaissance due to a potential AFFF release in response to an aircraft incident. An accident occurred at this location in 1997 involving an EC-130 aircraft, which experienced landing gear failure during landing operations and crashed. According to airfield personnel, the aircraft fuel tank was breached during the crash and an unknown volume of AFFF was deployed to prevent ignition. The aircraft accident occurred towards the south side of the runway just north of Taxiway M (**Figure 5-11**). Based on a search of the ASN, on 02 September 1997 an EC-135C was heavily damaged in landing from a nose wheel collapse at PAAF and may represent the incident described above (ASN 2020). The location of PAAF Taxiway M Crash Site is shown on **Figure 5-11**. The current/future land use is and will remain industrial.

As part of the IRP, Taxiway M is located within the boundary of the Former Fragmentation Field (FTBR-008-R-1 / 37225.1256). No active remediation efforts are underway for this IRP site and LUCs are in place.

5.2.2.5 Fire Station #1 (Building 6-9572)

Fire Station #1 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical storage of AFFF concentrate and presence of firefighting vehicles with onboard AFFF systems (one engine with 25 gallons of AFFF concentrate). The building was constructed and opened in 1954 and is reportedly scheduled to be replaced. No releases or spills of AFFF were identified. Fire Station #1 is situated next to Knox Street Fire Training Pits, where AFFF foam is confirmed to have been released during training exercises. The location of Fire Station #1 is shown on **Figure 5-12**. The current/future land use is and will remain industrial.

As part of the IRP, Fire Station #1 is located within the boundary of solid waste management units (SWMUs) 4 and 18 (FTBR-004; Alias: SWMUs 4 and 18, Landfill 4 and Fire Training Pits 18 / 37225.1003). The primary contaminants of concern are metals and volatile organic compounds. No active remediation efforts are underway for this IRP site and LUCs are in place.

5.2.2.6 Fire Station #2 (Building P-4539)

Fire Station #2 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical storage of AFFF concentrate and presence of firefighting vehicles with onboard AFFF systems. This fire station was constructed and opened in 1957 and serves SAAF. No releases or spills of AFFF were identified. The fire station houses one engine equipped with 40-gallons of AFFF concentrate and two crash trucks, each equipped with 210-gallons of AFFF concentrate. The current and historic AFFF product-type is unknown. To the west and southwest are four aircraft hangars with previously confirmed impacts from PFAS constituents. Further west and off-post are the headwaters of the Cross Creek and Little Cross Creek stream system that forms the FPWC reservoirs downstream. The location of Fire Station #2 is shown on **Figure 5-13**. The current/future land use is and will remain industrial.

As part of the IRP, Fire Station #2 is located within the boundary of CCFTBR0012 / 37225.1194. No information for this IRP site could be located.

5.2.2.7 Fire Station #3 (Building B-7002)

Fire Station #3 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical storage of AFFF concentrate and presence of firefighting vehicles with onboard AFFF systems. Fire Station #3 was constructed and opened in 2004. No releases or spills of AFFF were identified. The fire station houses one engine equipped with 30-gallons of AFFF concentrate. The current and historical AFFF product-type is unknown. The location of Fire Station #3 is shown on **Figure 5-14**. The current/future land use is and will remain industrial.

As part of the Military Munitions Response Program, Fire Station #3 is located within the boundary of FTBR-010-R-1 (Alias: Former Pistol Range / 37225.1258). The site is inactive and received NFA status from NCDEQ.

5.2.2.8 Fire Station #5 (Building E-3673)

Fire Station #5 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical storage of AFFF concentrate and presence of firefighting vehicles with onboard AFFF systems. No releases or spills of AFFF were identified. The fire station houses one engine equipped with 60-gallons of AFFF concentrate. The current and historical AFFF product-type is unknown. The location of Fire Station #5 is shown on **Figure 5-15**. The current/future land use is and will remain industrial.

5.2.2.9 Fire Station #7 (Building 250) and Foam Shed

Fire Station #7 and Foam Shed is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical storage of AFFF concentrate and presence of multiple firefighting vehicles with onboard large-volume AFFF systems. Fire Station #7 is the largest fire station at Fort Bragg and serves PAAF. The fire station houses one engine equipped with 25-gallons of AFFF concentrate and eight crash trucks, with four equipped with 130-gallon AFFF tanks and four equipped with 500-gallon AFFF tanks. The current and historical AFFF product-type is unknown. The foam shed was previously used to store AFFF concentrate. Currently the shed is used to store ancillary equipment

and empty AFFF drums. No releases or spills of AFFF were identified by the installation, however, the SI field team witnessed a minor spill from a crash truck while on site. The location of Fire Station #7 is shown on **Figure 5-16**. The current/future land use is and will remain industrial.

5.2.2.10 Former Fire Training Area #4

The Former Fire Training Area #4 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to AFFF training operations. This site was a firefighter training area on PAAF, located southwest of the intersection of Hurst Drive and Aldish Road. The site consisted of an unlined pit of approximately 6 acres and was in operation from the 1950s through 1989. Several remedial actions have been carried out at this site including, soil removal, a free-product recovery system, soil vapor extraction, and air sparging. The disposal site for the excavated soils was not determined. The site was issued an NFA status and LUCs were set in 2009. Since 2009, the area has been redeveloped and currently houses the Joint Special Operations Command (JSOC). The boundary of the former fire training area is unknown; the estimated location of Fire Training Area #4 is shown on **Figure 5-17**. The current/future land use is and will remain industrial.

As part of the IRP, Fire Training Area #4 is located within the boundaries of FTBR-306 (Alias: FT001, Fire Training Area #4 / 37225.1113) and CCFTBR0094 (Alias: JIB Soil Removal Project, Landfill 4, and Fire Training Pits 18 / 37225.1107). For FTBR-306, the primary contaminants of concern are petroleum, oil and lubricants; the site received NFA status in 2009 and LUCs are in place. For CCFTBR0094, NFA was received in 2015.

5.2.2.11 Knox Street Fire Training Pits

The Knox Street Fire Training Pits is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to reportedly frequent training with AFFF. The site is associated with Fire Station #1 and overlaps with an approximately 10-acre abandoned landfill (FTBR-004) just south of the intersection of Honeycutt Road and Knox Street. The two training pits were constructed on the northern half of the abandoned landfill in 1966. From 1966 to 1978, the pits were lined with sand. In 1978, the pits were modified and lined with concrete and a drainage system constructed directing pit contents to an oil-water separator (USGS 1996). The location of the Knox Street Fire Training Pits is shown on **Figure 5-12**. The current/future land use is and will remain industrial, and the training pits continue to be actively used for firefighter training activities.

As part of the IRP, Fire Station #1 is located within the boundary of SWMUs 4 and 18 (FTBR-004; Alias: SWMUs 4 and 18, Landfill 4 and Fire Training Pits 18 / 37225.1003). The primary contaminants of concern are volatile organic compounds and pesticides. No active remediation efforts are underway for this IRP site and LUCs are in place.

5.2.2.12 Joint Firefighting Training Area and Retention Pond

The JFTA and Retention Pond is identified as an AOPI following personnel interviews and site reconnaissance due to confirmation of accidental AFFF discharge during water-based training activities. The training facility is equipped with a liquid propane fire system with a temperature shut-off. The site is only used for water-based training activities, but according to Fort Bragg Fire Department personnel AFFF

has been accidentally discharged on several occasions. The location of JFTA is shown on **Figure 5-18**. The current/future land use is and will remain industrial.

As part of the IRP, JFTA is located within the boundary of the Former Fragmentation Field (FTBR-008-R-1; Alias: Frag Field / 37225.1256). No active remediation efforts are underway for this IRP site, LUCs are in place.

5.2.2.13 Biosolid Application Area at Honeycutt Road

The Biosolid Application Area at Honeycutt Road is identified as an AOPI following personnel interviews and site reconnaissance due to the confirmation that biosolids from the Former WWTP had be spread over this area. The area covers approximately 10-acres and located north of the intersection of Honeycutt Road and Parham Boulevard, near SAAF. It is unknown when or how much biosolids were spread. PFAS compounds are not removed during the water treatment process at WWTPs. Therefore, any PFAS constituent related impacts to the WWTP would be retained in the biosolids. Since these were spread over the area at Honeycutt Road, the soils could be a source of PFAS compounds in this area. The location of the Biosolid Application Area at Honeycutt Road is shown on **Figure 5-19**. The current/future land use is and will remain industrial.

5.2.2.14 Camp Mackall – Fire Station #4 (Building T-2766)

The Camp Mackall – Fire Station #4 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical storage of AFFF concentrate and presence of firefighting vehicles with onboard AFFF systems. Additionally, a small volume of AFFF concentrate is stored in the shed on the southwest side of the building. Fire Station #4 was constructed and opened in 1983. No releases or spills of AFFF are noted. The well associated with Fire Station #4 was sampled in 2016, revealing no detections of PFAS constituents. The location of Fire Station #4 is shown on **Figure 5-20**. The current/future land use is and will remain industrial.

5.2.2.15 Former Wastewater Treatment Plant

The Former WWTP is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the potential for AFFF releases (specifically in hangars) to enter the sanitary system and impact the WWTP. Several hangars have floor drains that were tied into the sanitary system leading to the WWTP. Further, it was reported that after a release, the retention ponds associated with several hangars would have been pumped and transferred to the WWTP. Since the WWTP processes were not designed to remove PFAS compounds, these compounds can essentially pass-through and accumulate in the biosolids. The WWTP effluent discharge was to the Little River. The location of the WWTP is shown on **Figure 5-21**. The current/future land use is and will remain industrial.

As part of the IRP, the Former WWTP is collocated with FTBR-038, -039, -049, -042, and -050 (corresponding to the Grit Chamber, Primary Sedimentation Tanks, Biofilters, Secondary Sedimentation Tanks, and the WWTP Sludge Drying beds respectively / 37225.1028, -.1023, -.1022, -.1021, and -.1020 respectively). FTBR-038, -039, -040, and -042 received NFA status from NCDEQ in 2005. FTBR-050 received an NFA from NCDEQ on 19 August 2008.

5.2.2.16 Sicily Drop Zone – Biosolid Application and Crash Site

The Sicily Drop Zone – Biosolid Application and Crash Site area is identified as an AOPI following personnel interviews and site reconnaissance due to the confirmation that biosolids from the Former WWTP had been spread over this area with the purpose of re-grading the airfield. The exact area of coverage is unknown, but the presumed biosolid application area extent is shown on **Figure 5-22**. PFAS compounds are not removed during the water treatment process at WWTPs. Therefore, any PFAS constituent related impacts to the WWTP would be retained in the biosolids. Since these were spread over an unknown area at SDZ, the soils could be a source of PFAS constituents in this area.

Additionally, there have been at least two aircraft crashes at SDZ, where AFFF was either confirmed or likely to have been used. On 01 July 1987, a C-130 crashed during a training exercise and on 09 August 1989 another C-130 crashed at SDZ during a training exercise. Both accidents occurred at the southern end of the runway. The volume of AFFF used in response to these aircraft crashes is unknown.

The location of SDZ is shown on **Figure 5-22**. The current/future land use is and will remain industrial.

5.2.2.17 Original Fire Station (Building 300)

The Original Fire Station (Building 300) was opened in 1934 and served PAAF. The fire station was closed and converted into a medical supply and maintenance building (Medical Logistics Supply) in 1979. Currently, the building is used as an emergency medical services substation and houses an ambulance. During the latter years of operation as a fire station there was likely storage of AFFF. During this operation as a fire station there was a truck and hose wash rack along the northwest side of the building, which may have resulted in minor release(s) of AFFF. The building is listed on the National Register of Historic Places as part of the Pope Air Force Base historic district. The location of the Original Fire Station (Building 300) is shown on **Figure 5-23**. The current/future land use is and will remain industrial.

5.2.2.18 Former Fire Station #1

The first fire station at the original Fort Bragg (prior to PAAF inclusion) was opened in 1919 when the installation was Camp Bragg. Records regarding this fire station are very limited. Former Fire Station #1 (1919 to 1975) was located on the southside of Randolph Street between Hamilton Street and Knox Street. The station housed two trucks and is assumed to have been closed circa-1975 (Legeros 2020), but photographic evidence suggests the building remained standing at least into the mid-1980s. The date that firefighting operations at this location ended is unavailable. Due to the assumed operation into the 1970s, it is likely that AFFF was stored at this station. The location of the Former Fire Station #1 is shown on **Figure 5-24**. The current/future land use is and will remain industrial.

5.2.2.19 Former Fire Station #3

Former Fire Station #3 is located northwest of the intersection of Butner Road and Dunham Street. The station was closed in 2004 and demolished circa-2008. Due to the operational timeframe, AFFF use, and storage is probable. This site is not associated with any former or active IRP sites. The location of the Former Fire Station #3 is shown on **Figure 5-25**. The current/future land use is and will remain industrial.

5.2.2.20 World War II Era Fire Stations A through C (3 AOPIs)

Three WWII era former fire stations were identified and represent three separate AOPIs. Limited historical building information was available for these stations and will therefore be designated herein as Former Fire Station A, Former Fire Station B, and Former Fire Station C. These fire stations were decommissioned circa-1975 (Legeros 2020). AFFF was likely stored and/or used at each of these fire stations during the latter years of operation. Potential for AFFF spills or release was confirmed by current fire department personnel.

World War II Era Fire Stations A

Former Fire Station A was located on the northwest corner of the intersection of Normandy Drive and Sicily Drive. The building was converted into an Army Air Force Exchange Service Shoppette prior to demolition. This site is not associated with any former or active IRP sites. The location of the Former Fire Station A is shown on **Figure 5-26**. The current/future land use is and will remain industrial.

World War II Era Fire Stations B

Former Fire Station B was located on the southeast corner of the intersection of Woodruff Street and Reilly Road. The building was later converted and housed the Army Test, Measurement, Diagnostic, Equipment Calibration Lab prior to demolition. This site is not associated with any former or active IRP sites. The location of the Former Fire Station B is shown on **Figure 5-27**. The current/future land use is and will remain industrial.

World War II Era Fire Stations C

Former Fire Station C was located on the northeast corner of the intersection of Honeycutt Road and Blackjack Street. Following service as a fire station, the building was converted for motor pool use, and subsequently used as a live burn for firefighting training. This site is collocated with CCFTBR0029, no further details were available for this IRP site. The location of the Former Fire Station C is shown on **Figure 5-28**. The current/future land use is and will remain industrial.

5.2.2.21 Hush House (Building 532)

The Hush House (Building 532) is located on northern portion of PAAF and serves as the primary AFFF storage facility at Fort Bragg. Storage at the Hush House began in October 2010. In addition to bulk AFFF storage, this building is also used to house ancillary crash truck(s) and the foam trailer. Potential releases from this area would likely discharge to sanitary drains located within the building. Releases could impact the paved and grassy areas surrounding Building 532 and infiltrate to groundwater should a potential release leave the building. The location of the Hush House (Building 532) is shown on **Figure 5-29**. The current/future land use is and will remain industrial.

5.2.2.22 Fire Station #6

Fire Station #6 (Building 532) is located 5.6 miles north-northwest of PAAF and primarily serves the Linden Oaks Community (base housing). The fire station houses one engine that held 35 gallons of Universal Green AR-AFFF 3% during the PA site visit. Prior to 2019, the engine held 35 gallons of National Foam 3% AR-AFFF. Interviewees stated they did not know if other foam products were utilized

historically. No foam was stored at the fire station during the PA site visit, and interviewees reported no use or disposal of foam in or around the fire station.

Potential incidental spills of AFFF during filling of fire truck tanks may have flowed to the paved and unpaved areas west of the engine bay, and may have infiltrated to groundwater. The location of Fire Station #6 is shown on **Figure 5-30**. The AOPI is expected to remain a fire station. .

5.2.2.23 Fire Response Area - Range 78

On 01 June 2015 a timber-cutting commercial vehicle caught fire at Range 78, an operational training range, near Raeford-Vass Road. Emergency response from Fire Station #5 involved the use of AFFF to extinguish the fire. The unknown volume of foam was sprayed onto the fire and onto soil at the fire location and may have infiltrated to groundwater. The approximate location of the Range 78 fire is shown on **Figure 5-31**. The land use is expected to remain as an active munitions training range.

5.2.2.24 Fire Response Area - Luzon Drop Zone

On 25 October 2017, Fire Station #4 responded to a vehicle fire (Ford F-250) in Luzon Drop Zone, a dirt airfield neighboring Camp Mackall and used for airborne training activities. Interviewees did not know the volume or type of foam that was used, but AFFF is typically used to respond to fires potentially involving fuels. The foam was sprayed into the fire and to the ground surface from Crash Truck 42. AFFF sprayed onto soil may have infiltrated to groundwater. The location of the Luzon Drop Zone fire is shown on **Figure 5-32**. The land use is expected to remain as a drop zone/airfield.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at Fort Bragg, an SI for PFOS, PFOA, and PFBS was conducted in accordance with CERCLA. SI sampling was completed at Fort Bragg at 26 of the 42 AOPIs to evaluate the presence or absence of PFOS, PFOA, and PFBS in comparison with the OSD risk screening levels. The remaining 16 AOPIs were evaluated based on PFOS, PFOA, and PFBS data obtained during a previous investigation (SCFS 2016) or as part of the Fort Bragg DPW potable water well sampling (e.g., Fire Station #8). As such, a QAPP Addendum (Arcadis 2019b) was developed to supplement the general information provided in the PQAPP (Arcadis 2019a) and to detail the site-specific proposed scopes of work for the SI. Preliminary CSMs were prepared for the 23 AOPIs identified during preliminary assessment, in accordance with the USACE Engineer Manual on Conceptual Site Models, EM 200-1-12 (USACE 2012). Preliminary CSMs were not included in the QAPP Addendum for the 16 AOPIs with existing PFOS, PFOA, and PFBS data which were not sampled during the SI or the 10 AOPIs identified following the initial SI sampling event (see **Section 6.3.3**). The preliminary CSMs identified potential human health receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSMs identified 15 soil, 16 groundwater, 10 surface water, and 10 sediment pathways as potentially complete or complete, which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on preliminary CSMs (Arcadis 2019b). The SI scope of work was completed in January 2020, November 2020, and January 2022 through the collection of field data and analytical samples. A summary of the sampling efforts is provided below.

- The following 15 AOPIs were sampled by SCFS in 2015/2016 (SCFS 2016):
    - PAAF Outfall 303, PAAF Buildings 750, 741, 734/736, 732, 726, 724, 722, 712, 708 and retention pond, and SAAF Buildings P7937, P8944, P9647 and retention pond, P3807 and retention pond, and P3007
- The following 16 AOPIs were sampled during the SI in January 2020:
    - PAAF Buildings 173 and R-3065, PAAF Green Ramp Crash Site, PAAF Taxiway M Crash Site, Fire Station #1, Fire Station #2, Fire Station #3, Fire Station #5, Fire Station #7, Former Fire Training Area #4, Knox Street Fire Training Pits, Joint Firefighting Training Area and retention pond, Biosolid Application Area at Honeycutt Road, Camp Mackall – Fire Station #4, Former Wastewater Treatment Plant, and Sicily Drop Zone Biosolid Application and Crash Site.
- The following 7 AOPIs were sampled during SI resampling efforts in November 2020:
    - Original Fire Station, Former Fire Station #1, Former Fire Station #3, Former Fire Station A, Former Fire Station B, Former Fire Station C, and Hush House.
    - Additionally, surface water and sediment samples were collected from Little Cross Creek adjacent to SAAF.
- The following AOPI was sampled by Fort Bragg during routine sampling activities in 2021:
    - Fire Station #8
- The following 3 AOPIs were sampled during SI resampling efforts in January 2022:

- Fire Station #6 and Fire Response Areas at Range 78 and Luzon Drop Zone.

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 2019b) and PQAPP (Arcadis 2019a). The subsections below summarize the DQOs, sampling design and rationale, sampling activities and methods, and data analyses procedures for the SI phase at Fort Bragg. 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 QAPP Addendum (Arcadis 2019b), 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, surface water, and sediment for PFOS, PFOA, or 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.

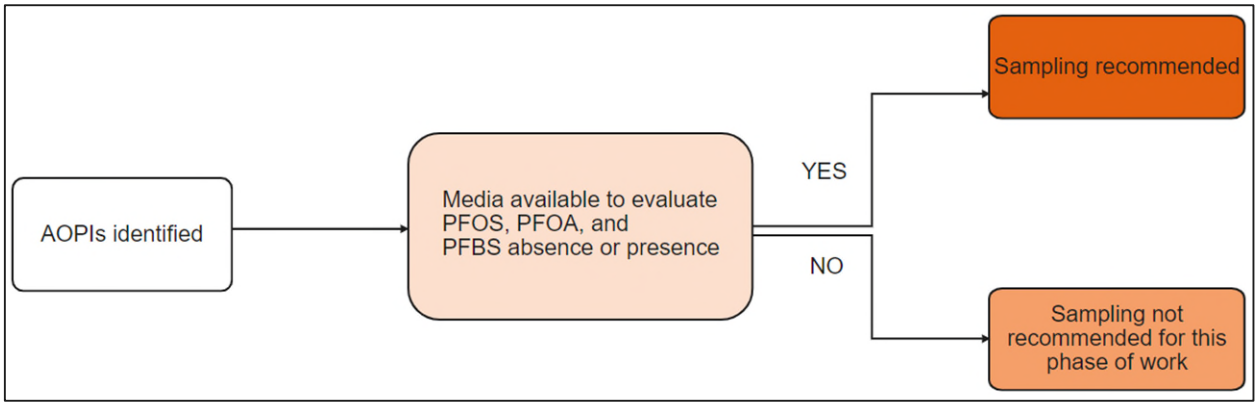

Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at Fort Bragg is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2019b). Briefly, for AOPIs with no previous PFOS, PFOA, and PFBS sampling, soil, groundwater, surface water, and sediment sampling were conducted. Soil samples were collected from the upper 2-feet of potentially impacted soil, as determined by the field geologist. Therefore, in some cases the composite soil sample was collected from a deeper interval. Surface water and sediment samples were collected at AOPIs where direct surface water impacts were possible or suspected. First-encountered groundwater was sampled from soil borings and was no deeper than 4 feet of the first encountered groundwater. The sampling depths noted for 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.

The initial SI scope of work was completed in January 2020 through the collection of field data and analytical samples from the following 16 AOPIs which were identified during the PA: PAAF Building R-3065, PAAF Building 173, Green Ramp Crash Site, Taxiway M Crash Site, Fire Station #1, Knox Street Fire Training Pits, Fire Station #2, Fire Station #3, Fire Station #5, Fire Station #7 and Foam Shed, Former Fire Training Area #4, JFTA and Retention Pond, Honeycutt Road - Biosolid Application Area, Camp Mackall-Fire Station #4, Former WWTP, and SDZ. After the initial SI sampling, ten additional AOPIs were identified and sampled, raising the total number of identified AOPIs requiring sample collection from 16 to 26. An additional AOPI, Fire Station #8 which was sampled by Fort Bragg during routine sampling activities, was also added.

All supplemental sampling followed procedures outlined within the site-specific QAPP addendum (Arcadis 2019b). The November 2020 sampling was additionally covered by the PFAS SI Supplemental Sampling Addendum (Arcadis 2020) and included the Original Fire Station, Former Fire Station #1, Former Fire Station #3, Former WWII Era Fire Stations (Former Fire Station A, Former Fire Station B, and Former Fire Station C), and the AFFF storage area at Hush House (Building 532). In addition to the new AOPIs sampled in November 2020, resampling at Fire Station #5 was completed to obtain a groundwater sample, and surface water and sediment samples were collected within Little Cross Creek (a creek proximal to and potentially impacted by AOPIs at SAAF). The January 2022 sampling was additionally covered by the PFAS SI Supplemental Sampling Addendum (Arcadis 2021) and included Fire Station #6, and the fire response areas associated with Range 78 and Luzon Drop Zone.

6.3 Sampling Methods and Procedures

Environmental data were collected and analyzed in accordance with the PQAPP (Arcadis 2019a), 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 QAPP Addendum (Arcadis 2019b), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2019c). 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 2019a) and site-specific QAPP Addendum (Arcadis 2019b). 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 K** and **L**, respectively. Photographs of the sampling activities are included in **Appendix M**.

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 direct-push technology (DPT), dual-tube drill casing was advanced using a top-down

sampling method to minimize cross-contamination at depth. Soil samples were collected in PFAS-free acetate liners; depending on field conditions, either a peristaltic pump or portable bladder pump with PFAS-free disposable high-density polyethylene (HDPE) tubing or a PFAS-free disposable bailer was used to collect groundwater samples through a screen-point sampler. In some cases, temporary wells were constructed for groundwater sample collection when recharge rates were found to be too slow for sample collection through the drill rod. Surface water samples were collected using direct-fill methods just below the water surface. Sediment samples were collected from the upper 10 centimeters using a decontaminated Lexan tube and stainless-steel trowel; sediment samples were decanted before bottling for laboratory analysis.

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. Subsequent resampling efforts also adhered to the QA/QC requirements outlined in the PQAPP and QAPP Addendum.

QA/QC samples were collected at the frequencies specified in the QAPP Addendum (Arcadis 2019b), typically at a rate of 1 per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicates samples were collected for media sampled for PFOS, PFOA, and PFBS, and total organic carbon (TOC) only. EBs were collected for media sampled for PFOS, PFOA, and PFBS, at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2019b). The decontaminated reusable equipment from which EBs were collected include tubing (HDPE and non-HDPE when necessary), tubing weights, screen-point samplers, drill casing and cutting shoes, hand augers, water-level meters, acetate liners, bailers, and stainless-steel trowels as applicable to the sampled media. Source blanks were collected from the water used to pressure-wash drill tooling. Analytical results for blank samples are discussed in **Section 7.43**.

6.3.3 Field Change Reports

One instance of major scope modification (i.e., with a significant impact on the project scope and warranting discussion with USACE) was encountered during the Fort Bragg SI work. Seven additional AOPIs were identified (each described in **Section 5**, above, including the Original Fire Station, Former Fire Station #1, Former Fire Station #3, World War II Era Fire Stations A-C, and the Hush House). These AOPIs and the proposed sampling were documented in a Field Change Request and sampling memorandum dated 10 September 2020, attached in **Appendix N**. An additional three AOPIs were further identified including Fire Station #6 and fire response areas at Range 78 and Luzon Drop Zone. These AOPIs and the proposed sampling were documented in the memorandum dated December 2021, and attached in **Appendix N**.

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 site-specific QAPP Addendum.

Minor modifications from and clarifications for the procedures and scope of work detailed in the QAPP Addendum and PQAPP and that did not affect DQOs are documented in Field Change Reports included as **Appendix N** and are summarized below:

- Fire Training Area #4: Both proposed boring locations at this AOPI were moved prior to the initiation of SI field work.
    - FTBG-01a: FT4- GW/ SO-01 moved approximately 100 feet to the northwest, outside of the fenced area. The reason for this change was the originally proposed location was within a concrete lined stormwater retention pond. The boring was not moved to the immediate vicinity of the originally proposed location as this would have impeded a security checkpoint or would have been within the high-security area of JSOC.
    - FTBG-01b: FT4-GW/SO-02 was moved approximately 125 feet to the south southwest to avoid working within the high security area of JSOC. Groundwater was not encountered so a groundwater sample was not collected.
- WWTP: One groundwater sample removed, one sample renamed, one sediment sample was not collected, and one surface water/sediment sample was not collected.
    - FTBG-02a: The originally proposed WWTP-GW/SO-03 was not sampled. This location was removed due to access restrictions and based on field observations of built structures did not appear to be an area at risk for PFOS, PFOA, and PFBS impacts.
    - FTBG-02b: Due to the removal of the originally proposed WWTP-GW/SO-03, WWTP-GW/SO-04 was renamed WWTP-GW/SO-03.
    - The sediment sample, WWTP-SE-01, associated with the surface water sample (WWTP-SW-01) was not collected due to restrictive access (barbed wire and steep riverbank).
    - WWTP- SE/SW-02, was not collected from the originally proposed location due to restrictive access.
- Fire Station #3: Two sampling locations were moved.
    - FTBG-03a: FS3-GW/SO-01 was moved approximately 100 feet to the northeast. On site features indicated the likely runoff direction of a release would be towards the northeast of the fire station garage.
    - FTBG-03b: FS3-SO-03 was moved approximately 50 feet to the north. The reason for this change was surface water conveyance features indicated the location should be moved.
- Fire Station #5: One sample location was moved.
    - FTBG-04: FS5-GW/SO-02 was moved approximately 130 feet to the south-southwest. The reasons for this change were access restrictions and surface water conveyance features indicated the location should be moved. No groundwater was collected at this location as sufficient groundwater was not encountered. A supplemental boring and groundwater sample was collected during the PFAS SI Supplemental Sampling effort in November 2020.
- Fire Station #2: Two sampling locations were moved.

  - FTBG-05a: FS2-GW/SO-01 was moved approximately 50 feet to the east southeast. The reason for this change was surface water conveyance features indicated the location should be moved.
  - FTBG-05b: FS2-GW/SO-02 was moved approximately 50 feet to the north. The reason for this change was surface water conveyance features indicated the location should be moved.
- Green Ramp and Taxiway M Crash Sites: Two sampling locations were moved, and another was removed.
  - FTBG-06a: CR-GW/SO-01 was moved approximately 40 feet to the northeast to avoid possible buried utilities.
  - FTBG-06b: CR-GW/SO-02 was moved approximately 350 feet to the northwest. The reason for this change stemmed from further discussions with the current airfield manager and a review of the interview log from the former airfield manager which informed the decision to move this sampling point to a location where PFOS, PFOA, and PFBS was more likely to be present.
  - FTBG-06c: CR-GW/SO-03 was removed from the sampling plan. This removal was based on discussion with the current airfield manager and determination that the location was likely upgradient of the possible AFFF release. Additionally, work in this area would have significantly interrupted the airfield operations and thus the Army mission.
- Fire Station #1 and Knox Street Fire Training Pits: One boring location was moved, and one groundwater sample was removed.
  - FTBG-07: FS1-GW/SO-01 moved approximately 40 feet to the northeast to avoid the sprinkler training system.
  - Monitoring well, AEHA4-1 was determined to be upgradient from probable AFFF release points, and therefore was removed from the sampling program.
- PAAF Building R-3065: Two boring locations were moved.
  - FTBG-08a: R3065-GW/SO-01 moved approximately 1,200 feet to the northwest. The basis for this change was the presence of surface water conveyance features indicated the original proposed location was at low risk from potential AFFF releases.
  - FTBG-08b: R3065-GW/SO-02 was moved approximately 100 feet to the west northwest; based on surface water conveyance features encountered and access.
- PAAF Building 173: One boring location was moved.
  - FTBG-09: B173-GW/SO-01 moved approximately 320 feet to the southeast for utilities avoidance.
- Sicily Drop Zone: One groundwater sample was collected via check valve.
  - FTBG-10: The depth to groundwater at SDZ-GW-04 was deeper than anticipated and required a check valve for collection. The sample tubing used was provided by the drillers

and was likely low-density polyethylene. An EB from this tubing was collected to inform potential PFOS, PFOA, and PFBS contamination.

6.3.4 Decontamination

Non-dedicated reusable sampling equipment (e.g., hand augers, drill cutting shoes and casing, screen-point samplers, 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 (see Appendix A in Arcadis 2019a).

6.3.5 Investigation-Derived Waste

IDW, including soil cuttings, excess sediment, groundwater, surface water, decontamination fluids, were collected and placed in Department of Transportation-approved 55-gallon drums, segregated by medium: waters and soil/sediment, and stored with secondary containment at the staging area. Due to the collocation of AOPIs and IRP sites, drums were labeled as pending analysis. Equipment IDW including personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, Lexan tubes, and HDPE and silicon tubing) that may contact sampling media were disposed of as municipal waste. Analytical results for IDW samples collected during the SI are discussed in **Section 7.41**.

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 PFOS, PFOA, and PFBS analysis by liquid chromatography with tandem mass spectrometry. Laboratory analyses associated with the SI were completed in accordance with Worksheets #12.1 through #12.5 in the PQAPP (Arcadis 2019a). PFOS, PFOA, and PFBS were analyzed for in groundwater, soil, surface water, and sediment samples using an analytical method that is ELAP-accredited and compliant with QSM 5.1.1 (DoD 2018) / 5.3 (DoD and Department of Energy 2019), Table B-15 (DoD 2018). Potable water samples were analyzed for PFOS, PFOA, and PFBS according to USEPA Method 537 Version 1.1, in accordance with Worksheet #15 of the Fort Bragg QAPP Addendum (Arcadis 2019b).

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 2019b) 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 specific 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 O**).

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 2019a). Each laboratory data package/sample delivery group underwent Stage 3 data validation in accordance with 5.1.1 (DoD 2018) / 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 O**.

6.4.3 Data Usability Assessment and Summary

6.4.3.1 Data Collected Separately from SI Activities

As discussed in **Section 5.2.1**, during a PFC investigation in 2015 to 2016, hangars with AFFF fire suppression systems at PAAF and SAAF were inventoried, and a subset of these buildings were sampled for PFAS constituents (SCFS 2016). The analyses performed in 2015 to 2016 were completed prior to the laboratory's accreditation for PFAS constituent analysis under DoD ELAP requirements provided in the QSM, Table B-15 (DoD 2018). The laboratory methods used to collect the data included solid phase extraction to prepare the aqueous samples for analysis and isotope dilution for quantification of both soil and aqueous samples. Recoveries of isotopically labelled surrogates were between 50% and 150% for all samples and all analytes. Because of the methodological similarities between the method used and the requirements laid out in the QSM Table B-15 (DoD 2018) and the high level of data quality, these data are considered usable for decision making at Fort Bragg.

The sample collection associated with Fire Station #8 completed in 2021 was analyzed using an analytical method that is ELAP-accredited and compliant with QSM 5.3 (DoD and Department of Energy 2019) and Table B-15 (DoD 2018).

6.4.3.2 Data Collected During the SI

A data usability assessment was completed for all analytical data associated with SI sampling at Fort Bragg. Documentation generated during the data usability assessments, which were compiled into a DUSR (**Appendix O**), was prepared in accordance with the USACE Engineer Manual 200-1-10 (USACE

2005), the Final DoD General Data Validation Guidelines (DoD and Department of Energy 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.

During the validation process, PFOS, PFOA, and PFBS detections in sample FTBR-FFSC-GW-01 have been qualified as "X". The data qualified as "X" was due to extracted internal standards exhibiting recoveries less than 20%, which is indicative of matrix interference. PFOS, PFOA, and PFBS are considered present in the affected sample; however, the reported concentrations have potential unknown bias and therefore these detected results are unable to be evaluated against screening criteria. Although the "X" qualifier indicates that these data may not be suitable for evaluation and decision making, these data are used for evaluation based on the confirmation of presence and the site-specific history.

Based on the final data usability assessment, the environmental data collected at Fort Bragg 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 O**), and as indicated in the full analytical tables (**Appendix P**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019a) and QAPP Addendum (Arcadis 2019b). Data qualifiers applied to laboratory analytical results for samples collected during the SI at Fort Bragg 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 on **Table 6-2**.

Table 6-2 OSD Risk Screening Levels Calculated for PFOS, PFOA, 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. 2019. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. 15 October (**Appendix A**). The risk screening levels for PFBS in tap water and soil were updated in April 2021 based on the updated toxicity values published by the USEPA (USEPA 2021).
2. All soil data will be screened against both the Residential Scenario and Industrial/Commercial risk screening levels (if collected from less than 2 feet bgs), regardless of the current and projected land use of the AOPI. Soil samples collected from greater than 2 feet but less than 15 feet bgs will be compared to the Industrial/Commercial risk screening levels only, and soil samples collected from greater than 15 feet bgs will not be compared to either risk screening level.
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. While the current and most likely future land uses of the AOPIs at Fort Bragg 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. Comparison of surface water data to the OSD residential tap water screening levels is only performed for the sample collected from Little Cross Creek (associated with the Fire Station #2 AOPI), because the Glenville Reservoir operated by FPWC is located downstream. At other surface water sampling locations, comparison to the OSD residential tap water screening levels is not made because the surface water is not used as a drinking water source nearby and the surface water is not an expression of groundwater (i.e., seeps or springs). Comparison of sediment results to the OSD soil screening levels is not performed, as the sediment samples were collected from beneath surface water features, not from a dry streambed or drainage way. The data from the AOPIs 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 from AOPIs during the SI at Fort Bragg (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 2019b). Additionally, analytical results for the 16 AOPIs sampled separately from the SI activities are also discussed in this section. Based on the presence of PFAS concentrations exceeding OSD risk screening levels for these 16 AOPIs, additional sampling was not performed during the SI field investigation phase. 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 **7-4** provide a summary of the groundwater, soil, surface water, and sediment analytical results for PFOS, PFOA, and PFBS. **Table 7-5** summarizes all 42 AOPIs and whether their PFOS, PFOA, and PFBS sampling results exceed the OSD risk screening levels. **Appendix P** includes the full suite of analytical results for media sampled during this SI, as well as for the QA/QC samples. An overview of AOPIs at Fort Bragg with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2** through **7-31** show the PFOS, PFOA, and PFBS analytical results in groundwater, soil, surface water and sediment 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 at the AOPIs are reported in ng/L, or ppt, and soil and sediment data are reported in mg/kg, or ppm.

Field parameters, measured for groundwater during low flow purging and sample collection and for surface water during sample collection, are provided on the field forms in **Appendix L**. Soil and sediment lithological descriptions are provided on the field forms in **Appendix L**. The results of the SI are grouped by AOPI and discussed for each medium as applicable. Groundwater was generally first encountered within 20 feet bgs but was as shallow as 0.5 feet bgs and as deep as 53 feet bgs.

Table 7-5 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Yes/No)
PAAF – Outfall 303	No
PAAF – Building 750	Yes
PAAF – Building 741	Yes
PAAF – Building 734/736 (Nosedock #5)	Yes
PAAF – Building 732	Yes
PAAF – Building 726	Yes
PAAF – Building 724	Yes

AOPI Name	OSD Exceedances (Yes/No)
PAAF – Building 722	Yes
PAAF – Building 712	Yes
PAAF – Building 708 and Retention Pond	Yes
SAAF – Building P7937	Yes
SAAF – Building P8944	Yes
SAAF – Building P9647 and Retention Pond	Yes
SAAF – Building P3807 and Retention Pond	Yes
SAAF – Building P3007	Yes
Fire Station #8	Yes
PAAF – Building 173	Yes
PAAF – Building R-3065	Yes
Crash Site – Green Ramp (PAAF)	Yes
Crash Site – Taxiway M (PAAF)	Yes
Fire Station #1	Yes
Fire Station #2 (SAAF)	Yes
Fire Station #3	Yes
Fire Station #5	Yes
Fire Station #7 and Foam Shed (PAAF)	Yes
Former Fire Training Area #4	Yes
Knox Street Fire Training Pits	Yes
Joint Firefighting Training Area and Retention Pond	Yes
Biosolid Application Area – Honeycutt Road	Yes
Camp Mackall – Fire Station #4[a]	No
Former WWTP	Yes
Sicily Drop Zone – Biosolid application and Crash Site	Yes
Original Fire Station (Building 300 - PAAF)	Yes
Former Fire Station #1	Yes
Former Fire Station #3	Yes
Former Fire Station A	No
Former Fire Station B	Yes
Former Fire Station C	Yes
Hush House (Building 532 – PAAF)	Yes
Fire Station #6	No

AOPI Name	OSD Exceedances (Yes/No)
Fire Response Area – Range 78	No
Fire Response Area – Luzon Drop Zone	No

7.1 PAAF Outfall 303

The subsections below summarize the surface water and sediment PFOS, PFOA, and PFBS analytical results associated with PAAF Outfall 303. Although groundwater sampling was not directly conducted at PAAF Outfall 303, groundwater samples from proximal locations associated with Building 750 are present (SCFS 2016), and the subsections below summarize these proximal groundwater PFOS, PFOA, and PFBS analytical results. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.1.1 Groundwater

Groundwater sampling adjacent to PAAF Outfall 303 was completed on 15 October 2015, at a location to the southeast of the outfall. One groundwater sample was collected from 15 to 19 feet bgs via DPT from the southwest corner of Building 750 near a sewer lift station (Site 3-SB01-GW-019) (**Figure 7-2**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

PFOS (2,900 ng/L) and PFOA (74 ng/L) were detected above the OSD risk screening levels of 40 ng/L in the groundwater sample. PFBS (30 ng/L) was detected, but at a concentration below the OSD risk screening level of 600 ng/L.

7.1.2 Surface Water

Surface water sampling was completed on 06 October 2015. One surface water sample was collected from the effluent catchment of the outfall located north of Building 750. (Site 3-SW-01-001) (**Figure 7-2**). A summary of PFOA, PFOA, and PFBS surface water results is provided in **Table 7-3**. The full suite of analytical results is included in **Appendix F**.

In Site 3-SW-01-001, PFOS (420 J[1] ng/L [440 J ng/L][2]), PFOA (30 J ng/L [30 J ng/L]), and PFBS (20 J ng/L [21 J ng/L]) were detected. Since this outfall does not flow to a surface water feature with an identified drinking water intake within 5-miles and there is no presumed contribution from the outfall to groundwater due to the concrete construction, these data are not compared to the OSD risk screening level.

[1] J qualifier indicates result is less than the level of quantification and greater than or equal to the laboratory level of detection. See data validation in the PFC report in Appendix F for sample specific details.
[2] Duplicate results are included within brackets associated with parent samples.

7.1.3 Sediment

Sediment sampling was completed on 06 October 2015. One sediment sample was collected from the effluent catchment of the outfall located north of Building 750 (Site 3-SD01-001) (**Figure 7-2**). A summary of PFOA, PFOA, and PFBS sediment analytical results is provided in **Table 7-4**. The full suite of analytical results is included in **Appendix F**. In sediment sample Site 3-SD01-001, PFOS (0.00035 mg/kg [0.00045 mg/kg]) was detected, and PFOA and PFBS were not detected.

7.2 PAAF – Building 750

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building 750 at PAAF. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.2.1 Groundwater

Groundwater sampling at Building 750 was completed on 15 October 2015. One groundwater sample was collected from 15-19 feet bgs via DPT from the southwest corner of Building 750 near a sewer lift station (Site 3-SB01-GW-019) (**Figure 7-2**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

PFOS, PFOA and PFBS were detected in the groundwater sample. PFOS (2,900 ng/L) and PFOA (74 ng/L) were detected above the OSD risk screening levels of 40 ng/L. PFBS (30 ng/L) was detected, but below the OSD risk screening level of 600 ng/L.

7.2.2 Soil

In total, three soil samples were collected at Building 750 (**Figure 7-2**). Two shallow soil samples (0 to 0.5 feet bgs interval; Site 3-SB02-SS-001 and Site 3-SB03-SS-001) were collected on 06 October 2015 and were located on the northwest and southwest sides of Building 750. A subsurface soil sample (18.5 to 19.0 feet bgs interval; Site 3-SB01-SBS-019) was collected and collocated with the groundwater sample. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

PFOS was detected in both shallow soil samples at concentrations below residential OSD risk screening level of 0.13 mg/kg: Site 3-SB02-SS-001 (0.0025 mg/kg) and Site 3-SB03-SS-001 (0.00045 mg/kg). PFOA was not detected in either of the two shallow soil samples. PFOS (0.0011 mg/kg) and PFOA (0.00038 mg/kg) were detected in the subsurface soil sample, but not compared to the OSD risk screening level due to depth. PFBS was not detected in any of the soil samples.

7.3 PAAF – Building 741

Groundwater and soil sampling was not directly conducted at Building 741. PFOS, PFOA and/or PFBS exceedance in groundwater is assumed for Building 741 based on the confirmed historical presence of an AFFF suppression system (retrofitted with a high expansion foam suppression system), confirmed historical foam release that might be attributable to Building 741 (SCFS 2015), and the confirmed PFOS

and PFOA impacts to groundwater from proximal sample locations associated with Buildings 750 and 734/736 (SCFS 2016).

The subsection below summarizes the groundwater and PFOS, PFOA, and PFBS analytical results proximal to Building 741 at PAAF. Adjacent soil sampling was not considered. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.3.1 Groundwater

Groundwater sampling adjacent to Building 741 was completed on 15 October 2015, and focused at Building 750 to the southwest and Building 734/736 to the northeast. Groundwater sample Site 3-SB01-GW-019 was collected from 15-19 feet bgs via DPT from the southwest corner of Building 750 near a sewer lift station (**Figure 7-2**) and groundwater sample Site 2-SB04-GW-015 was collected from 11 to 15 feet bgs between Buildings 734/736 to the northeast of Building 741 (**Figure 7-3**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

At Building 750, PFOS (2,900 ng/L) and PFOA (74 ng/L) were detected above the OSD risk screening levels of 40 ng/L. PFBS (30 ng/L) was detected, but below the OSD risk screening level of 600 ng/L. At Buildings 734/736, PFOS (430 ng/L) and PFOA (210 ng/L) were detected at concentrations exceeding the OSD risk screening level. PFBS (110 ng/L) was detected but did not exceed the OSD risk screening level.

7.4 PAAF – Building 734/736 (Nosedock #5)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building 734/736 at PAAF. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFSC (SCFS 2016).

7.4.1 Groundwater

Groundwater sampling at Building 734/736 was completed on 14 October 2015. In total, two groundwater samples were collected with one from the grassy area between Building 734 and 736 (Site 2-SB04-GW-015; screened 11 to 15 feet bgs) and another from the grassy area northeast of Building 734 (Site 2-SB03-GW-019; screened 15 to 19 feet bgs) (**Figure 7-3**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In Site 2-SB04-GW-015, PFOS (430 ng/L) and PFOA (210 ng/L) were detected at concentrations exceeding OSD risk screening levels. PFBS (110 ng/L) was detected but did not exceed OSD risk screening levels. In SB03-GW019, PFOS (3,000 ng/L), PFOA (1,300 ng/L), and PFBS (740 ng/L) were detected above the OSD risk screening levels of 40 ng/L (PFOS and PFOA) and 600 ng/L (PFBS).

7.4.2 Soil

In total, five soil samples were collected along a linear southwest to northeast trending transect located on the southeast side of Buildings 734 and 736 (**Figure 7-3**). These soil samples consisted of two shallow

soil samples and three subsurface samples. The two shallow soil samples (0 to 0.5 feet bgs interval; Site 2-SB03-SS-001 and Site 2-SB04-SS-001) were collected on 06 October 2015. On 14 October 2015, subsurface soil samples, Site 2-SB03-SBS-019, Site 2-SB04-SBS-015, and Site 2-SB05-SBS-013, were collected depths of 18.5 to 19, 14.5 to 15, and 12.5 to13 feet bgs, respectively. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In shallow soil samples Site2-SB03-SS-001 and Site 2-SB04-SS-001, PFOS (0.0018 mg/kg and 0.002 mg/kg) and PFOA (0.00034 mg/kg and 0.00024 mg/kg) were detected at concentrations below the residential soil OSD risk screening level. PFBS was not detected in either shallow soil sample. In subsurface soil samples Site 2-SB04-SBS-015 and Site 2-SB05-SBS-013, PFOS was detected in each of the samples at concentrations below the industrial/commercial soil OSD risk screening level. PFOA was detected in SB03-SBS-015 at a concentration below industrial/commercial soil OSD risk screening levels. PFOS and PFOA were detected in SB03-SBS-019, but not compared with OSD risk screening level due to the depth of the sample. PFBS was not detected in any of the subsurface soil samples collected.

7.5 PAAF – Building 732

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building 732 at PAAF. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.5.1 Groundwater

Groundwater sampling at Building 732 was completed on 14 October 2015. One groundwater sample was collected southwest of Building 732 (Site 2-SB03-GW-019; screened 15 to 19 feet bgs) (**Figure 7-3**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In Site 2-SB03-GW019, PFOS (3,000 ng/L), PFOA (1,300 ng/L), and PFBS (740 ng/L) were detected above the OSD risk screening levels of 40 ng/L (PFOS and PFOA) and 600 ng/L (PFBS).

7.5.2 Soil

In total, two soil samples were collected southwest of Building 732 and collocated with the groundwater sample described above (**Figure 7-3**). These soil samples consisted of one shallow soil sample and one subsurface sample. The shallow soil sample (0 to 0.5 feet bgs interval; Site 2-SB03-SS-001) was collected on 06 October 2015. The subsurface soil sample (18.5 to 19.0 feet bgs interval; Site 2-SB03-SBS-019) was collected on 14 October 2015. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In shallow soil sample Site 2-SB03-SS-001, PFOS (0.0018 mg/kg) and PFOA (0.00034 mg/kg) were detected at concentrations below the residential soil OSD risk screening levels, respectively. PFOS (0.0032 mg/kg) and PFOA (0.00038 mg/kg) were detected in the subsurface soil sample, Site 2-SB03-SBS-019, but not compared to OSD risk screening levels due to the depth of the sample. PFBS was not detected in either soil sample.

7.6 PAAF – Building 726

Groundwater and soil sampling was not directly conducted at Building 726. PFOS, PFOA and/or PFBS exceedance in groundwater is assumed for Building 726 based on the confirmed PFOS and PFOA impacts to groundwater from proximal sample locations associated with Buildings 732 and 724 (SCFS 2016).

The subsection below summarizes the groundwater and PFOS, PFOA, and PFBS analytical results proximal to Building 726 at PAAF. Adjacent soil sampling was not considered. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.3.1 Groundwater

Groundwater sampling adjacent to Building 726 was completed on 14 October 2015, at Buildings 732 (Site 2-SB02-GW019) and 724 (Site 2-SB04-GW015). Both collected groundwater samples yielded detections of PFOS, PFOA, and PFBS. PFOS (3,100 ng/L and 430 ng/L) and PFOA (330 ng/L and 210 ng/L) exceed the tapwater OSD risk screening level. Based on the presumed groundwater flow direction, these exceedances imply that the groundwater associated with Building 726 very likely exceeds the tapwater OSD risk screening level.

7.7 PAAF – Building 724

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building 724 at PAAF. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.7.1 Groundwater

Groundwater sampling at Building 724 was completed on 14 October 2015. One groundwater sample was collected from the grassy area east of Building 724 (Site 2-SB02-GW-019; screened 15 to 19 feet bgs) (**Figure 7-3**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In Site 2-SB02-GW-019, PFOS (3,100 ng/L) and PFOA (330 ng/L) were detected above the OSD risk screening levels of 40 ng/L (PFOS and PFOA). PFBS (170 ng/L) was detected but did not exceed the OSD risk screening level of 600 ng/L.

7.7.2 Soil

In total, two soil samples were collected east of Building 724 and collocated with the groundwater sample described above (**Figure 7-3**). These soil samples consisted of one shallow soil sample and one subsurface sample. The shallow soil sample (0 to 0.5 feet bgs interval; Site 2-SB02-SS-001) was collected on 06 October 2015. The subsurface soil sample (17.5 to 18.0 feet bgs interval; Site 2-SB02-SBS-018) was collected on 14 October 2015. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

For surface soil sample Site 2-SB02-SS-001, PFOS (0.0047 mg/kg) and PFOA (0.00023 mg/kg) were detected at concentrations below the residential soil OSD risk screening levels. For subsurface soil sample Site 2-SB02-SBS-018, PFOS (0.0017 mg/kg) and PFOA (0.0011 mg/kg) were detected. Subsurface samples were not compared with OSD risk screening levels due to the depth of sample. PFBS was not detected in either soil sample.

7.8 PAAF – Building 722

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building 722 at PAAF. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.8.1 Groundwater

Groundwater sampling at Building 722 was completed on 14 and 16 October 2015. Two groundwater samples were collected from the grassy area east of Building 722 (Site 2-SB01-GW-019; screened 15 to 19 feet bgs) and existing well (Site 2-GW-MW4-12) (**Figure 7-3**). An additional groundwater sample was collected from an existing well (Site 2-GW-18M17), approximately 450 feet in the downgradient groundwater flow direction. In addition, the groundwater sample associated with Building 724 and described in **Section 7.7.1** may also be representative of impacts from Building 722. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

PFOS (1,000 ng/L [1,600 ng/L]) and PFOA (100 ng/L [100 ng/L]) were detected above the OSD risk screening levels of 40 ng/L (PFOS and PFOA) in groundwater sample Site 2-SB01-GW-019. PFBS (88 ng/L [91 ng/L]) was also detected in this sample but did not exceed the OSD risk screening level of 600 ng/L. Proximal to Site 2-SB01-GW-019, the sample collected from existing well MW4-12 (Site 2-GW-MW4-12) exhibited PFOS (560 ng/L) and PFOA (92 ng/L) detections above the OSD risk screening level. PFBS (71 ng/L) was also detected in this sample, but at a concentration below the OSD risk screening level. Downgradient, in the groundwater sample collected from existing well 18M17 (Site 2-GW-18M17), PFOS (260 ng/L) and PFOA (100 ng/L) were detected above OSD risk screening level. PFBS (30 ng/L) was again detected but did not exceed OSD risk screening level.

7.8.2 Soil

One shallow soil sample and one subsurface soil sample were collocated with groundwater sample Site 2-SB01-GW-019 (**Figure 7-3**). The shallow soil sample (0 to 0.5 feet bgs interval; Site 2-SB01-SS-001) was collected on 06 October 2015. The subsurface soil sample (18.5 to 19.0 feet bgs interval; Site 2-SB01-SBS-019) was collected on 14 October 2015. Additionally, the Building 724 soil sampling detailed in **Section 7.7.2**, may also be representative of impacts from Building 722 activities. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

PFOS (0.021 mg/kg) and PFOA (0.00016 mg/kg) were detected at concentrations below the residential soil OSD risk screening levels in the shallow soil sample (Site 2-SB01-SS-001). PFOS (0.0015 mg/kg

[0.0015 mg/kg]) and PFOA (0.00016 mg/kg [0.00012 U[3] mg/kg]) were also detected in the subsurface soil sample (Site 2-SB01-SBS-019). The detections in the subsurface soil were not compared to the OSD risk screening levels due to the depth of sampling. PFBS was not detected in either soil sample.

7.9 PAAF – Building 712

Groundwater and soil sampling was not directly conducted at Building 712 (**Figures 7-3** and **7-4**). PFOS, PFOA and/or PFBS exceedance in groundwater is assumed for Building 712 based on the confirmed PFOS and PFOA impacts to groundwater from a proximal sample associated with Building 722 (SCFS 2016). Adjacent soil sampling at Building 722, Site 2-SB01-SS-001 (detailed in **Section 7.8.2**), may also be representative of potential releases from Building 712.

The subsection below summarizes the groundwater PFOS, PFOA, and PFBS analytical results proximal to Building 712 at PAAF. The sample was collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.9.1 Groundwater

The groundwater sample collected from existing well Site 2-GW-MW4-12 associated with Building 722 is proximal to Building 712, as the location of this well potentially represents an area of surface water conveyance from Building 712. The groundwater sample collected from existing well MW4-12 (Site 2-GW-MW4-12) at Building 722 exhibited PFOS (560 ng/L) and PFOA (92 ng/L) detections above the OSD risk screening level. PFBS (71 ng/L) was also detected in this sample, but at a concentration below the OSD risk screening level.

7.10 PAAF – Building 708 and Retention Pond

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building 708 and retention Pond at PAAF. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.10.1 Groundwater

Groundwater sampling at Building 708 was completed on 14 and 16 October 2015. Three groundwater samples were collected from the grassy area north of Building 708 (Site 1-SB01-GW-019, screened 15 to 19 feet bgs; Site 1-SB02-GW-018, screened 14 to 18 feet bgs) and existing well Site 2-GW-323MW01 (**Figure 7-4**). An additional groundwater sample at the associated retention pond was completed on 15 October 2015. Site 1-SB03-GW-012 (screened 8 to 12 feet bgs) was collected from the northwest side of the retention pond. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

PFOS (50 ng/L) and PFOA (75 ng/L) were detected above the OSD risk screening levels of 40 ng/L in groundwater sample Site 1-SB01-GW-019. PFBS (190 ng/L) was also detected in this sample but did not

[3] U qualifier indicates the analyte was not detected at or above the limit of quantitation

exceed the OSD risk screening level of 600 ng/L. PFOS (80 ng/L) and PFOA (62 ng/L) were detected above the OSD risk screening levels of 40 ng/L in groundwater sample Site 1-SB02-GW-018. PFBS (57 ng/L) was also detected in this sample but did not exceed the OSD risk screening level of 600 ng/L. In existing well Site 1- GW-323MW01, PFOS (450 ng/L) and PFOA (430 ng/L) were detected above the OSD risk screening level. PFBS (140 ng/L) was also detected but did not exceed the OSD risk screening level. Near the retention pond, PFOS (1,600 ng/L) and PFOA (150 ng/L) were detected above the OSD risk screening level of 40 ng/L in groundwater sample Site 1-SB03-GW-012. PFBS (30 ng/L) was detected but did not exceed the OSD risk screening level of 600 ng/L in this sample.

7.10.2 Soil

Two soil samples, Site 1-SB01-SBS-019 (18.5-19 ft bgs) and Site 1-SB02-SBS-018 (17.5 to 18 feet bgs) were collected north of Building 708 and collocated with the groundwater samples described above (**Figure 7-4**). These subsurface soil samples were collected on 14 October 2015. An additional subsurface soil sample, Site 1-SB03-SBS-012 (11.5-12 ft bgs) was collected on 15 October 2015 near the retention pond and collected with the retention pond groundwater sample detailed above. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

For Site 1-SB01-SBS-019 and Site 1-SB02-SBS-018, PFOS (0.0004 mg/kg and 0.00077 mg/kg), PFOA (0.00047 mg/kg and 0.00022 mg/kg), and PFBS (0.00047 mg/kg and 0.00044 mg/kg) were detected. The detections in these subsurface soil samples were not compared to the OSD risk screening levels due to the depth of sampling. Near the retention pond, Site 1-SB03-SBS-012, PFOS (0.014 mg/kg), PFOA (0.00048 mg/kg), and PFBS (0.00055 mg/kg) were detected at concentrations below the industrial/commercial soil OSD risk screening level.

7.11 SAAF – Building P7937

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building P7937 at SAAF. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.11.1 Groundwater

Groundwater sampling at Building P7937 was completed on 16 October 2015. Two groundwater samples were collected. One sample was located near the northwest corner of the building (Site 5-SB01-GW-009, screened 5 to 9 feet bgs); the second sample was collected in the parking area on the west side of the building (Site 5-SB02-GW-012, screened 8 to 12 feet bgs) (**Figure 7-5**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

PFOS (2,700 ng/L) and PFOA (220 ng/L) were detected in groundwater sample Site 5-SB01-GW-009 at concentrations exceeding the OSD risk screening level, while PFBS (17 ng/L) was detected at a concentration below the OSD risk screening level. PFOS (72,000 ng/L), PFOA (2,500 ng/L), and PFBS (2,000 ng/L) were detected in groundwater sample Site 5-SB02-GW-012 at concentrations exceeding the OSD risk screening levels.

7.11.2 Soil

Soil sampling at Building P7937 was completed on 6 October and 16 October 2015. One shallow soil sample was collected from near the southeast corner of the building (Site 5-SB03-SS-001; 0 to 0.5 feet bgs). Two subsurface soil samples were collected from the northwest (Site 5-SB01-SBS-009; 8.5 to 9 feet bgs) and west (Site 5-SB02-SBS-012; 11.5-12 feet bgs) of the building, collocated with the groundwater sampling described in the section above (**Figure 7-5**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In the shallow soil (Site 5-SB03-SS-001), PFOS (0.0032 mg/kg) and PFOA (0.0001 mg/kg) were detected but did not exceed residential soil OSD risk screening levels. PFBS was not detected in this shallow soil sample. In the two subsurface soil samples (Site 5-SB01-SBS-009 and Site 5-SB02-SBS-012), PFOS (0.0019 mg/kg and 0.89 mg/kg) and PFOA (0.00023 mg/kg and 0.014 mg/kg) were detected but did not exceed the commercial/industrial soil OSD risk screening levels. PFBS (0.0067 mg/kg) was detected in Site 5-SB02-SBS-012 but did not exceed the industrial/commercial soil OSD risk screening level; PFBS was not detected in Site 5-SB01-SBS-009.

7.12 SAAF – Building P8944

The subsection below summarizes the soil PFOS, PFOA, and PFBS analytical results associated with Building P8944 at SAAF. Groundwater was not directly conducted at Building P8944. PFOS, PFOA and/or PFBS exceedance in groundwater is assumed for Building P8944 based on the confirmed PFOS impacts to groundwater from proximal samples associated with Building P9647 (SCFS 2016). Soil sampling at Building P8944 was conducted in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016). The subsections below summarize the groundwater PFOS, PFOA, and PFBS analytical results proximal to Building P8944 and the analytical results for soil sampling performed at Building P8944.

7.12.1 Groundwater

No direct groundwater sampling was conducted at Building P8944. Two groundwater samples associated with the downgradient Building P9647 were collected on 15-16 October 2015 and may represent, in part, impacts originating from Building P8944. Groundwater sample Site 5-SB06-GW-028 was located near the southern wall of the building and the groundwater sample Site 5-SB05-GW-028 was collected from the southwest corner of the retention pond (**Figure 7-5**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

Only PFOS (17,000 ng/L) was detected in groundwater sample Site 5-SB05-GW-028 and the concentration exceeded the OSD risk screening level. Although PFOA and PFBS were not detected, this sample was analyzed using a high-level analysis protocol that has an elevated calibration range. With the elevated detection limits, the determination of presence or absence of PFOA and PFBS cannot be confirmed. In the groundwater sample collected near the retention pond (Site 5-SB06-GW-028), PFOS (37 ng/L), PFOA (7 ng/L), and PFBS (120 ng/L) were detected at concentrations below the associated OSD risk screening levels.

7.12.2 Soil

Soil sampling at Building P8944 was completed on 6 October and 16 October 2015. Sampling consisted of one shallow soil sample collected from near the northeast corner of the building (Site 5-SB04-SS-001; 0 to 0.5 feet bgs) (**Figure 7-5**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In the shallow soil sample (Site 5-SB04-SS-001), PFOS (0.0012 mg/kg) was detected but did not exceed residential soil OSD risk screening levels. PFOA and PFBS were not detected in the shallow soil sample.

7.13 SAAF – Building P9647 and Retention Pond

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building P9647 and retention pond at SAAF. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.13.1 Groundwater

Groundwater sampling at Building P9647 and retention pond was completed from 15 to 16 October 2015. Two groundwater samples were collected. One sample was located near the southern wall of the building (Site 5-SB06-GW-028, screened 24 to 28 feet bgs); the second sample was collected from the southwest corner of the retention pond (Site 5-SB05-GW-028, screened 24 to 28 feet bgs) (**Figure 7-5**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

Only PFOS (17,000 ng/L) was detected in groundwater sample Site 5-SB05-GW-028 was detected and the concentration exceeded the OSD risk screening level. Although PFOA and PFBS were not detected, this sample was analyzed using a high-level analysis protocol that has an elevated calibration range. With the elevated detection limits, the determination of presence or absence of PFOA and PFBS cannot be confirmed. In the groundwater sample collected near the retention pond (Site 5-SB06-GW-028), PFOS (37 ng/L), PFOA (7 ng/L), and PFBS (120 ng/L) were detected at concentrations below the associated OSD risk screening levels.

7.13.2 Soil

Soil sampling at Building P9647 and retention pond was completed from 15 to 16 October 2015. Two subsurface soil samples were collected from the south of the building, collocated with the groundwater samples detailed above (**Figure 7-5**). One subsurface soil sample was collected near the southern wall of the building (Site 5-SB06-SBS-028; 27.5 to 28 feet bgs) and a second subsurface soil sample was collected south of the retention pond (Site 5-SB05-SBS-028; 27.5 to 28 feet bgs). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In the subsurface soil adjacent to the building (Site 5-SB06-SBS-028), PFOS (0.0058 mg/kg) and PFOA (0.00045 mg/kg) were detected, and in the subsurface soil sample associated with the retention pond (Site 5-SB05-SBS-028), PFOS (0.00067 mg/kg) was detected. The PFOS and PFOA detections were not

compared with OSD risk screening levels due to the sample depths. PFOA was not detected in Site 5-SB05-SBS-028. PFBS was not detected in either soil sample associated with Building P9647 and retention pond.

7.14 SAAF – Building P3007

The subsection below summarizes the soil PFOS, PFOA, and PFBS analytical results associated with Building P3007. Groundwater was not directly conducted at Building P3007. PFOS, PFOA and/or PFBS exceedance in groundwater is assumed for Building P3007 based on the confirmed PFOS and PFOA impacts to groundwater from proximal downgradient samples associated with Building P3807 and retention pond (SCFS 2016). All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016). The subsections below summarize the groundwater PFOS, PFOA, and PFBS analytical results proximal to Building P3007 and the analytical results for soil sampling performed at Building P3007.

7.14.1 Groundwater

No direct groundwater sampling was conducted at Building P3007. Three groundwater samples collected downgradient of P3007 were associated with Building P3807 and retention pond and may represent, in part, impacts originating from Building P3007. Groundwater sampling was completed on 15 October 2015. One sample was located in the parking area west of the Building P3807 (Site 4-SB04-GW-037); the second and third samples were collected from along western and southern edge of the retention pond (Site 4-SB06-GW-034 and Site 4-SB07-GW-032) (**Figure 7-6**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

PFOS, PFOA, and PFBS were detected in groundwater at all three sampling locations. At Site 4-SB04-GW-037, PFOS (110 ng/L) exceeded the OSD risk screening level, while PFOA (25 ng/L) and PFBS (20 ng/L) did not exceed OSD risk screening levels. At Site 4-SB06-GW-034, PFOS (130 ng/L) and PFOA (280 ng/L) exceeded the OSD risk screening level, while PFBS (38 ng/L) did not. At Site 4-SB07-GW-032, PFOS (730 ng/L) exceeded the OSD risk screening level and PFOA (34 ng/L) and PFBS (130 ng/L) did not.

7.14.2 Soil

Soil sampling at Building P3007 was completed on 06 October 2015. One surface soil sample was collected near the northern wall of the building (Site 4-SB01-SS-001; 0 to 0.5 feet bgs) and a second sample was collected near the southern wall of the building (Site 4-SB02-SS-001; 0 to 0.5 feet bgs) (**Figure 7-6**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In the surface soil north of the building (Site 4-SB01-SS-001), PFOS (0.0013 mg/kg) and PFOA (0.00013 mg/kg) were detected but did not exceed residential soil OSD risk screening levels. In the surface soil sample south of the building (Site 4-SB02-SS-001), PFOS (0.00055 mg/kg) was detected but did not exceed the residential soil OSD risk screening levels, and PFOA was not detected. PFBS was not detected in either soil sample associated with Building P3007 and retention pond.

7.15 SAAF – Building P3807 and Retention Pond

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Building P3807 and retention pond at SAAF. All samples were collected in October 2015, as part of the PFC Investigation conducted by SCFS (SCFS 2016).

7.15.1 Groundwater

Groundwater sampling at Building P3807 and retention pond was completed on 15 October 2015. Three groundwater samples were collected. One sample was located in the parking area west of the building (Site 4-SB04-GW-037, screened 33 to 37 feet bgs); the second and third samples were collected from along western and southern edge of the retention pond (Site 4-SB06-GW-034, screened 30 to 34 feet bgs; Site 4-SB07-GW-032, screened 28 to 32 feet bgs) (**Figure 7-6**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

PFOS, PFOA, and PFBS were detected in groundwater at all three sampling locations. At Site 4-SB04-GW-037, PFOS (110 ng/L) exceeded the OSD risk screening level, while PFOA (25 ng/L) and PFBS (20 ng/L) did not exceed OSD risk screening levels. At Site 4-SB06-GW-034, PFOS (130 ng/L) and PFOA (280 ng/L) exceeded the OSD risk screening level, while PFBS (38 ng/L) did not. At Site 4-SB07-GW-032, PFOS (730 ng/L) exceeded the OSD risk screening level and PFOA (34 ng/L) and PFBS (130 ng/L) did not.

7.15.2 Soil

Shallow soil sampling at Building P3807 and retention pond was completed on 06 October 2015 and subsurface sampling was completed on 15 October 2015. Two subsurface soil samples were collected from the north (Site 4-SB03-SS-001; screened from 0 to 0.5 feet bgs) and south (Site 4-SB05-SS-001; screened from 0 to 0.5 feet bgs) of the building (**Figure 7-6**). Subsurface soil samples were collected along the west of Building P3807 (Site 4-SB04-SBS-037, 36.5 to 37 feet bgs) and west and south of the retention pond (Site 4-SB06-SBS-034; 33.5 to 34 feet bgs and Site 4-SB07-SBS-032; 31.5 to 32 feet bgs). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in the PFC report included in **Appendix F** (SCFS 2016).

In the surface soil sample collected from the north of the building, PFOS (0.0029 mg/kg) and PFOA (0.00014 mg/kg) were detected but did not exceed the residential soil OSD risk screening level. In the surface soil collected from the south of the building, PFOS (0.0017 mg/kg) and PFOA (0.00007 mg/kg) were detected but did not exceed the residential soil OSD risk screening level. PFBS was not detected in either of the surface soil samples. From the subsurface samples, only PFOS (0.00041 mg/kg) was detected in Site 4-SB07-SBS-032, otherwise there were no detections. This PFOS detection was not compared to OSD risk screening levels due to the depth of the samples.

7.16 SAAF – Fire Station #8

The subsections below summarize the groundwater PFOS, PFOA, and PFBS analytical results associated with Fire Station 8. All samples were collected in June 2021 by Fort Bragg DPW personnel.

7.16.1 Groundwater

Groundwater sampling at Fire Station #8 involved the sampling of a drinking water well that served the fire station and was completed on 15 to 16 October 2015 (**Figure 7-7**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS (1,100 ng/L) and PFOA (54 ng/L) were detected in the groundwater sample (Fire Station 8) at concentrations exceeding OSD risk screening level. PFBS (56 ng/L) was also detected but did not exceed OSD risk screening level.

7.17 PAAF – Building 173

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with PAAF – Building 173.

7.17.1 Groundwater

Groundwater sampling at Building 173 was completed on 21 January 2020. Two groundwater samples were collected from 9 to 13 feet bgs via DPT from the grassy areas adjacent to the hangar doors of PAAF – Building 173 (FTBR-B173-GW-01 and FTBR-B173-GW-02) (**Figure 7-8**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS and PFOA were detected in both samples. PFOS was detected above the OSD risk screening level of 40 ng/L in both FTBR-B173-GW-01 (190 ng/L) and FTBR-B173-GW-02 (1,600 D[4]J[5] ng/L). PFOA was detected at concentrations above the OSD risk screening level of 40 ng/L in sample FTBR-B173-GW-02 (400 ng/L). PFBS was detected, but below the OSD risk screening level of 600 ng/L in both samples FTBR-B173-GW-01 (19 ng/L) and FTBR-B173-GW-02 (380 ng/L).

7.17.2 Soil

Two shallow soil samples were collected at Building 173 on 21 January 2020, FTBR-B173-SO-01 (0.5 to 2.5 feet bgs) and FTBR-B173-SO-02 (0.5 to 2.5 feet bgs) (**Figure 7-8**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected in FTBR-B173-SO-02, but the concentration (0.014 mg/kg) is below the OSD risk screening level for residential (0.13 mg/kg) and industrial commercial (1.6 mg/kg). PFOA and PFBS were not detected at either sampling location.

[4] D qualifier indicates sample was diluted. See DUSR in **Appendix O** for sample-specific details.
[5] J qualifier indicates result is less than the level of quantification and greater than or equal to the laboratory level of detection. See DUSR in **Appendix O** for sample-specific details.

7.18 PAAF – Building R-3065

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with PAAF – Building R-3065.

7.18.1 Groundwater

Groundwater sampling at Building R-3065 was completed on 21 January 2020. Three in-situ groundwater samples were collected via DPT drilling. One groundwater sample, FTBR-R3065-GW-01 (14 to 18 feet bgs), was collected from a grassy area downgradient of the building. The second groundwater sample, FTBR-R3065-GW-02 (11 to 15 feet bgs) was collected from a grassy area adjacent to the main hangar door. The third groundwater sample, FTBR-R3065-GW-03 (7 to 11 feet bgs), was collected from the grassy area to the east (behind) the hangar (**Figure 7-8**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS and PFOA were detected in all samples. PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-R3065-GW-01 (3,800 DJ-[6] ng/L), FTBR-R3065-GW-02 (920 DJ- ng/L), and FTBR-R3065-GW-03 (2,100 DJ- ng/L). PFOA was detected at concentrations above the OSD risk screening level of 40 ng/L at FTBR-R3065-GW-01 (140 J- ng/L), FTBR-R3065-GW-02 (330 J- ng/L), and FTBR-R3065-GW-03 (370 J- ng/L). PFBS was detected, but below the OSD risk screening level of 600 ng/L in all samples at FTBR-R3065-GW-01 (52 J- ng/L), FTBR-R3065-GW-02 (67 J- ng/L), and FTBR-R3065-GW-03 (130 J- ng/L).

7.18.2 Soil

Three shallow soil samples were collected at Building R-3065 on 21 January 2020: FTBR-R3065-SO-01, FTBR-R3065-SO-02, and FTBR-R3065-SO-03 (all sampled 1 to 3 feet bgs) (**Figure 7-8**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected in all samples at concentrations below the OSD risk screening level for residential (0.13 mg/kg) and industrial commercial (1.6 mg/kg): FTBR-R3065-SO-01 (0.0014 mg/kg), FTBR-R3065-SO-02 (0.005 mg/kg), and FTBR-R3065-SO-03 (0.0057 mg/kg). PFOA was detected in one sample, FTBR-R3065-SO-02 (0.00064 J mg/kg), but below the OSD risk screening levels. PFBS were not detected at either sampling location.

7.19 PAAF – Green Ramp

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with PAAF – Green Ramp.

[6] A suffix of "-" to result qualifier(s) indicates that due to a reported method modification results may be biased low. See DUSR in **Appendix O** for sample-specific details.

7.19.1 Groundwater

Groundwater sampling at the Green Ramp AOPI occurred on 16 to 17 January 2020. One groundwater sample was collected from an existing groundwater monitoring well proximal to and slightly upgradient from the Green Ramp crash site (CR-MW-9-17_011620). A second in-situ groundwater sample was collected via DPT drilling in the downgradient of the surface runoff direction of the Green Ramp crash site (CR-GW-01) (9 to 13 feet bgs) (**Figure 7-9**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS and PFOA were detected in both samples. PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-CR-GW-01 (82 J ng/L) and FTBR-CR-MW-9-17 (760 DJ ng/L). PFOA was not detected at concentrations above the OSD risk screening level of 40 ng/L at FTBR-CR-GW-01 (21 J ng/L) and FTBR-CR-MW-9-17 (19 DJ ng/L). PFBS was detected, but below the OSD risk screening level of 600 ng/L in both samples FTBR-CR-GW-01 (39 J ng/L) and FTBR-CR-MW-9-17 (13 DJ ng/L).

7.19.2 Soil

One shallow soil sample and duplicate was collected at the Green Ramp Crash Site on 17 January 2020: FTBR-CR-SO-01 (1 to 3 feet bgs) (**Figure 7-9**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS, PFOA, and PFBS were not detected in FTBR-CR-SO-01.

7.20 PAAF – Taxiway M

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

7.20.1 Groundwater

Groundwater sampling at Taxiway M was completed on 17 January 2020. One groundwater sample, FTBR-CR-GW-02 (9 to 13 feet bgs), was collected via in-situ sampling via DPT drilling from a low-lying grassy area adjacent to the presumed Taxiway M crash site (**Figure 7-9**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected at FTBR-CR-GW-02 (46 J ng/L) and exceeded the OSD risk screening level of 40 ng/L. PFOA (4.8 J ng/L) was detected but below the OSD risk screening level of 40 ng/L. PFBS was detected, but below the OSD risk screening level of 600 ng/L at FTBR-CR-GW-02 (2.8 J- ng/L).

7.20.2 Soil

One shallow soil sample was collected at the Taxiway M Crash Site on 17 January 2020 (**Figure 7-9**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS (0.14 mg/kg) and PFOA (0.00078 J mg/kg) were detected. PFOS in FTBR-CR-SO-02 (3 to 5 feet bgs) did not exceed the OSD risk screening level for industrial/commercial soil. PFOA did not exceed the OSD risk screening level. PFBS was not detected.

7.21 Fire Station #1 (6-9572)

No samples were collected from within the Fire Station #1 footprint. The sampling design for Fire Station #1 instead was focused immediately downgradient of the AOPI, with sample locations surrounding the Knox Street Fire Training Pits (Fire Training Pits 18) AOPI and included groundwater samples collected from DPT and existing wells, as well as a surface water and sediment sample collected from the adjacent stream. PFOS, PFOA and/or PFBS exceedance in groundwater is assumed for Fire Station #1 based on the confirmed PFOS and PFOA impacts to groundwater in the proximal downgradient samples associated with Knox Street Fire Training Pits. The subsections below summarize the groundwater and surface water/sediment PFOS, PFOA, and PFBS analytical results proximal to Fire Station #1.

7.21.1 Groundwater

Four groundwater samples were collected from the existing wells immediately downgradient of Fire Station #1 on 20 January 2020 at locations associated with the Knox Street Fire Training Pits AOPI: one discreet DPT sample (FTBR-FS1-GW-01) and three from existing monitoring wells (FTBR-FS1-AEHA-2, FTBR-FS1-AEHA-3, and FTBR-FS1-AEHA-4) (**Figure 7-10**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS and PFOA were detected in all samples. PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-FS1-GW-01 (610 J- ng/L) and FTBR-FS1-AEHA- 02 (120 ng/L), but below OSD risk screening levels at FTBR-FS1-AEHA-03 (9.6 ng/L) and FTBR-FS1-AEHA-04 (25 ng/L). PFOA was detected at concentrations above the OSD risk screening level of 40 ng/L at FTBR-FS1-GW-01 (690 J- ng/L) and FTBR-FS1-AEHA- 02 (79 ng/L), but below OSD risk screening levels at FTBR-FS1-AEHA-03 (4.1 ng/L) and FTBR-FS1-AEHA-04 (6.4 ng/L). PFBS was detected, but below the OSD risk screening level of 600 ng/L in all samples FTBR-FS1-GW-01 (200 J- ng/L), FTBR-FS1-AEHA- 02 (25 ng/L), FTBR-FS1-AEHA-03 (3.2 J ng/L) and FTBR-FS1-AEHA-04 (6.2 ng/L).

7.21.2 Surface Water & Sediment

Surface water and sediment sampling was completed on 20 January 2020. One surface water and one sediment sample were collected from the unnamed tributary to the east at a location downgradient of both Fire Station #1 and the Knox Street Fire Training Pits (FTBR-FS1-SW-01 and FTBR-FS1-SE-01) (**Figure 7-10**). A summary of PFOA, PFOA, and PFBS surface water and sediment analytical results is provided in **Tables 7-3** and **7-4**, respectively. The full suite of analytical results is included in **Appendix P**.

In FTBR-FS1-SW-01, PFOS (170 ng/L), PFOA (67 ng/L), and PFBS (17 ng/L) were detected.

In sediment sample FTBR-FS1-SE-01, PFOS (0.00084 mg/kg) was detected, and PFOA and PFBS were not detected.

7.22 SAAF – Fire Station #2

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with SAAF – Fire Station #2. Due to the uncertainty in groundwater flow direction at SAAF and the high PFAS constituent concentrations identified at the hangars and at Fire Station #2, several existing monitoring wells, and a surface water sample from Little Cross Creek (along the western portion of the airfield) were sampled during a second sampling phase to identify immediate risk of potential migration towards the creek and subsequently off-installation.

7.22.1 Groundwater

Groundwater sampling at Fire Station #2 was completed on 16 January 2020. Three groundwater samples were collected via DPT from a downgradient transect at Fire Station #2 at SAAF (FTBR-FS2-GW-01 (20 to 24 feet bgs), FTBR-FS2-GW-02 (19 to 23 feet bgs), and FTBR-FS2-GW-03 (16 to 20 feet bgs)) (**Figure 7-11**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS and PFOA were detected in all samples. PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-FS2-GW-01 (16,000 DJ- ng/L), FTBR-FS2-GW-02 (5,800 DJ- ng/L), and FTBR-FS2-GW-03 (17,000 DJ- ng/L). PFOA was detected at concentrations above the OSD risk screening level of 40 ng/L at FTBR-FS2-GW-01 (530 DJ- ng/L), FTBR-FS2-GW-02 (270 DJ- ng/L), and FTBR-FS2-GW-03 (770 DJ- ng/L). PFBS was detected, but below the OSD risk screening level of 600 ng/L in all samples: FTBR-FS2-GW-01 (230 J- ng/L), FTBR-FS2-GW-02 (100 J- ng/L), and FTBR-FS2-GW-03 (100 J- ng/L).

Three additional groundwater samples were collected along the eastern boundary of SAAF, approximately 0.4 miles southwest of Fire Station #2, approximately 0.5 miles southeast of the northern airfield hangars, and just upgradient of the southern airfield hangars (FTBR-SAF-MW-14S, FTBR-SAF-MW-22, and FTBR-SAF-MW-24S) (**Figure 7-6**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**. There were no exceedances above OSD risk screening levels for PFOS, PFOA, or PFBS. PFOS was detected in FTBR-SAF-MW-22 (32 J ng/L) and FTBR-SAF-MW-24S (3.4 J ng/L). PFOA was detected at FTBR-SAF-MW-14S (2.1 J ng/L) and FTBR-SAF-MW-22 (19 ng/L). PFBS was detected at FTBR-SAF-MW-14S (5.1 ng/L).

7.22.2 Soil

Three shallow soil samples were collected at Fire Station #2 on 16 January 2020: FTBR-FS2-SO-01 (0 to 2 feet bgs), FTBR-FS2-SO-02 (1 to 3 feet bgs), and FTBR-FS2-SO-03 (1 to 3 feet bgs) (**Figure 7-11**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected in FTBR-FS2-SO-01 (0.089 mg/kg), FTBR-FS2-SO-02 (0.017 mg/kg), and FTBR-FS2-SO-03 (0.00085 J mg/kg) but were below the OSD risk screening level for residential (0.13 mg/kg) and industrial commercial (1.6 mg/kg). PFOA and PFBS were not detected.

7.22.3 Surface Water and Sediment

Surface water and sediment sampling associated with Fire Station #2 was completed on 05 November 2020. One surface water and one sediment sample were collected from Little Cross Creek to the south and east of Fire Station #2 and near the point where the creek leaves installation property (FTBR-LCC-SW-01 and FTBR-LCC-SE-01) (**Figure 7-12**). Downstream on Little Cross Creek is the Glenville Reservoir operated by FPWC. A summary of PFOA, PFOA, and PFBS surface water and sediment analytical results is provided in **Tables 7-3** and **7-4**, respectively. The full suite of analytical results is included in **Appendix P**.

PFOS at FTBR-LCC-SW-01 (120 ng/L) was detected above the OSD risk screening level of 40 ng/L. PFOA (13 ng/L) and PFBS (11 ng/L) were detected, but below the OSD risk screening levels of 40 ng/L and 600 ng/L, respectively.

In sediment sample FTBR-LCC-SE-01, PFOS, PFOA, and PFBS were not detected.

7.23 Fire Station #3 (B-7002)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Fire Station #3.

7.23.1 Groundwater

Groundwater sampling at Fire Station #3 was completed on 15 January 2020. One groundwater sample was collected via DPT and downgradient from Fire Station #3 (FTBR-FS3-GW-01 [17 to 20 feet bgs]) (**Figure 7-13**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-FS3-GW-01 (86 J- ng/L). PFOA (8.8 J- ng/L) was detected, but below the OSD risk screening level of 40 ng/L. PFBS (29 J- ng/L) was detected, but below the OSD risk screening level of 600 ng/L.

7.23.2 Soil

Three shallow soil samples were collected at Fire Station #3 on 15 January 2020: FTBR-FS3-SO-01 (1 to 3 feet bgs), FTBR-FS3-SO-02 (0.5 to 2.5 feet bgs), and FTBR-FS3-SO-03 (0.5 to 2.5 feet bgs) (**Figure 7-13**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected at FTBR-FS3-SO-01 and FTBR-FS3-SO-03. PFOS concentrations in FTBR-FS3-SO-01 (0.0006 J mg/kg) and FTBR-FS3-SO-03 (0.06 mg/kg) were below the OSD risk screening level for residential (0.13 mg/kg) and industrial/commercial (1.6 mg/kg). PFOS at FTBR-FS3-SO-02 was not detected. PFOA and PFBS were not detected in any sample.

7.24 Fire Station #5 (E-3673)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Fire Station #5.

7.24.1 Groundwater

Groundwater sampling at Fire Station #5 was completed on 05 November 2020. A single groundwater sample was collected via DPT from a boring advanced in the low-lying area southeast of Fire Station #5 (FS5-GW-01[51-55 feet bgs]) (**Figure 7-14**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-FS5-GW-01 (2,100 DJ ng/L). PFOA (38 DJ ng/L) and PFBS (32 DJ ng/L) were detected, but below the OSD risk screening level of 40 ng/L and 600 ng/L, respectively.

7.24.2 Soil

Three shallow soil samples were collected at Fire Station #5 on 15 January 2020: FTBR-FS5-SO-01 (0.5 to 2.5 feet bgs), FTBR-FS5-SO-02 (0.5 to 2.5 feet bgs), and FTBR-FS5-SO-03 (2 to 4 feet bgs); and a fourth collected on 05 November 2020: FTBR-FS5-SO-04 (0.5 to 2.5 feet bgs) (**Figure 7-14**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected at FTBR-FS5-SO-01 (0.0035 ng/L), FTBR-FS5-SO-03 (0.0071 mg/kg), and FTBR-FS5-SO-04 (0.035 mg/kg), but below the OSD risk screening level for residential (0.13 mg/kg) and industrial commercial (1.6 mg/kg). PFOS at FTBR-FS5-SO-02 was not detected. PFOA and PFBS were not detected in any sample.

7.25 PAAF – Fire Station #7 (R-250) and Foam Shed

The subsections below summarize the groundwater, soil, surface water and sediment PFOS, PFOA, and PFBS analytical results associated with PAAF – Fire Station #7 and Foam Shed.

7.25.1 Groundwater

Groundwater sampling at Fire Station #7 was completed on 21 January 2020. Two groundwater samples were collected via DPT and downgradient from Fire Station #7 and the Foam Shed (FTBR-FS7-GW-01 (9 to 13 feet bgs) and FTBR-FS7-GW-02 (10 to 14 feet bgs)) (**Figure 7-15**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS, and PFOA were detected above the OSD risk screening level of 40 ng/L at FTBR-FS7-GW-01 (180,000 DJ ng/L and 17,000 DJ ng/L, respectively) and FTBR-FS7-GW-02 (55,000 DJ- ng/L and 760 ng/L, respectively). PFBS was detected above the OSD risk screening level of 600 ng/L at FTBR-FS7-GW-01 (30,000 DJ- ng/L) and below OSD risk screening level at FTBR-FS7-GW-02 (310 DJ- ng/L).

7.25.2 Soil

Two shallow soil samples were collected at Fire Station #7 on 21 January 2020: FTBR-FS7-SO-01 and FTBR-FS7-SO-02 (both sampled 1.0 to 3.0 feet bgs) (**Figure 7-15**). A summary of PFOS, PFOA, and

PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected at FTBR-FS7-SO-01 (2 DJ mg/kg) and FTBR-FS7-SO-02 (0.36 DJ mg/kg). Both concentrations exceed the OSD risk screening level for residential (0.13 mg/kg), with one exceeding the industrial commercial OSD risk screening level (1.6 mg/kg). PFOA at FTBR-FS7-SO-01 (0.0032 mg/kg) and FTBR-FS7-SO-02 (0.0025 mg/kg) were detected, but below the residential and industrial/commercial OSD risk screening level. PFBS was not detected in either sample.

7.25.3 Surface Water & Sediment

Surface water and sediment sampling associated with Fire Station #7 was completed on 21 January 2020. One surface water and one sediment sample were collected from Tank Creek near Fire Station #7 and Foam Shed (FTBR-FS7-SW-01 and FTBR-FS7-SE-01) (**Figure 7-15**). The surface water sample was collected on the downstream side of Tank Creek relative to the fire station. Due to the lack of sediment in this area, the sediment sample was taken from the slightly upstream side of Tank Creek relative to the fire station location. A summary of PFOA, PFOA, and PFBS surface water and sediment analytical results is provided in **Tables 7-3** and **7-4**, respectively. The full suite of analytical results is included in **Appendix P**.

PFOS, PFOA, and PFBS at FTBR-FS7-SW-01 (1,200 DJ ng/L, 140 ng/L, and 78 ng/L, respectively) were detected in this surface water sample. In sediment sample FTBR-FS7-SE-01, PFOS (0.0012 mg/kg) was detected. PFOA and PFBS were not detected. These results were not compared to the OSD risk screening levels as this water body is not within 5-miles of a surface water drinking water intake.

7.26 Former Fire Training Area #4

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Former Fire Training Area #4.

7.26.1 Groundwater

Groundwater sampling at Former Fire Training Area #4 was completed on 14 January 2020. One groundwater sample was collected via DPT, downgradient from the original location of the Former Fire Training Area #4 (FT4-GW-01 [5 to 8 feet bgs]) (**Figure 7-16**). The proposed second groundwater sample at this AOPI was not recovered, as there was insufficient water in the installed temporary well. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-FT4-GW-01 (7,400 DJ ng/L [8,100 DJ ng/L] all duplicate results are bracketed). PFOA was detected above the OSD risk screening level of 40 ng/L at FTBR-FT4-GW-01 (1,300 DJ ng/L [1,500 DJ ng/L]). PFBS was detected at FTBR-FT4-GW-01 (160 ng/L [140 ng/L]), but below the OSD risk screening level of 600 ng/L.

7.26.2 Soil

Two shallow soil samples were collected at the Former Fire Training Area #4 on 14 January 2020 (**Figure 7-16**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

There were no detections above the OSD risk screening levels for PFOS, PFOA, or PFBS. PFOS was detected at FTBR-FT4-SO-01 (0.0051 mg/kg) and FTBR-FT4-SO-02 (0.0098 mg/kg). PFOA and PFBS at FTBR-FT4-SO-02 (0.0014 mg/kg and 0.0021 mg/kg, respectively) were detected, but below the OSD risk screening level.

7.27 Knox Street Fire Training Pits

The subsections below summarize the groundwater, soil, surface water, and sediment PFOS, PFOA, and PFBS analytical results associated with the Knox Street Fire Training Pits (Fire Training Pits 18).

7.27.1 Groundwater

Groundwater sampling at the Knox Street Fire Training Pits was completed on 20 January 2020. Four groundwater samples were collected from the following locations associated with the Knox Street Fire Training Pits AOPI: one discreet DPT sample (FTBR-FS1-GW-01 [9 to 13 feet bgs]) and three from existing monitoring wells (FTBR-FS1-AEHA-2 [screened interval from 8.89 to 17.89 feet bgs], FTBR-FS1-AEHA-3 [5.21 to 24.21 feet bgs], and FTBR-FS1-AEHA-4 [4.88 to 23.88 feet bgs]) (**Figure 7-10**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS and PFOA were detected in all samples. PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-FS1-GW-01 (610 J- ng/L) and FTBR-FS1-AEHA- 02 (120 ng/L), but below OSD risk screening levels at FTBR-FS1-AEHA-03 (9.6 ng/L) and FTBR-FS1-AEHA-04 (25 ng/L). PFOA was detected at concentrations above the OSD risk screening level of 40 ng/L at FTBR-FS1-GW-01 (690 J- ng/L) and FTBR-FS1-AEHA- 02 (79 ng/L), but below OSD risk screening levels at FTBR-FS1-AEHA-03 (4.1 ng/L) and FTBR-FS1-AEHA-04 (6.4 ng/L). PFBS was detected, but below the OSD risk screening level of 600 ng/L in all samples FTBR-FS1-GW-01 (200 J- ng/L), FTBR-FS1-AEHA- 02 (25 ng/L), FTBR-FS1-AEHA-03 (3.2 J ng/L) and FTBR-FS1-AEHA-04 (6.2 ng/L).

7.27.2 Soil

One shallow soil sample was collected at the Knox Street Fire Training Pits on 20 January 2020: FTBR-FS1-SO-01 (1 to 3 feet bgs) (**Figure 7-10**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS and PFOA were detected. PFOS and PFOA in FTBR-FS1-SO-01 (0.076 mg/kg and 0.00077 J mg/kg, respectively) were below the OSD risk screening level for residential (0.13 mg/kg) and industrial commercial (1.6 mg/kg). PFBS was not detected.

7.27.3 Surface Water & Sediment

Surface water and sediment sampling was completed on 20 January 2020. One surface water and one sediment sample were collected from the unnamed tributary to the east at a location downgradient of both Fire Station #1 and the Knox Street Fire Training Pits (FTBR-FS1-SW-01 and FTBR-FS1-SE-01) (**Figure 7-10**). A summary of PFOA, PFOA, and PFBS surface water and sediment analytical results is provided in **Tables 7-3** and **7-4**, respectively. The full suite of analytical results is included in **Appendix P**.

In FTBR-FS1-SW-01, PFOS (170 ng/L), PFOA (67 ng/L), and PFBS (17 ng/L) were detected.

In sediment sample FTBR-FS1-SE-01, PFOS (0.00084 mg/kg) was detected, and PFOA and PFBS were not detected.

7.28 Joint Firefighting Training Area and Retention Pond

The subsections below summarize the groundwater, soil, and surface water PFOS, PFOA, and PFBS analytical results associated with JFTA.

7.28.1 Groundwater

Groundwater sampling at JFTA was completed on 23 January 2020. Two samples were collected via placement of temporary wells installed via hand auger (JTFA-GW-01 (0 to 4 feet bgs) and JTFA-GW-02 (0 to 5 feet bgs) and one sample was collected from an existing monitoring well (JTFA-MW-01) at JFTA (**Figure 7-17**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-JFTA-GW-01 (29,000 DJ ng/L), FTBR-JFTA-GW-02 (1,100 DJ- ng/L), and FTBR-JFTA-MW-01 (28,000 DJ ng/L). PFOA was detected above the OSD risk screening level of 40 ng/L at FTBR-JFTA-GW-01 (500 DJ ng/L), FTBR-JFTA-GW-02 (260 J- ng/L), and FTBR-JFTA-MW-01 (1,200 DJ ng/L). PFBS was detected above the OSD risk screening level of 600 ng/L at FTBR-JFTA-GW-01 (1,100 DJ ng/L), FTBR-JFTA-GW-02 (880 DJ- ng/L), and FTBR-JFTA-MW-01 (4,900 DJ ng/L).

7.28.2 Soil

Two shallow soil samples were collected at JFTA on 23 January 2020 (**Figure 7-17**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected at FTBR-JFTA-SO-01 (0.31 DJ mg/kg [0.23 DJ mg/kg]) above the OSD risk screening level for residential (0.13 mg/kg). PFOS was also detected at FTBR-JFTA-SO-02 (0.0023 mg/kg), but below OSD risk screening level. PFOA was detected at FTBR-JFTA-SO-01 (0.00076 J mg/kg [0.00082 J mg/kg]), but below OSD risk screening level. PFBS was not detected in either sample.

7.28.3 Surface Water

Surface water sampling associated with JFTA was completed on 23 January 2020. One surface water sample was collected from retention pond associated with JFTA (FTBR-JFTA-SW-01) (**Figure 7-17**). A

summary of PFOA, PFOA, and PFBS surface water and sediment analytical results is provided in **Tables 7-3** and **7-4**, respectively. The full suite of analytical results is included in **Appendix P**.

PFOS, PFOA, and PFBS at FTBR-JFTA-SW-01 (12,000 DJ ng/L, 550 DJ ng/L, and 480 DJ ng/L, respectively) were detected from standing water within the JFTA retention pond. Since the retention pond is both lined and not connected to a surface water body, these results are not compared to the OSD risk screening levels.

7.29 Honeycutt Road – Biosolid Application Area

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Honeycutt Road – Biosolid Application Area.

7.29.1 Groundwater

Groundwater sampling at the Honeycutt Road biosolid application area was completed on 16 January 2020. Three groundwater samples were collected via DPT across a downgradient transect within the Honeycutt Road – Biosolid Application Area (HC-GW-01 (16 to 20 feet bgs), HC-GW-02 (16 to 20 feet bgs), and HC-GW-03 (15 to 19 feet bgs)) (**Figure 7-18**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-HC-GW-01 (1,400 DJ ng/L), FTBR-HC-GW-02 (340 J- ng/L), and FTBR-HC-GW-03 (550 J ng/L). PFOA was detected above the OSD risk screening level of 40 ng/L at FTBR-HC-GW-02 (120 J ng/L) and FTBR-HC-GW-03 (83 J ng/L). PFOA at FTBR-HC-01 (31 ng/L) was detected but did not exceed the OSD risk screening level. PFBS at FTBR-HC-GW-01 (6.8 ng/L), FTBR-HC-GW-02 (3.3 J ng/L), and FTBR-HC-GW-03 (1.9 J ng/L) were detected but below the OSD risk screening level of 600 ng/L.

7.29.2 Soil

Three shallow soil samples were collected at the Honeycutt Road biosolid application area on 16 January 2020 (**Figure 7-18**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected at FTBR-HC-SO-01 (0.0077 DJ mg/kg), FTBR-HC-SO-02 (0.0025 mg/kg), and FTBR-HC-SO-03 (0.00073 J mg/kg). PFOS was also detected at FTBR-HC-SO-02 (0.00056 J mg/kg). PFBS was not detected in either sample.

7.30 Camp Mackall – Fire Station #4

The subsections below summarize the groundwater PFOS, PFOA, and PFBS analytical results associated with Camp Mackall – Fire Station #4. Based on the personnel interviews, AFFF had never been released at this fire station. Given that the water supply well is installed in the shallow aquifer system (81 feet bgs) and the reported absence of AFFF release, only groundwater was collected, and soil sampling was not considered. The location of the groundwater sample is up and side gradient of the fire

station and, therefore, may not be representative of potential contamination resulting from spills originating at the fire station.

7.30.1 Groundwater

Groundwater sampling at Camp Mackall – Fire Station #4 was completed on 13 January 2020. One groundwater sample was collected from the post-treatment side of the potable water well system at Camp Mackall – Fire Station #4 AOPI (FS4-GW-01) (**Figure 7-19).** The water treatment system consisted of a dilute chlorination delivery system via a peristaltic feed. During sampling, the treatment system was unable to be bypassed to collect a pre-treatment source sample. The location of the groundwater well is side or upgradient from the potential AFFF release point at Fire Station #4. However, since this water system provides drinking water to all the buildings along the southern portion of Camp Mackall, it was important to sample. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS, PFOA, and PFBS were not detected.

7.31 Former Wastewater Treatment Plant

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

7.31.1 Groundwater

Groundwater sampling at the Former WWTP was completed on 14 January 2020. Three groundwater samples were collected via DPT from the Former WWTP AOPI (WWTP-GW-01 (5 to 8 feet bgs), WWTP-GW-02 (11.5 to 14.5 feet bgs), and WWTP-GW-03 (11 to 21 feet bgs) (**Figure 7-20**). The fourth proposed sample from the Former WWTP was not collected due to access restrictions and the determination that this location was not necessary to inform absence/presence at this AOPI. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected above the OSD risk screening level of 40 ng/L at FTBR-WWTP-GW-01 (290 J ng/L), FTBR-WWTP-GW-02 (520 J ng/L), and FTBR-WWTP-GW-03 (290 J- ng/L). PFOA was detected above the OSD risk screening level of 40 ng/L at FTBR-WWTP-GW-01 (70 J ng/L) and FTBR-WWTP-GW-02 (150 J ng/L). PFOA at FTBR-WWTP-03 (33 J- ng/L) did not exceed the OSD risk screening level. PFBS was detected at FTBR-WWTP-GW-01 (15 J ng/L), FTBR-WWTP-GW-02 (15 J ng/L), and FTBR-WWTP-GW-03 (9 J- ng/L) but below the OSD risk screening level of 600 ng/L.

7.31.2 Soil

Three shallow soil samples were collected at the Former WWTP on 14 January 2020 (**Figure 7-20**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected at FTBR-WWTP-SO-01 (0.0079 mg/kg) and FTBR-WWTP-SO-02 (0.00097 J mg/kg), but below OSD risk screening level for residential (0.13 mg/kg) and industrial commercial (1.6 mg/kg).

PFOA was detected at FTBR-WWTP-SO-01 (0.00078 J mg/kg) but below the OSD risk screening level. PFBS was not detected in either sample.

7.31.3 Surface Water and Sediment

Surface water and sediment sampling associated with the Former WWTP was completed on 15 January 2020 and 02 November 2020. One surface water sample was collected from Little River at the former effluent discharge point at the Former WWTP (FTBR-WWTP-SW-01) (**Figure 7-20**). No sediment sample could be collected due to access restrictions (razor wire fencing). During the second phase of sampling in November 2020, an additional surface water and sediment sample was proposed at the confluence of Tank Creek and Little River. Due to restricted access, this sample could not be collected, and an alternative sampling location was utilized. Samples were collected from Tank Creek near the boundary of PAAF (FTBR-WWTP-SW-02 and FTBR-WWTP-SE-02) (**Figure 7-14**). A summary of PFOS, PFOA, and PFBS surface water and sediment analytical results is provided in **Tables 7-3** and **7-4**, respectively. The full suite of analytical results is included in **Appendix P**.

PFOS was detected at FTBR-WWTP-SW-01 (3.8 ng/L [3.9 ng/L]). PFOA and PFBS were not detected at FTBR-WWTP-SW-01. PFOS, PFOA, and PFBS at FTBR-WWTP-SW-02 (540 ng/L [520 J+[7] ng/L], 47 ng/L [49 ng/L], and 31 ng/L [32 ng/L], respectively) were detected.

In sediment sample FTBR-WWTP-SE-02, PFOS (0.00059 J mg/kg [0.00057 mg/kg]) was detected. PFOA and PFBS were not detected. Since these surface water bodies are not within 5-miles of a known surface water intake for potable water supply, these results were not compared to the OSD risk screening levels.

7.32 Sicily Drop Zone

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with SDZ – Biosolid Application Area and Crash Sites.

7.32.1 Groundwater

Groundwater sampling at the SDZ AOPI was completed on 23 January 2020. Four groundwater samples were collected via DPT (FTBR-SDZ-GW-01 [11-15 feet bgs], FTBR-SDZ-GW-02 [16 to 20 feet bgs], FTBR-SDZ-GW-03 [21 to 25 feet bgs], and FTBR-SDZ-GW-04 [36 to 40 feet bgs]) (**Figure 7-21**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS at FTBR-SDZ-GW-01 (3.4 J ng/L [2.9 J ng/L]), FTBR-SDZ-GW-02 (5.6 ng/L), FTBR-SDZ-GW-03 (3.7 ng/L), and FTBR-SDZ-GW-04 (110 J- ng/L) were detected. Only FTBR-SDZ-GW-04 exceeded the OSD risk screening level of 40 ng/L. PFOA was detected at FTBR-SDZ-GW-03 (8.9 ng/L) and FTBR-SDZ-GW-04 (28 J- ng/L) but did not exceed the OSD risk screening level. PFBS at FTBR-SDZ-GW-04 (3.9 J- ng/L) was detected but below the OSD risk screening level of 600 ng/L.

[7] The suffix of "+" to the qualifier indicates the result may be biased high. See DUSR in **Appendix O** for sample-specific details.

7.32.2 Soil

Four shallow soil samples were collected at SDZ on 23 January 2020 (**Figure 7-21**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected at FTBR-SDZ-SO-04 (0.0041 mg/kg) but below OSD risk screening level for residential (0.13 mg/kg) and industrial commercial (1.6 mg/kg). PFOA and PFBS were not detected.

7.33 Original PAAF Fire Station (Building 300)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the potential storage or release of AFFF at the Original PAAF Fire Station (Building 300).

7.33.1 Groundwater

Groundwater sampling at the Original Fire Station at PAAF was completed on 03 November 2020. One groundwater sample was collected via DPT from the grassy area north of the Original Fire Station (Building 300) AOPI (OFS-GW-01 [10 to 14 feet bgs]) (**Figure 7-22**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS (2,000 DJ ng/L) and PFOA (1,200 DJ ng/L) at FTBR-OFS-GW-01 exceeded the OSD risk screening levels of 40 ng/L. PFBS at FTBR-OFS-GW-01 (180 ng/L) was detected below the OSD risk screening level of 600 ng/L.

7.33.2 Soil

A single shallow soil sample was collected at Original Fire Station on 03 November 2020 (**Figure 7-22**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS (0.016 mg/kg) and PFOA (0.00081 J mg/kg) were detected at FTBR-OFS-SO-01 but below OSD risk screening level for residential (0.13 mg/kg) and industrial commercial (1.6 mg/kg). PFBS was not detected.

7.34 Former Fire Station #1

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the potential storage or release of AFFF at the Former Fire Station #1.

7.34.1 Groundwater

Groundwater sampling at Former Fire Station #1 was completed on 3 November 2020. One groundwater sample was collected via DPT from the grassy area north of the paved parking lot that was the previous location of the Former Fire Station #1 AOPI (FFS1-GW-01 [20 to 24 feet bgs]) (**Figure 7-23**). A summary

of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS (320 J- ng/L) at FTBR-FFS1-GW-01 exceeded the OSD risk screening levels of 40 ng/L. PFOA (24 J- ng/L) and PFBS (6.9 J- ng/L) at FTBR-FFS1-GW-01 were detected below the OSD risk screening levels of 40 ng/L and 600 ng/L, respectively.

7.34.2 Soil

A single shallow soil sample was collected at Former Fire Station #1 on 03 November 2020 (**Figure 7-23**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS, PFOA, and PFBS were not detected at FTBR-FFS1-SO-01.

7.35 Former Fire Station #3

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the potential storage or release of AFFF at the Former Fire Station #3.

7.35.1 Groundwater

Groundwater sampling at Former Fire Station #3 was completed on 04 November 2020. One groundwater sample was collected via DPT from the grassy area to the west of the Former Fire Station #3 AOPI building footprint (FFS3-GW-01 [16 to 20 feet bgs]) (**Figure 7-24**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS (79 ng/L [76 ng/L]) at FTBR-FFS3-GW-01 exceeded the OSD risk screening levels of 40 ng/L. PFOA (12 ng/L [13] ng/L) and PFBS (16 ng/L [16 ng/L]) at FTBR-FFS3-GW-01 were detected below the OSD risk screening levels of 40 ng/L and 600 ng/L, respectively.

7.35.2 Soil

A single shallow soil sample was collected at Fire Station #3 on 04 November 2020 (**Figure 7-24**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS (0.063 mg/kg [0.08 mg/kg]) was detected at FTBR-FFS3-SO-01 but does not exceed the OSD screening level for residential (0.13 mg/kg) or industrial/commercial (1.6 mg/kg). PFOA was detected in the duplicate sample (0.00067 J mg/kg), but not in the parent sample. PFBS was not detected at FTBR-FFS3-SO-01.

7.36 WWII Era Fire Stations (A-C)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the potential storage or release of AFFF at the Former WWII Era Fire Stations.

7.36.1 Groundwater

A single boring was advanced via DPT at each of the three Former WWII Era Fire Stations, generally in grassy areas to the north or east of the former building footprints as determined from historical aerial photographs (**Figure 7-25** through **7-27**, for A-C, respectively). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

WWII Era Fire Station A

Groundwater sampling at WWII Era Fire Station A (5 to 9 feet bgs) was completed on 04 November 2020 (**Figure 7-25**). The selected sampling location is not downgradient to the estimated groundwater flow direction at the former fire station, however, there is limited knowledge of the former fire station, and it was assumed that the sampled location near the assumed former fire station engine bay was a potential release area. PFOS (7.2 ng/L), PFOA (26 ng/L), and PFBS (21 J+ ng/L) at FTBR-FFSA-GW-01 were detected below the OSD risk screening levels of 40 ng/L, 40 ng/L, and 600 ng/L, respectively.

WWII Era Fire Station B

Groundwater sampling at WWII Era Fire Station B (26 to 30 feet bgs) was completed on 03 November 2020 (**Figure 7-26**). PFOS (57 J- ng/L) and PFOA (48 J- ng/L) at FTBR-FFSA-GW-01 both exceed the OSD risk screening levels of 40 ng/L. PFBS (22 J- ng/L) was detected below the OSD risk screening level.

WWII Era Fire Station C

Groundwater sampling at WWII Era Fire Station C (21 to 25 feet bgs) was completed on 04 November 2020 (**Figure 7-27**). PFOS (200 X ng/L) and PFOA (80 X ng/L) both exceed the OSD risk screening levels of 40 ng/L. PFBS (26 X ng/L) at FTBR-FFSA-GW-01 was detected below the OSD risk screening levels of 600 ng/L. These data were qualified “X”. As discussed in **Section 6.4.3**, these data are suitable to determine presence, but the concentration is suspect due to matrix interference in the sample. While their use in decision making is questionable, these data will be used for decision making based on the site history as a fire station.

7.36.2 Soil

A single shallow soil sample was collected at each of the three WWII Era Fire Stations A-C from 03 to 04 November 2020 (**Figure 7-25** through **7-27**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical PFAS results is included in **Appendix P**.

PFOS, PFOA, and PFBS were not detected in any sample.

7.37 Hush House (Building 532)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the storage or potential release of AFFF at the Hush House (Building 532). The initially planned approach of sampling the sediment trap on Building 532 was not accomplished as the trap could not be accessed. As a result, a DPT boring was advanced to obtain an in-situ groundwater sample.

7.37.1 Groundwater

Groundwater sampling at the Hush House was completed on 03 November 2020. A single groundwater sample was collected via DPT from a boring advanced in the grassy area to the east of the Hush House (HH-GW-01 [6 to 10 feet bgs]) (**Figure 7-28**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS (1,100 DJ ng/L) and PFOA (60 ng/L) at FTBR-HH-GW-01 exceeded the OSD risk screening levels of 40 ng/L. PFBS (1,100 DJ ng/L) was detected but did not exceed the OSD risk screening level of 600 ng/L. It should be noted that sampling at this AOPI was located approximately 0.5 mile downgradient from the largest groundwater detections at Fire Station #7 and Foam Shed.

7.37.2 Soil

A single shallow soil sample was collected at Hush House on 03 November 2020 (**Figure 7-28**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS (0.00084 J mg/kg) was detected at FTBR-HH-SO-01 but does not exceed the OSD screening level for residential (0.13 mg/kg) or industrial/commercial (1.6 mg/kg). PFOA and PFBS were not detected in FTBR-HH-SO-01.

7.38 Fire Station #6

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Fire Station #6.

7.38.1 Groundwater

Groundwater sampling at Fire Station #6 was completed on 11 January 2022. One groundwater sample was collected via DPT from the grassy ditch to the west and across the street from the fire station (FTBR-FS6-1-GW [20 to 24 feet bgs]) (**Figure 7-29**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFBS was detected in FTBR-FS6-1-GW (4.4 ng/L [4.8 ng/L]), less than the OSD risk screening level of 600 ng/L.PFOS and PFOA were not detected.

7.38.2 Soil

Three shallow soil samples were collected at Fire Station #6 on 11 January 2022 (**Figure 7-29**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS, PFOA, and PFBS were not detected at FTBR-FS6-1-SO. PFOS was detected at FTBR-FS6-2-SO (0.013 mg/kg) and FTBR-FS6-3-SO (0.013 mg/kg [0.013 mg/kg]), at concentrations below the OSD risk screening levels for residential (0.13 mg/kg) and industrial/commercial (1.6 mg/kg) scenarios. PFOA and PFBS were not detected in FTBR-FS6-2-SO or FTBR-FS6-3-SO.

7.39 Fire Response Area – Range 78

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Fire Response Area – Range 78. Soil sampling was conducted in an area that was identified by Fort Bragg Fire Department personnel as the general location of the fire, but they did not know the fire's exact location. As such, the soil sampling locations were selected to triangulate the area around the approximate release area.

Range 78 is an active range, and intrusive activities were limited by Fort Bragg Range Control. Use of a drill rig was prohibited, so groundwater samples could not be collected.

7.39.1 Soil

Three shallow soil samples were collected at Range 78 on 10 January 2022 in the approximate area of the fire (**Figure 7-30**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS, PFOA, and PFBS were not detected in any of the three collected samples.

7.40 Fire Response Area – Luzon Drop Zone

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Fire Response Area at Luzon Drop Zone. Soil sample locations were adjusted based on input from personnel with knowledge of the fire location during the field effort. The groundwater sample location was shifted slightly to align closer to the fire location and slightly downgradient.

7.40.1 Groundwater

Groundwater sampling at Fire Response Area - Luzon Drop Zone was completed on 10 January 2022. One groundwater sample was collected via DPT from a boring advanced in the sandy area to the southeast of the identified fire location (LDZ-GW-01 [41 to 45 feet bgs]) (**Figure 7-31**). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. The full suite of analytical results is included in **Appendix P**.

PFOS, PFOA, and PFBS were not detected in the groundwater sample.

7.40.2 Soil

Three shallow soil samples were collected at Luzon Drop Zone on 10 January 2022 (**Figure 7-31**). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. The full suite of analytical results is included in **Appendix P**.

PFOS was detected in FTBR-LDZ-2-SO (0.0028 mg/kg) and FTBR-LDZ-3-SO (0.0016 mg/kg), at concentrations below the OSD risk screening levels for residential (0.13 mg/kg) and industrial/commercial (1.6 mg/kg) scenarios. PFOS was not detected in FTBR-LDZ-1-SO. PFOA and PFBS were not detected in any of the three samples.

7.41 Investigation Derived Waste

Composite toxicity characteristic leaching procedure samples were collected by medium, for analysis of metals and supplemented by SI results (**Appendix P**). Documentation related to IDW, including laboratory analytical reports and chains of custody, is included as part of **Appendix P** and **L**, respectively. IDW from the initial mobilization consisted of two 55-gallon soil drums and one 55-gallon water drum. This waste was removed from the installation on 20 March 2020 and transported by Covanta Environmental Solutions (PAR000043025) to the designated facility CES-Augusta (GAR000011817) located at 3920 Goshen Industrial Boulevard, Augusta, Georgia 30906. IDW from the second field mobilization consisted of one 55-gallon soil drum and one 55-gallon water drum. The waste from the second mobilization was removed from the installation on 03 February 2021 by EcoFlo, Inc. (NCD980842132) and transported to the designated facility: Cycle Chem, Inc. (PAD067098822) located at 550 Industrial Drive, Lewisberry, Pennsylvania, 17339.

7.42 TOC, pH, and Grain Size

In addition to sampling soil for PFAS, 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 150 to 6,600 mg/kg. The TOC at this installation was lower than typical organic content in soil (topsoil: 5,000 to 30,000 mg/kg, desert: less than 5,000 mg/kg, organic: greater than 120,000 mg/kg). The combined percentage of fines in soils at Fort Bragg ranged from 0.8 to 65.6% with an average of 18.4%. 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 averaged 12.7% and is typical for a clayey loam (Loam [0 to 12%]/clay [0 to 20%]). The pH of the soil was slightly acidic with an average pH of 5.6 (range 4.1 to 9.4). 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 Fort Bragg than in soils with greater percentages of fines and TOC.

7.43 Blank Samples

Detections of PFOS, PFOA, and PFBS constituents are summarized below for QA/QC samples. Most detected concentrations were low-level. Other than those noted below, concentrations of PFOS, PFOA, and PFBS in all other QA/QC samples were not detected.

PFBS was detected in one source blank (SB-01_011720; 1.5 ng/L J). PFOS and PFOA were not detected in this source blank. This source blank was collected from the water tank used as decontamination water for the first week of the field event (14 to 18 January 2020).

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

7.44 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2019b) were re-evaluated and updated, if necessary, based on the SI sampling results. The CSMs presented on **Figures 7-32** through

7-40 and in this section therefore represent the current understanding of the potential for human exposure. For some AOPIs, the CSM is the same and thus shown on the same figure.

Many of the PFAS constituents found in AFFF and metal plating operations are surfactants (which do not volatilize) and are found in a charged or ionic state at environmentally-relevant pH (i.e., pH 5 to 9 standard units). PFOS, PFOA, and PFBS are each negatively charged at environmentally-relevant pH. The media potentially affected by PFOS, PFOA, and 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, hunters, or fisherman 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, 40 of 42 AOPIs were considered to have complete or potentially complete exposure pathways. Although the CSMs indicate a 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 multiple CSMs:

- The AOPIs are not residential or recreational sites and are wholly located within the installation boundaries. Therefore, for the CSMs that include soil as a potential exposure medium, 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.

Figure 7-32 shows the CSM for PAAF Outfall 303 AOPI. This outfall serves as the primary discharge point of surface water conveyance at PAAF. Surface water from PAAF flows through concrete piping to the northwest and through Outfall 303 into a short unnamed tributary that drains to Little River. Therefore, all AFFF releases at PAAF could potentially impact this outfall (SCFS 2016). Additionally, the unnamed tributary adjacent to (east of) Outfall 303 previously was NPDES permitted for discharge from a formerly active remediation system serving Building 742 (FTBR-308). It is unknown if the treated water from this remediation system contained PFOS, PFOA, and PFBS but based on detections in nearby borings the location of this NPDES outfall may be an area of interest for future investigations.

- The PAAF Outfall 303 AOPI was not sampled during the SI, however PFOS, PFOA, and/or PFBS were detected in surface water and sediment samples collected near the outfall location during a prior investigation. Site workers could contact constituents in surface water and sediment via incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation site workers are potentially complete.
- Little River is not used and is not likely to be used in the future for drinking water. However, recreational users could contact constituents in Little River and downstream waterbodies via incidental ingestion and dermal contact (i.e., various water activities such as swimming, boating, and fishing). Therefore, the surface water and sediment exposure pathways for on-installation recreational users and for off-installation receptors are potentially complete.
- It is not expected that residents would contact constituents in on-post waterbodies. Therefore, the surface water and sediment exposure pathways (via incidental ingestion and dermal contact) for on-installation residents are incomplete.
- There is a potential for surface water to recharge shallow groundwater downgradient of the AOPI. There are currently no on-post drinking water wells in proximity to and downgradient of identified AOPIs. 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 flow direction is generally to the north or northwest. Downgradient from PAAF and beyond the installation boundary are several domestic water wells. Therefore, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.

Figure 7-33 shows the CSM for the following 19 AOPIs at PAAF: Buildings 750, 741, 734/736 (Nosedock #5), 732, 726, 724, 722, 712, 708 and Retention Pond, 173, R-3065; Green Ramp Crash Site; Taxiway M Crash Site; Fire Station #7 and Foam Shed; Former Fire Training Area #4; Joint Firefighting Training Area; Former WWTP; Building 300 (Original Fire Station); and Building 532 (Hush House). The potential PFOS, PFOA, and/or PFBS release sources include AFFF fire suppression systems in the various hangars, releases in response to aircraft accidents at the crash sites, releases during firefighter training activities, storage and accidental release at the fire stations and storage areas, and latent PFOS, PFOA, and/or PFBS releases via biosolids at the WWTP.

- PFOS, PFOA, and/or PFBS were either detected in soil, or soil sample results from proximal AOPIs were used to infer the presence of PFOS, PFOA, and PFBS in soil, at these AOPIs. 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 samples collected during the SI or in historical groundwater samples collected during a prior investigation. There are currently no on-post drinking water wells in proximity to and downgradient of identified AOPIs. 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 flow direction is generally to the north or northwest, except for the Former WWTP AOPI where groundwater flow is towards the east. Downgradient from PAAF and beyond the installation boundary are several domestic water wells. Therefore, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.
- General conveyance of surface water runoff south of Tank Creek is towards Tank Creek (tributary of Little River) and north of Tank Creek is generally direct to Little River by way of Outfall 303. PFOS, PFOA, and/or PFBS were detected in surface water and sediment samples collected from Tank Creek and Little River during the SI at the Fire Station #7 and Foam Shed and Former WWTP AOPIs. These sample locations are downgradient of and potentially associated with all the PAAF AOPIs. Site workers who may clean out drainage courses at PAAF could contact constituents in surface water and sediment via incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation site workers are potentially complete.
- Little River is not used and is not likely to be used in the future for drinking water. However, recreational users could constituents in Little River and downstream waterbodies via incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation recreational users and for off-installation receptors are potentially complete.
- It is not expected that residents would contact constituents in on-post waterbodies. Therefore, the surface water and sediment exposure pathways (via incidental ingestion and dermal contact) for on-installation residents are incomplete.

Figure 7-34 shows the CSM for the following six AOPIs at SAAF: Buildings P7937, P8944, P9647, P3807, and P3007; and Fire Station #2. Potential PFOS, PFOA, and/or PFBS release is likely from AFFF fire suppression systems within the hangars and incidental release and storage at the fire station.

- PFOS, PFOA, and/or PFBS were detected in soil at these AOPIs, 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 samples collected during the SI or in historical groundwater samples collected during a prior investigation. There are currently no on-post drinking water wells in proximity to and downgradient of identified AOPIs. 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 flow direction away from SAAF is generally to the south. Downgradient from SAAF and beyond the installation boundary are high density residential properties. Due to the absence of land

use controls preventing potable use of groundwater in this area, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.

- Drainage from the SAAF AOPIs could reach Cross Creek and/or Little Cross Creek and the downgradient Greenville Lake which is used as a backup emergency water supply FPWC. PFOS, PFOA, and/or PFBS were detected in surface water samples from Little Cross Creek, which flows parallel to SAAF. FPWC is the source of potable water for Fort Bragg and off-post communities. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents and for off-installation drinking water receptors are potentially complete.
- Site workers who may clean out drainage courses at SAAF could contact constituents in surface water and sediment via incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation site workers are potentially complete.
- It is not likely that on-installation residents would contact constituents in on-post waterbodies. Therefore, the surface water and sediment exposure pathways (via incidental ingestion and dermal contact) for on-installation residents are incomplete.
- The area to the east of Little Cross Creek on-post is used as hunting grounds. Recreational users could contact constituents in on-post waterbodies and downstream off-post waterbodies through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation recreational users and for off-installation receptors are potentially complete.

Figure 7-35 shows the CSM for six AOPIs: Fire Station #1, Knox Street Fire Training Pits, Fire Station #3, Biosolid Application Area at Honeycutt Road, Former Fire Station #3, and Fire Response Area - Luzon Drop Zone. PFOS, PFOA, and PFBS have been historically stored in volume at Fire Station #1 as AFFF, and AFFF has been historically used/released during firefighter training or response activities.

- PFOS, PFOA, and/or PFBS were detected in soil at these AOPIs, 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 samples collected during the SI. There are currently no on-post drinking water wells in proximity to and downgradient of identified AOPIs. 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 flow direction away from these AOPIs is towards the southeast for Knox Street Fire Training Pits, Biosolid Application Area at Honeycutt Road, and Fire Response Area - Luzon Drop Zone, and towards the north for Fire Station #3 and Former Fire Station #3. Several domestic water wells have been identified in the downgradient off-installation areas. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.
- PFOS, PFOA, and/or PFBS were detected in surface water and sediment samples collected at the Fire Station #1 and Knox Street Fire Training Pits AOPIs. Surface water and sediment samples were not collected at the other AOPIs represented by **Figure 7-35**, however there are nearby surface water bodies to which shallow groundwater may discharge. Surface water courses near these AOPIs or to which shallow groundwater may discharge are not used and are not likely to be used in the future as

a source of drinking water. Site workers may contact constituents in these on-post surface water bodies through incidental ingestion and dermal contact (e.g., during bridge inspections). Therefore, the surface water and sediment exposure pathways for on-installation site workers are potentially complete.

- Residents are unlikely to contact constituents in these on-post surface water bodies. Therefore, the surface water and sediment exposure pathways for on-installation residents are incomplete.
- Recreational users could contact constituents downstream of the receiving surface water body both on- and off-post, through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation recreational users and for off-installation receptors are potentially complete.

Figure 7-36 shows the CSM for four AOPIs: Former Fire Station #1, WWII Era Fire Station A, WWII Era Fire Station B, and WWII Era Fire Station C. These AOPIs likely stored PFOS, PFOA, and/or PFBS in the form of AFFF.

- PFOS, PFOA, and/or PFBS were not detected in soil at these AOPIs. However, the soil exposure pathway for on-installation site workers remains potentially complete because PFOS, PFOA, and/or PFBS were detected in groundwater samples at these AOPIs and the source of PFOS, PFOA, and/or PFBS in the groundwater is unknown.
- PFOS, PFOA, and/or PFBS were detected in groundwater samples collected during the SI. There are currently no on-post drinking water wells in proximity to and downgradient of identified AOPIs. 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 flow direction away from these AOPIs is towards the southeast (Former Fire Station #1, WWII Era Fire Station A and WWII Era Fire Station C) or north (WWII Era Fire Station B). Several domestic water wells have been identified in the downgradient off-installation areas. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.
- Surface water courses near these AOPIs or to which shallow groundwater may discharge are not used and are not likely to be used in the future as a source of drinking water. On-installation site workers and residents are not likely to contact constituents in these on-post surface water bodies through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for these receptors are incomplete.
- Recreational users could contact constituents in the various on-post and downstream receiving surface water bodies through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation recreational users and for off-installation receptors are potentially complete.

Figure 7-37 shows the CSM for Camp Mackall – Fire Station #4 and Fire Response Area - Range 78 AOPIs. PFOS, PFOA, and/or PFBS, in the form of AFFF, is stored at the fire station; no releases or spills of AFFF are noted. Soil samples were not collected at the Camp Mackall – Fire Station #4, and PFOS, PFOA, and PFBS were not detected in groundwater at this AOPI. AR-AFFF was used to extinguish a commercial vehicle fire at the Fire Response Area – Range 78 AOPI. PFOS, PFOA, and PFBS were not detected in soil samples collected at this AOPI. Based on the SI sample results and the fact there are no

documented AFFF releases or spills at the fire station, all potential human exposure pathways at both AOPIs are incomplete.

Figure 7-38 shows the CSM for Fire Station #5 and Fire Station #6 AOPIs. PFOS, PFOA, and/or PFBS, in the form of AFFF, has been stored at this fire station in some volume. Currently, this storage is only on fire engines, but larger volumes may have been stored in the past.

- 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 samples collected during the SI. There are currently no on-post drinking water wells in proximity to and downgradient of identified AOPIs. 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 flow direction away from Fire Station #5 is towards the east-southeast, and flow direction away from Fire Station #6 is towards the south. Several domestic water wells have been identified in the off-installation area downgradient to the west of Beaver Creek Pond. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.
- There are no surface water courses near Fire Station #5 AOPI. Shallow groundwater discharge to downgradient surface water is unlikely due to the distance to the nearest surface water. Therefore, all surface water and sediment exposure pathways are incomplete.

Figure 7-39 shows the CSM for Sicily Drop Zone (Biosolid Application Area and Crash Site) AOPI. AFFF has been deployed historically during emergency response to aircraft accidents. It was reported that biosolids from the Former WWTP were used in the past for regrading activities at the dirt airfield.

- 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 samples collected during the SI. There are currently no on-post drinking water wells in proximity to and downgradient of identified AOPIs. 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 flow from this AOPI is towards the northeast. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.
- Surface water runoff drains to Jumping Run Creek, a tributary of Little River. Little River is not used and is not likely to be used in the future for drinking water. It is not expected that site workers or residents would contact constituents in these on-post waterbodies. Therefore, the surface water and sediment exposure pathways (via incidental ingestion and dermal contact) for on-installation site workers and residents are incomplete.

- Recreational users could constituents in Little River and downstream waterbodies via incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation recreational users and for off-installation receptors are potentially complete.

Figure 7-40 shows the CSM for Fire Station #8. This AOPI likely stored PFOS, PFOA, and/or PFBS in the form of AFFF.

- Soil samples were not collected at this AOPI. However, the soil exposure pathway for on-installation site workers is potentially complete because PFOS, PFOA, and/or PFBS were detected in groundwater samples at the AOPI and the source of PFOS, PFOA, and/or PFBS in the groundwater is unknown.
- PFOS, PFOA, and/or PFBS were detected in groundwater samples collected from the Fire Station #8 well by the installation. The Fire Station #8 well is no longer used for drinking water. There are currently no on-post drinking water wells in proximity to and downgradient of identified AOPIs. 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 flow direction away from this AOPI is towards the southeast. Based on this presumed groundwater flow direction, impacted groundwater is anticipated to remain within the boundaries of the installation and specifically within the operational range. Therefore, the groundwater exposure pathway for off-installation drinking water receptors is considered to be incomplete.
- Surface water courses near these AOPIs or to which shallow groundwater may discharge are not used and are not likely to be used in the future as a source of drinking water. On-installation site workers and residents are not likely to contact constituents in these on-post surface water bodies through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for these receptors are incomplete.
- Recreational users could contact constituents in the various on-post and downstream receiving surface water bodies through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation recreational users are potentially complete.
- Due to the distance the surface water would have to flow in order to reach off-post surface water (in excess of 7 miles by stream), the surface water and sediment exposure pathways for off-installation recreational users are incomplete.

8 OFF-POST PRIVATE POTABLE WELL INVESTIGATION

Based on SI sampling results, off-post private potable wells were identified for potential sampling as part of the PA/SI investigation at Fort Bragg to determine whether there are off-post impacts to drinking water due to Army operations. These wells are downgradient of groundwater wells along the northern (all PAAF AOPIs) and southern installation (all SAAF AOPIs) boundaries where PFOS, PFOA, and/or PFBS concentrations were detected at concentrations greater than the USEPA lifetime health advisory. To identify potential potable wells that were downgradient of the northern and southern installation boundary to include in this sampling effort, an off-post well survey was completed using readily available information from online sources (NC OneMap 2020). County records were also 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. After reviewing the available information related to groundwater flow direction for the areas, numerous off-post private potable wells were identified for possible sampling as part of this investigation based on the understanding of the relationship between on- and off-post hydrogeological conditions. Community outreach and notification will be coordinated between the Army PA/SI team, Fort Bragg, Headquarters of the Department of the Army, and USAEC Divisions to sample private potable wells located immediately downgradient of the installation boundary. A letter report presenting a summary of the off-post private well investigation results and the associated laboratory reports will be included in a subsequent addendum (when available).

9 CONCLUSIONS AND RECOMMENDATIONS

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

OSD provided residential risk screening levels based on the USEPA oral reference dose for PFOS, PFOA, and PFBS in soil and groundwater (tap water) and industrial/commercial risk screening levels for PFOS, PFOA, and PFBS in soil (**Appendix A**). A combination of document review, internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFOS, PFOA, and PFBS use, storage, and/or disposal at Fort Bragg. Following the evaluation, 39 AOPIs were identified.

Fort Bragg has 14 drinking water supply wells located throughout the main cantonment and operational range area, and one at Camp Mackall (**Figure 2-2** and **5-20**). Drinking water supply wells are screened in deeper aquifers at depths ranging 50 to 210 feet bgs (average of approximately 120 feet bgs). Eleven wells were sampled in 2016, a subset of these wells was sampled again in 2019, 2020, and 2021 (including a twelfth well at Fire Station #8). Results of this sampling identified three wells with low-level detections of PFOA and in some cases of PFOS at Pre-Ranger, Range 74, and Eureka Springs as these locations are far removed from identified AOPIs there is no clear source for these impacts. The groundwater sample collected from one well, associated with Fire Station #8, contained PFOS at a concentration that exceeds the OSD risk screening level of 40 ng/L.

Twenty-six of the 42 AOPIs were sampled during the SI at Fort Bragg to identify presence or absence of PFOS, PFOA, and PFBS at each AOPI. The SI scope of work was completed in accordance with the PQAPP (Arcadis 2019a) and the QAPP Addendum (Arcadis 2019b). Of the remaining 16 AOPIs, 14 were directly sampled during the 2016 PFC investigation, one (Building 712) is a hangar with a suppression system situated between two sampled buildings with confirmed PFOS, PFOA, and/or PFBS in the groundwater (SCFS 2016), and data for the last was based on sampling of a potable water well adjacent to the AOPI (Fire Station #8) that was performed by Fort Bragg personnel.

Forty AOPIs had detections of PFOS, PFOA, and PFBS in soil, groundwater, surface water, and/or sediment and 37 AOPIs exceeded OSD risk screening levels in one or more sampled media. The maximum concentration of PFAS constituents identified in groundwater was 180,000 ng/L (PFOS) at Fire Station #7 that serves PAAF. The maximum concentration of PFAS constituents identified in soil was 2.0 mg/kg (PFOS) at Fire Station #7. Surface water was collected at six locations that geographically constrains all AOPIs with to potential to impact off-post surface water features. The maximum concentration of PFAS constituents identified in surface water was 12,000 ng/L (PFOS) at JFTA, which was collected from a lined retention pond. The highest concentration of PFAS constituents identified from non-retention pond sampling was 1,200 ng/L (PFOS) collected from Tank Creek and associated with Fire Station #7.

Following the SI sampling, 40 of the 42 AOPIs with confirmed PFOS, PFOA, and/or PFBS presence were considered to have complete or potentially complete exposure pathways. Soil exposure pathways for on-installation site workers are complete at 35 AOPIs and potentially complete at four AOPIs. At Fire Station

#8, the associated drinking water well has been removed from service, and aside from Fire Station #8, there are currently no on-post drinking water wells proximal to identified AOPIs. Therefore, the groundwater exposure pathways for on-installation drinking water receptors are potentially complete to account for potential future use of the on-post groundwater downgradient of 40 AOPIs. The surface water exposure pathways for on-installation drinking water receptors are potentially complete at the six SAAF AOPIs where runoff and groundwater drainage could reach (via Little Cross Creek which flows parallel to SAAF) the downgradient Greenville Lake which is used as a backup emergency water supply for FPWC. Due to the absence of land use controls preventing potable use of off-post groundwater, the groundwater exposure pathways for off-installation drinking water receptors are potentially complete at 39 AOPIs. Finally, surface water and sediment exposure pathways are potentially complete for on-installation site workers at 33 AOPIs and for on- and/or off-installation recreational users at 38 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 Fort Bragg, PFOS, PFOA, and PFBS sampling and recommendations for each AOPI; further investigation is warranted at Fort Bragg. In accordance with CERCLA, site-specific risk will be assessed during a future phase to evaluate whether remedial actions are required. For Former Fire Station A, supplemental groundwater sampling is recommended based on the detections of PFOS, PFOA, and PFBS in groundwater collected in a suspected AFFF runoff location, indicating the potential for concentrations of PFOS, PFOA, and/or PFBS exceeding OSD risk screening levels downgradient.

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

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes, No, ND, NS)				Recommendation
	GW	SO	SW	SE	
PAAF – Outfall 303	Yes [a]	NS	NA*	NA*	Further study in Remedial Investigation
PAAF – Building 750	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 741	Yes [a]	NS	NS	NS	Further study in Remedial Investigation
PAAF – Building 734/736 (Nosedock #5)	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 732	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 726	Yes [a]	NS	NS	NS	Further study in Remedial Investigation
PAAF – Building 724	Yes*	No*	NS	NS	Further study in Remedial Investigation

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes, No, ND, NS)				Recommendation
	GW	SO	SW	SE	
PAAF – Building 722	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 712	Yes*	No*	NS	NS	Further study in Remedial Investigation
PAAF – Building 708 & Retention Pond	Yes*	No*	NS	NS	Further study in Remedial Investigation
SAAF – Building P7937	Yes*	No*	NS	NS	Further study in Remedial Investigation
SAAF – Building P8944	Yes [a]	No*	NS	NS	Further study in Remedial Investigation
SAAF – Building P9647 and Retention Pond	Yes*	No*	NS	NS	Further study in Remedial Investigation
SAAF – Building P3807 and Retention Pond	Yes*	No*	NS	NS	Further study in Remedial Investigation
SAAF – Building P3007	Yes [a]	No*	NS	NS	Further study in Remedial Investigation
Fire Station #8	Yes*	NS	NS	NS	Further study in Remedial Investigation
PAAF – Building 173	Yes	No	NS	NS	Further study in Remedial Investigation
PAAF – Building R-3065	Yes	No	NS	NS	Further study in Remedial Investigation
Crash Site – Green Ramp (PAAF)	Yes	No	NS	NS	Further study in Remedial Investigation
Crash Site – Taxiway M (PAAF)	Yes	Yes	NS	NS	Further study in Remedial Investigation
Fire Station #1 [a]	Yes	NS	NA	NA	Further study in Remedial Investigation
Fire Station #2 (SAAF)	Yes	No	Yes	NA	Further study in Remedial Investigation
Fire Station #3	Yes	No	NS	NS	Further study in Remedial Investigation
Fire Station #5	Yes	No	NS	NS	Further study in Remedial Investigation
Fire Station #7 & Foam Shed (PAAF)	Yes	Yes	NA	NA	Further study in Remedial Investigation
Former Fire Training Area #4	Yes	No	NS	NS	Further study in Remedial Investigation

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes, No, ND, NS)				Recommendation
	GW	SO	SW	SE	
Knox Street Fire Training Pits	Yes	No	NA	NA	Further study in Remedial Investigation
Joint Firefighting Training Area and Retention Pond	Yes	Yes	NA	NS	Further study in Remedial Investigation
Biosolid Application Area – Honeycutt Road	Yes	No	NS	NS	Further study in Remedial Investigation
Camp Mackall – Fire Station #4[b]	No	NS	NS	NS	No action at this time
Former WWTP	Yes	No	NA	NA	Further study in Remedial Investigation
Sicily Drop Zone – Biosolid application and Crash Site	Yes	No	NS	NS	Further study in Remedial Investigation
Original Fire Station (Building 300 - PAAF)	Yes	No	NS	NS	Further study in Remedial Investigation
Former Fire Station #1	Yes	No	NS	NS	Further study in Remedial Investigation
Former Fire Station #3	Yes	No	NS	NS	Further study in Remedial Investigation
Former Fire Station A[c]	No	No	NS	NS	Supplemental Groundwater Sampling[d]
Former Fire Station B	Yes	No	NS	NS	Further study in Remedial Investigation
Former Fire Station C	Yes	No	NS	NS	Further study in Remedial Investigation
Hush House (Building 532 – PAAF)	Yes	No	NS	NS	Further study in Remedial Investigation
Fire Station #6	No	No	NS	NS	No action at this time
Fire Response Area – Range 78	NS	No	NS	NS	No action at this time
Fire Response Area – Luzon Drop Zone	No	No	NS	NS	No action at this time

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
NA – not applicable
ND – non-detect
NS – not sampled
SE – sediment
SO – soil

SW – surface water
[a] – The AOPI was not directly sampled; however, sampling conducted at proximal locations where exceedances could be potentially attributed to the AOPI were used to support the decision to recommend further study in a remedial investigation.
[b] – The sample at Camp Mackall was collected from the drinking water system located up and side gradient of Fire Station #4 and, therefore, may not be representative of potential contamination resulting from spills originating at the fire station. However, based on sampling conducted by Fort Bragg and during this PA/SI the drinking water system serving Fire Station #4 and other buildings along the southern portion of Camp Mackall is not impacted by PFAS constituents.
[c] – The sample location at Former Fire Station A was collected from an area upgradient of the potential source and, therefore, may not provide necessary information to exclude the site from further investigation. However, the groundwater flow direction is approximated based on regional groundwater flow and does not account for local groundwater flow variation
[d] – Due to the potential for downgradient PFOS, PFOA, and/or PFBS exceedances of OSD risk screening levels, supplemental groundwater sampling is recommended for this AOPI.
* - Indicates that sampling was conducted prior to or outside the scope of the current SI.

Data collected during the PA (**Sections 3** through **Section 5**) and SI (**Section 6** through **Section 8**) were sufficient to draw the conclusions summarized above. The data limitations relevant to the development of this PA/SI for PFOS, PFOA, and PFBS at Fort Bragg 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.

A comprehensive well survey was not completed as part of the PA; therefore, the information reviewed regarding off-post wells is limited to what is contained in the EDR well search results (**Appendix E**) and other well records found within the Public Water Supply Water Sources feature layer in North Carolina OneMap online GIS application (NC OneMap) supported by the North Carolina Department of Environment and Natural Resources, Division of Water Resources, Public Water Supply Section (NC OneMap 2020). Many of the wells identified through NC OneMap were also identified in the EDR well search, however, there were many wells identified in the EDR well search that were not corroborated by the NC OneMap. The EDR well search report (**Appendix E**) was referenced when identifying potential off-post drinking water receptors.

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.

Several emergency response reports (fire reports) were provided by the Fort Bragg Fire Department. AFFF use was not required to be reported until 2016, therefore the use of foam cannot be confirmed for most of these reported emergency responses. The fire reports provided were recognized by fire department personnel as having the potential for AFFF use. A thorough review of the provided reports was completed and two AOPIs were identified. These AOPIs (Fire Response Area -Range 78 and Fire

Response Area - Luzon Drop Zone) were sampled during a third field mobilization in January 2022. Additional instances of AFFF use in these fire reports were determined to be off-installation. Based on the fire response reports reviewed and the understanding that AFFF use was not mandated as reportable until 2016, only fire reports from 2016 to present were reviewed.

Finally, the available PFOS, PFOA, and PFBS analytical data is limited to the shallow aquifer system. Most wells on- and off-installation are not screened within the shallow aquifer system. Additionally, the available data is limited to a select list of PFAS compounds (**Table 6.2**) which were analyzed per the selected analytical method. The sampling scope of the SI focused on identifying presence or absence of PFOS, PFOA, and PFBS at the AOPIs. SI sampling at locations at or in proximity of the AOPIs did not delineate the extent of PFOS, PFOA, and PFBS impacts or identify the primary migration pathways for the chemicals. Available data, including PFOS, PFOA, and PFBS, is listed in **Appendix P**, which were analyzed per the selected analytical method.

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

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ACRONYMS

°F	degrees Fahrenheit
%	percent
AFFF	aqueous film-forming foam
amsl	above mean sea level
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	United States Army
ASN	Aviation Safety Network
ATF	Aberdeen Training Facility
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
DPW	Directorate of Public Works
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
Fort Bragg	United States Army Garrison Fort Bragg
FPWC	Fayetteville Public Works Commission
GIS	geographic information system
GW	groundwater
HDPE	high-density polyethylene
HI-EX	high expansion
IDW	investigation-derived waste
IMCOM	Installation Management Command
installation	United States Army and Reserve installation

IRP	Installation Restoration Program
JFTA	Joint Firefighting Training Area
LOD	limit of detection
LOQ	limit of quantitation
JSOC	Joint Special Operations Command
LUC	land use control
mg/kg	milligram per kilogram
NA	not applicable
ND	non-detect
NFA	No Further Action
NPDES	National Pollutant Discharge Elimination System
NCDEQ	North Carolina Department of Environmental Quality
NC OneMap	North Carolina OneMap online GIS application
ng/L	nanogram per liter (parts per trillion)
NS	not samples
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PAAF	Pope Army Airfield
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFC	perfluorinated chemicals
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	parts per million
ppt	parts per trillion
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual

RSL	Regional Screening Level
SAAF	Simmons Army Airfield
SCFS	SES Construction and Fuel Services, LLC
SDZ	Sicily Drop Zone
SE	sediment
SI	site inspection
SO	soil
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
SW	surface water
SWMU	solid waste management unit
TGI	technical guidance instruction
TOC	total organic carbon
UCMR3	third Unregulated Contaminant Monitoring Rule
U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States. Army Environmental Command
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WWII	World War II
WWTP	wastewater treatment plant

TABLES

Table 6-1 - Monitoring Well Construction Details
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Bragg, North Carolina

Area of Potential Interest	Sampling Location ID	Matrix	Sample Method	Total Well Depth (from TOC)	Screened Interval	Casing Diameter	Dedicated Bladder Pump
				(ft bgs)	(ft bgs)	(inches)	(Y/N)
Green Ramp Crash Site	FTBR-MW9-17-GW [Existing MW]	Groundwater	Grab	39	28.1 - 38.1	2	N
Fire Station 1 & Knox Street Firefighter Training Pits	FS1-AEHA-2-GW [Existing MW]	Groundwater	Grab	NA	8.89 - 17.89	2	N
	FS1-AEHA-3-GW [Existing MW]	Groundwater	Grab	NA	5.21 - 24.21	2	N
	FS1-AEHA-4-GW [Existing MW]	Groundwater	Grab	NA	4.88 0- 23.88	2	N
Camp MacKall Fire Station 4	FS4-GW-01 [Well #1][1]	Groundwater	Grab	81	NA	NA	N
Joint Fire Training Area	JFTA-MW-01-GW [Existing MW]	Groundwater	Grab	13.5	NA	2	N
SAAF - West of Hangar Line	SAF-MW-14S [Existing MW]	Groundwater	Grab	27	15.5 - 25	2	N
	SAF-MW-22 [Existing MW]	Groundwater	Grab	27.3	17 - 27	2	N
	SAF-MW-24S [Existing MW]	Groundwater	Grab	37	13 - 23	2	N

Notes:
1. Water supply well at Fire Station 4 was sampled via spigot. Depth to water could not be measured.

Acronyms/Abreviations:
amsl - above mean sea level
bgs - below ground surface
ft - feet
GS - ground surface
ID - identification
MP - measuring point
N - no
NA - not available
NM - not measured (not surveyed)
SAAF - Simmons Army Airfield
TOC - top of casing
Y - yes

Table 7-1 - Groundwater PFOS, PFOA, and PFBS Analytical Results
USACE PFAS Premliminary Assessment/Site Inspection
Fort Bragg, North Carolina

AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
			OSD Tapwater HQ=0.1		40		40		600	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Building 173 (PAAF)	B173-GW-01	B173-GW-01_012120	01/21/2020	N	**190**		**13**		**19**	
	B173-GW-02	B173-GW-02_012120	01/21/2020	N	**1,600**	DJ	**400**		**380**	
Building R3065 (PAAF)	R3065-GW-01	R3065-GW-01_012120	01/21/2020	N	**3,800**	DJ-	**140**	J-	**52**	J-
	R3065-GW-02	R3065-GW-02_012120	01/21/2020	N	**920**	DJ-	**330**	J-	**67**	J-
	R3065-GW-03	R3065-GW-03_012120	01/21/2020	N	**2,100**	DJ-	**370**	J-	**130**	J-
Green Ramp Crash Sites	CR-GW-01	CR-GW-01_011720	01/17/2020	N	**82**	J	**21**	J	**39**	J
	CR-MW-9-17	CR-MW-9-17_011620	01/16/2020	N	**760**	DJ	**19**		**13**	
Taxiway M Crash Sites	CR-GW-02	CR-GW-02_011720	01/17/2020	N	**46**	J	**4.8**	J	**2.8**	J
Fire Station 1 & Knox FTP	FS1-AEHA4-2	FS1-AEHA4-2_012020	01/20/2020	N	**120**		**79**		**25**	
	FS1-AEHA4-3	FS1-AEHA4-3_012020	01/20/2020	N	**9.6**		**4.1**		**3.2**	J
	FS1-AEHA4-4	FS1-AEHA4-4_012220	01/22/2020	N	**25**		**6.4**		**6.2**	
	FS1-GW-01	FS1-GW-01_012020	01/20/2020	N	**610**	J-	**690**	J-	**200**	J-
Fire Station 2 (SAAF)	FS2-GW-01	FS2-GW-01_011620	01/16/2020	N	**16,000**	DJ-	**530**	J-	**230**	J-
	FS2-GW-02	FS2-GW-02_011620	01/16/2020	N	**5,800**	DJ-	**270**	J-	**100**	J-
	FS2-GW-03	FS2-GW-03_011620	01/16/2020	N	**17,000**	DJ-	**770**	J-	**100**	J-
Fire Station 3	FS3-GW-01	FS3-GW-01_011520	01/15/2020	N	**86**	J-	**8.8**	J-	**29**	J-
Fire Station 5	FS5-GW-01	FS5-GW-01-110520	11/05/2020	N	**2,100**	DJ	**38**	DJ	**32**	DJ
Fire Station 7/8 & Foam Storage Shed (PAAF)	FS7-GW-01	FS7-GW-01_012120	01/21/2020	N	**180,000**	DJ	**17,000**	DJ	**30,000**	DJ
	FS7-GW-02	FS7-GW-02_012120	01/21/2020	N	**55,000**	DJ-	**760**	DJ-	**310**	DJ-
FT001 (FTA#4)	FT4-GW-01	DUP-01_011420 / FT4-GW-01_011420	01/14/2020	FD	**8,100**	DJ	**1,500**	DJ	**140**	
		FT4-GW-01_011420	01/14/2020	N	**7,400**	DJ	**1,300**	DJ	**160**	
Joint Firefighting Training Area	JFTA-GW-01	JFTA-GW-01_012320	01/23/2020	N	**29,000**	DJ	**500**	DJ	**1,100**	DJ
	JFTA-GW-02	JFTA-GW-02_012320	01/23/2020	N	**1,100**	DJ-	**260**	J-	**880**	DJ-
	JFTA-MW-01	JFTA-MW-01_012020	01/20/2020	N	**28,000**	DJ	**1,200**	DJ	**4,900**	DJ
Biosolid Application Area: Honeycutt Road	HC-GW-01	HC-GW-01_011620	01/16/2020	N	**1,400**	DJ	**31**		**6.8**	
	HC-GW-02	HC-GW-02_011620	01/16/2020	N	**340**	J	**120**	J	**3.3**	J
	HC-GW-03	HC-GW-03_011620	01/16/2020	N	**550**	J	**83**	J	**1.9**	J
Fire Station 4 (Camp Mackall)	FS4-GW-01	FS4-GW-01_011320	01/13/2020	N	3.6	U	3.6	U	3.6	U
former Wastewater Treatment Plant	WWTP-GW-01	WWTP-GW-01_011420	01/14/2020	N	**290**	J	**70**	J	**15**	J
	WWTP-GW-02	WWTP-GW-02_011420	01/14/2020	N	**520**	J	**150**	J	**15**	J
	WWTP-GW-03	WWTP-GW-03_011520	01/15/2020	N	**290**	J-	**33**	J-	**9.0**	J-

Table 7-1 - Groundwater PFOS, PFOA, and PFBS Analytical Results
USACE PFAS Premliminary Assessment/Site Inspection
Fort Bragg, North Carolina

AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
			OSD Tapwater HQ=0.1		40		40		600	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Sicily Drop Zone	SDZ-GW-01	DUP-2_012320-1 / SDZ-GW-01_012320	01/23/2020	FD	**2.9**	J	3.4	U	3.4	U
		SDZ-GW-01_012320	01/23/2020	N	**3.4**	J	3.6	U	3.6	U
	SDZ-GW-02	SDZ-GW-02_012320	01/23/2020	N	**5.6**		3.5	U	3.5	U
	SDZ-GW-03	SDZ-GW-03_012320	01/23/2020	N	**3.7**		**8.9**		3.5	U
	SDZ-GW-04	SDZ-GW-04_012320	01/23/2020	N	**110**	J-	**28**	J-	**3.9**	J-
Original Fire Station	OFS-GW-01	OFS-GW-01-110320	11/03/2020	N	**2,000**	DJ	**1,200**	DJ	**180**	
Former Fire Station 1	FFS1-GW-01	FFS1-GW-01-110320	11/03/2020	N	**320**	J-	**24**	J-	**6.9**	J-
Former Fire Station 3	FFS3-GW-01	FD-GW-01-110420 / FFS3-GW-01-110420	11/04/2020	FD	**76**		**13**		**16**	
		FFS3-GW-01-110420	11/04/2020	N	**79**		**12**		**16**	
WWII Era Fire Station A	FFSA-GW-01	FFSA-GW-01-110420	11/04/2020	N	**7.2**		**26**		**21**	J+
WWII Era Fire Station B	FFSB-GW-01	FFSB-GW-01-110320	11/03/2020	N	**57**	J-	**48**	J-	**22**	J-
WWII Era Fire Station C	FFSC-GW-01	FFSC-GW-01-110420	11/04/2020	N	**Present**		**Present**			R
Hush House (Building 532)	HH-GW-01	HH-GW-01-110320	11/03/2020	N	**1,100**	DJ	**60**		**29**	
Fire Station 6	FS6-GW-01	FTBR-FS6-1-GW-011122	01/11/2022	N	3.7	U	3.7	U	**4.4**	
		FTBR-FD-1-GW-011122	01/11/2022	FD	4.3	U	4.3	U	**4.8**	
Fire Response Area: Luzon Drop Zone	LDZ-GW-01	FTBR-LDZ-1-GW-011022	01/10/2022	N	40	U	40	U	**32**	J
Simmons Army Airfield	SAF-MW-14S	SAF-MW-14S-110520	11/05/2020	N	3.6	U	**2.1**	J	**5.1**	
	SAF-MW-22	SAF-MW-22-110520	11/05/2020	N	**32**	J	**19**		3.6	U
	SAF-MW-24S	SAF-MW-24S-110520	11/05/2020	N	**3.4**	J	3.8	U	3.8	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 2019 Office of the Secretary of Defense (OSD) risk screening levels, using a hazard quotient (HQ) of 0.1 (OSD. 2019. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. October.).

Acronyms/Abbreviations:
AOPI = Area of Potential Interest
FD = field duplicate sample
GW = Groundwater
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
DJ	The analyte was analyzed at dilution and the result is an estimated quantity
DJ-	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).
Present	The sample results were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. These data are used for evaluation based on the confirmation of presence and the site-specific history.

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USACE PFAS Premliminary Assessment/Site Inspection
Fort Bragg, North Carolina

AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
			OSD Industrial/Commercial HQ=0.1		1.6		1.6		25	
			OSD Residential HQ=0.1		0.13		0.13		1.9	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Building 173 (PAAF)	B173-SO-01	B173-SO-01_012120(0.5'-2.5')	01/21/2020	N	0.00091	UB	0.00091	U	0.00091	U
	B173-SO-02	B173-SO-02_012120	01/21/2020	N	**0.0014**		0.0011	U	0.0011	U
Building R3065 (PAAF)	R3065-SO-01	R3065-SO-01_012120(1'-3')	01/21/2020	N	**0.0014**		0.0012	U	0.0012	U
	R3065-SO-02	R3065-SO-02_012120(1'-3')	01/21/2020	N	**0.0050**		**0.00064**	J	0.00096	U
	R3065-SO-03	R3065-SO-03_012120(1'-3')	01/21/2020	N	**0.0057**		0.0012	U	0.0012	U
Green Ramp Crash Site	CR-SO-01	CR-SO-01_011720(1'-3')	01/17/2020	N	0.00097	U	0.00097	U	0.00097	U
		DUP-01_011720	01/17/2020	FD	0.00097	U	0.00097	U	0.00097	U
Taxiway M Crash Sites	CR-SO-02	CR-SO-02_011720(3'-5')	01/17/2020	N	**0.14**		**0.00078**	J	0.0011	U
Fire Station 1_ Knox Srt Fire Trng Pits (FTBR-004; FTA 18)	FS1-SO-01	FS1-SO-01_012020 (1'-3')	01/20/2020	N	**0.076**		**0.00077**	J	0.0013	U
Fire Station 2 (SAAF)	FS2-SO-01	FS2-SO-01_011620(0'-2')	01/16/2020	N	**0.089**		0.0012	U	0.0012	U
	FS2-SO-02	FS2-SO-02_011620(1'-3')	01/16/2020	N	**0.017**		0.0010	U	0.0010	U
	FS2-SO-03	FS2-SO-03_011620(1'-3')	01/16/2020	N	**0.00085**	J	0.0010	U	0.0010	U
Fire Station 3	FS3-SO-01	FS3-SO-01_011520(1'-3')	01/15/2020	N	**0.00060**	J	0.0011	U	0.0011	U
	FS3-SO-02	FS3-SO-02_011520(0.5'-2.5')	01/15/2020	N	0.0010	U	0.0010	U	0.0010	U
	FS3-SO-03	FS3-SO-03_011520(0.5'-2.5')	01/15/2020	N	**0.060**		0.0012	U	0.0012	U

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USACE PFAS Premliminary Assessment/Site Inspection
Fort Bragg, North Carolina

AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
			OSD Industrial/Commercial HQ=0.1		1.6		1.6		25	
			OSD Residential HQ=0.1		0.13		0.13		1.9	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Fire Station 5	FS5-SO-01	FS5-SO-01_011520(0.5'-2.5')	01/15/2020	N	**0.0035**		0.0012	U	0.0012	U
	FS5-SO-02	FS5-SO-02_011520(0.5'-2.5')	01/15/2020	N	0.0012	U	0.0012	U	0.0012	U
	FS5-SO-03	FS5-SO-03_011520(2'-4')	01/15/2020	N	**0.0071**		0.0012	U	0.0012	U
	FS5-SO-04	FS5-SO-04-110520	11/05/2020	N	**0.035**		0.0010	U	0.0010	U
Fire Station 7/8 & Foam Storage Shed (PAAF)	FS7-SO-01	FS7-SO-01_012120 (1-'3')	01/21/2020	N	**2.0**	DJ	**0.0032**		0.0010	U
	FS7-SO-02	FS7-SO-02_012120 (1'-3')	01/21/2020	N	**0.36**	DJ	**0.0025**		0.0010	U
FT001 (FTA#4)	FT4-SO-01	FT4-SO-01_011420(1'-3')	01/14/2020	N	**0.0051**		0.0012	U	0.0012	U
	FT4-SO-02	FT4-SO-02_011420(3'-5')	01/14/2020	N	**0.0098**		**0.0014**		**0.0021**	
Joint Firefighting Training Area	JFTA-SO-01	DUP-2_012320 / JFTA-SO-01_012320(1'-3')	01/23/2020	FD	**0.23**	DJ	**0.00076**	J	0.0010	U
		JFTA-SO-01_012320(1'-3')	01/23/2020	N	**0.31**	DJ	**0.00082**	J	0.0010	U
	JFTA-SO-02	JFTA-SO-02_012320(1'-3')	01/23/2020	N	**0.0023**		0.0013	U	0.0013	U
Biosolid Application Area: Honeycutt Road	HC-SO-01	HC-SO-01_011620(0.5'-2.5')	01/16/2020	N	**0.0077**		**0.00056**	J	0.0011	U
	HC-SO-02	HC-SO-02_011620(0.5'-2.5')	01/16/2020	N	**0.0025**		0.0012	U	0.0012	U
	HC-SO-03	HC-SO-03_011620(1'-3')	01/16/2020	N	**0.00073**	J	0.0012	U	0.0012	U

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USACE PFAS Premliminary Assessment/Site Inspection
Fort Bragg, North Carolina

AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
			OSD Industrial/Commercial HQ=0.1		1.6		1.6		25	
			OSD Residential HQ=0.1		0.13		0.13		1.9	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
former Wastewater Treatment Plant	WWTP-SO-01	WWTP-SO-01_011420(3'-5')	01/14/2020	N	**0.0079**		**0.00078**	J	0.0011	U
	WWTP-SO-02	WWTP-SO-02_011420(2'-4')	01/14/2020	N	**0.00097**	J	0.0012	U	0.0012	U
	WWTP-SO-03	WWTP-SO-03_0115209(1'-3')	01/15/2020	N	0.0011	U	0.0011	U	0.0011	U
Sicily Drop Zone: Biosolid Application	SDZ-SO-01	SDZ-SO-01_012320(1'-3')	01/23/2020	N	0.0012	UB	0.0012	U	0.0012	U
	SDZ-SO-02	SDZ-SO-02_012320(1'-3')	01/23/2020	N	0.0010	UB	0.0010	U	0.0010	U
	SDZ-SO-03	SDZ-SO-03_012320(1'-3')	01/23/2020	N	0.00097	UB	0.00097	U	0.00097	U
	SDZ-SO-04	SDZ-SO-04_012320(1'-3')	01/23/2020	N	**0.0041**		0.0011	U	0.0011	U
Original Fire Station (PAAF; Building 300)	OFS-SO-01	OFS-SO-01-110320	11/03/2020	N	**0.016**		**0.00081**	J	0.00090	U
Former Fire Station 1	FFS1-SO-01	FFS1-SO-01-110320	11/03/2020	N	0.00090	U	0.00090	U	0.00090	U
Former Fire Station 3	FD-SO-01	FFS3-SO-01-110420	11/04/2020	FD	**0.080**		**0.00067**	J	0.0010	U
	FFS3-SO-01	FFS3-SO-01-110420	11/04/2020	N	**0.063**		0.00098	U	0.00098	U
WWII Era Fire Station A	FFSA-SO-01	FFSA-SO-01-110420	11/04/2020	N	0.0011	U	0.0011	U	0.0011	U
WWII Era Fire Station B	FFSB-SO-01	FFSB-SO-01-110320	11/03/2020	N	0.0010	U	0.0010	U	0.0010	U
WWII Era Fire Station C	FFSC-SO-01	FFSC-SO-01-110420	11/04/2020	N	0.00083	U	0.00083	U	0.00083	U

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USACE PFAS Premliminary Assessment/Site Inspection
Fort Bragg, North Carolina

AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
			OSD Industrial/Commercial HQ=0.1		1.6		1.6		25	
			OSD Residential HQ=0.1		0.13		0.13		1.9	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Hush House (Building 532)	HH-SO-01	HH-SO-01-110320	11/03/2020	N	**0.00084**	J	0.0011	U	0.0011	U
Fire Station 6	FS6-SO-1	FS6-1-SO-011122	01/11/2022	N	0.0011	U	0.0011	U	0.0011	U
	FS6-SO-2	FS6-2-SO-011122	01/11/2022	N	**0.013**		**0.00056**	J	0.0010	U
	FS6-SO-3	FS6-3-SO-011122	01/11/2022	N	**0.013**		0.00099	U	0.00099	U
	FD-SO-1	FS6-3-SO-011122	01/11/2022	FD	**0.013**		0.0011	U	0.0011	U
Fire Response Area: Range 78	R78-SO-1	R78-1-SO-011022	01/10/2022	N	0.0011	U	0.0011	U	0.0011	U
	R78-SO-2	R78-2-SO-011022	01/10/2022	N	0.00093	U	0.00093	U	0.00093	U
	R78-SO-3	R78-3-SO-011022	01/10/2022	N	0.0011	U	0.0011	U	0.0011	U
Fire Response Area: Luzon Drop Zone	LDZ-SO-1	LDZ-1-SO-011022	01/10/2022	N	0.00093	U	0.00093	U	0.00093	U
	LDZ-SO-2	LDZ-2-SO-011022	01/10/2022	N	**0.0028**	U	0.00093	U	0.00093	U
	LDZ-SO-3	LDZ-3-SO-011022	01/10/2022	N	**0.0016**	U	0.00088	U	0.00088	U

Notes:

1. **Bolded** values indicate the result was detected greater than the limit of detection
2. All laboratory reported results in nanograms per gram (ng/g) were converted to milligrams per kilogram (mg/kg).
3. Data are compared to the 2019 Office of the Secretary of Defense (OSD) risk screening levels for the residential and commerical/industrial scenario, using a hazard quotient (HQ) of 0.1 (OSD. 2019. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. October.).
4. 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:
AOPI = Area of Potential Interest
FD = field duplicate sample
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
SO = Soil

Qualifier	Description
DJ	The analyte was analyzed at dilution and the result is an estimated quantity
J	The analyte was positively identified; however the associated numerical value is an estimated concentration only
U	The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
UB	The analyte is considered nondetect at the listed value due to associated blank contamination.

Table 7-3 - Surface Water PFOS, PFOA, and PFBS Analytical Results
USACE PFAS Premliminary Assessment/Site Inspection
Fort Bragg, North Carolina

AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
			OSD Tapwater HQ=0.1		40		40		600	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Fire Station 1_ Knox Srt Fire Trng Pits (FTBR-004; FTA 18)	FS1-SW-01	FS1-SW-01_012020	01/20/2020	N	**170**		**67**		**17**	
Fire Station 7/8 & Foam Storage Shed (PAAF)	FS7-SW-01	FS7-SW-01_012120	01/21/2020	N	**1,200**	DJ	**140**		**78**	
Joint Firefighting Training Area	JFTA-SW-01	JFTA-SW-01_012020	01/20/2020	N	**12,000**	DJ	**550**	DJ	**480**	DJ
former Waste Water Treatment Plant	WWTP-SW-01	WWTP-SW-01-011520	01/15/2020	N	**3.8**		3.4	U	3.4	U
		DUP-2_011520 / WWTP-SW-01_011520	01/15/2020	FD	**3.9**		3.7	U	3.7	U
	WWTP-SW-02	FD-SW-01-110220 / WWTP-SW-02-110220	11/02/2020	FD	**520**	J+	**49**		**32**	
		WWTP-SW-02-110220	11/02/2020	N	**540**		**47**		**31**	
Little Cross Creek (west of SAAF)	LCC-SW-01	LCC-SW-01-110520	11/05/2020	N	**120**		**13**		**11**	

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 2019 Office of the Secretary of Defense (OSD) risk screening levels, using a hazard quotient (HQ) of 0.1 (OSD. 2019. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. October.).

Acronyms/Abbreviations:
AOPI = Area of Potential Interest
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
SW = Surface water

Qualifier	Description
DJ	The analyte was analyzed at dilution and the result is an estimated quantity
J+	The result is an estimated quantity; the result may be biased high.
U	The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).

Table 7-4 - Sediment PFOS, PFOA, and PFBS Analytical Results
USACE PFAS Premliminary Assessment/Site Inspection
Fort Bragg, North Carolina

Associated AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
			OSD Industrial/Commercial HQ=0.1		1.6		1.6		25	
			OSD Residential HQ=0.1		0.13		0.13		1.9	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Fire Station 1_ Knox Srt Fire Trng Pits (FTBR-004; FTA 18)	FS1-SE-01	FS1-SE-01_012020	01/20/2020	N	**0.00084**	J	0.0011	U	0.0011	U
Fire Station 7/8 & Foam Storage Shed (PAAF)	FS7-SE-01	FS7-SE-01_012120	01/21/2020	N	**0.0012**		0.0012	U	0.0012	U
former Wastewater Treatment Plant	WWTP-SE-02	FD-SE-01-110220 / WWTP-SE-02-110220	11/02/2020	FD	**0.00057**	J	0.00095	U	0.00095	U
		WWTP-SE-02-110220	11/02/2020	N	**0.00059**	J	0.00088	U	0.00088	U
Little Cross Creek (west of SAAF)	LCC-SE-01	LCC-SE-01-110520	11/05/2020	N	0.0012	U	0.0012	U	0.0012	U

Notes:

1. **Bolded** values indicate the result was detected greater than the limit of detection
2. All laboratory reported results in nanograms per gram (ng/g) were converted to milligrams per kilogram (mg/kg).
3. Data are compared to the 2019 Office of the Secretary of Defense (OSD) risk screening levels for the residential and commerical/industrial scenario, using a hazard quotient (HQ) of 0.1 (OSD. 2019. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. October.).
4. 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:
AOPI = Area of Potential Interest
FD = field duplicate sample
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
SE = Sediment

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

FIGURES

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Bragg, NC

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Figure 2-1
Site Location

Legend

- Fort Bragg Installation Boundary
- Camp Mackall

Data Sources:
Fort Bragg, GIS Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS Preliminary Assessment / Site Inspection Fort Bragg, NC

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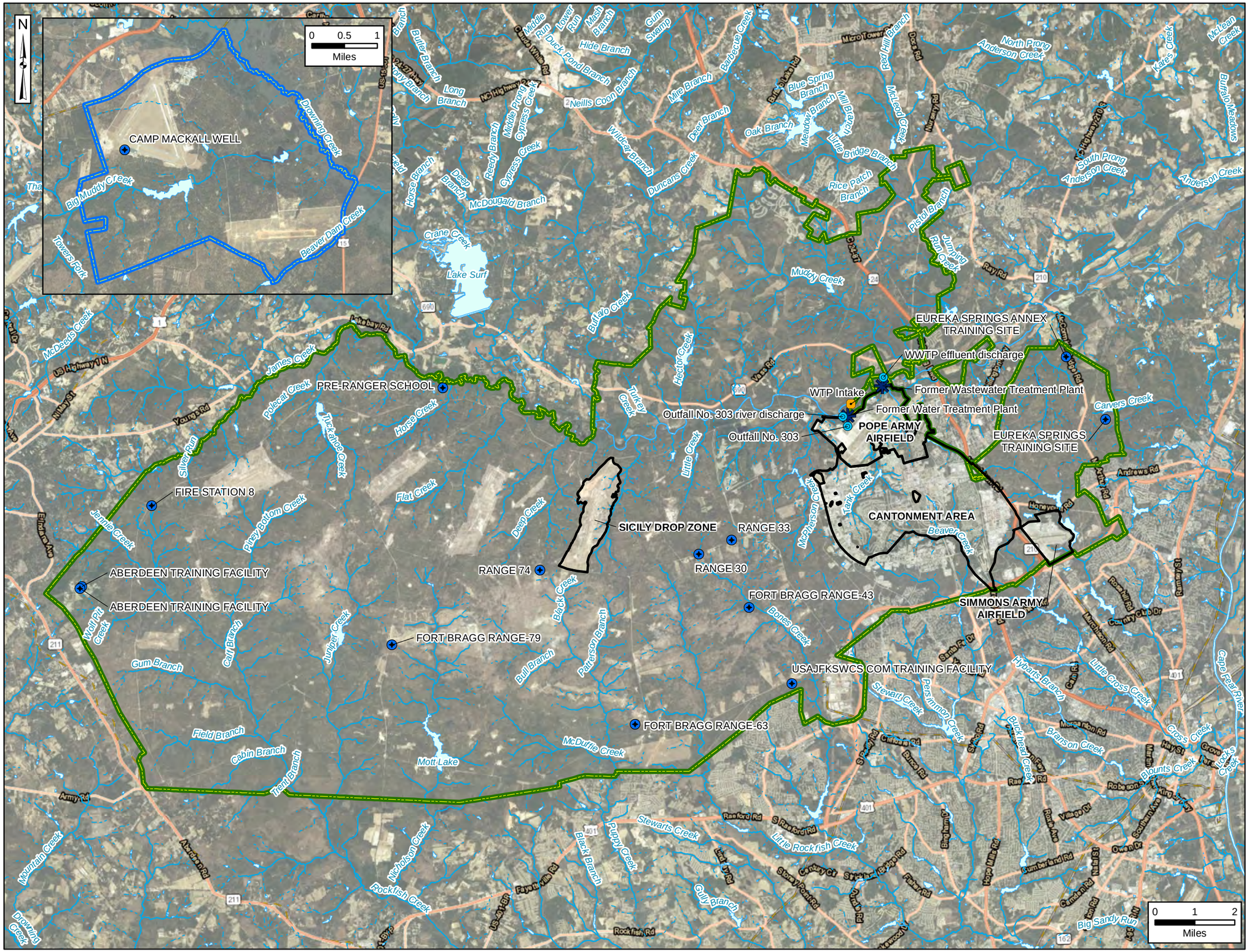
Figure 2-2
Site Layout



Legend

- Fort Bragg Installation Boundary
- Camp Mackall
- Cantonment Area / Airfield / Drop Zone
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Water Supply Well
- Intake
- Outfall
- Former Treatment Plant

USAJFKSWCSCOM = U.S. Army John F. Kennedy Special Warfare Center and School Command
WTP = Water Treatment Plant
WWTP = Wastewater Treatment Plant

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
EDR, Well Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS Preliminary Assessment / Site Inspection Fort Bragg, NC

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Figure 2-3
Topographic Map

Legend

- Installation Boundary
- Airfield / Drop Zone
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
ESRI ArcGIS Online, USA Topo Maps

Coordinate System:
WGS 1984, UTM Zone 17 North

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Preliminary Assessment / Site Inspection
Fort Bragg, NC

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Figure 2-4
Off-Post Potable Supply Wells

Legend

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

State Water Wells

- Community
- Non-Community
- Non-Public Water System
- Non-Transient Non-Community

Data Sources:
Fort Bragg, GIS Data, 2018
EDR, Well Data, 2018
NHD, Water Bodies, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS Preliminary Assessment / Site Inspection Fort Bragg, NC

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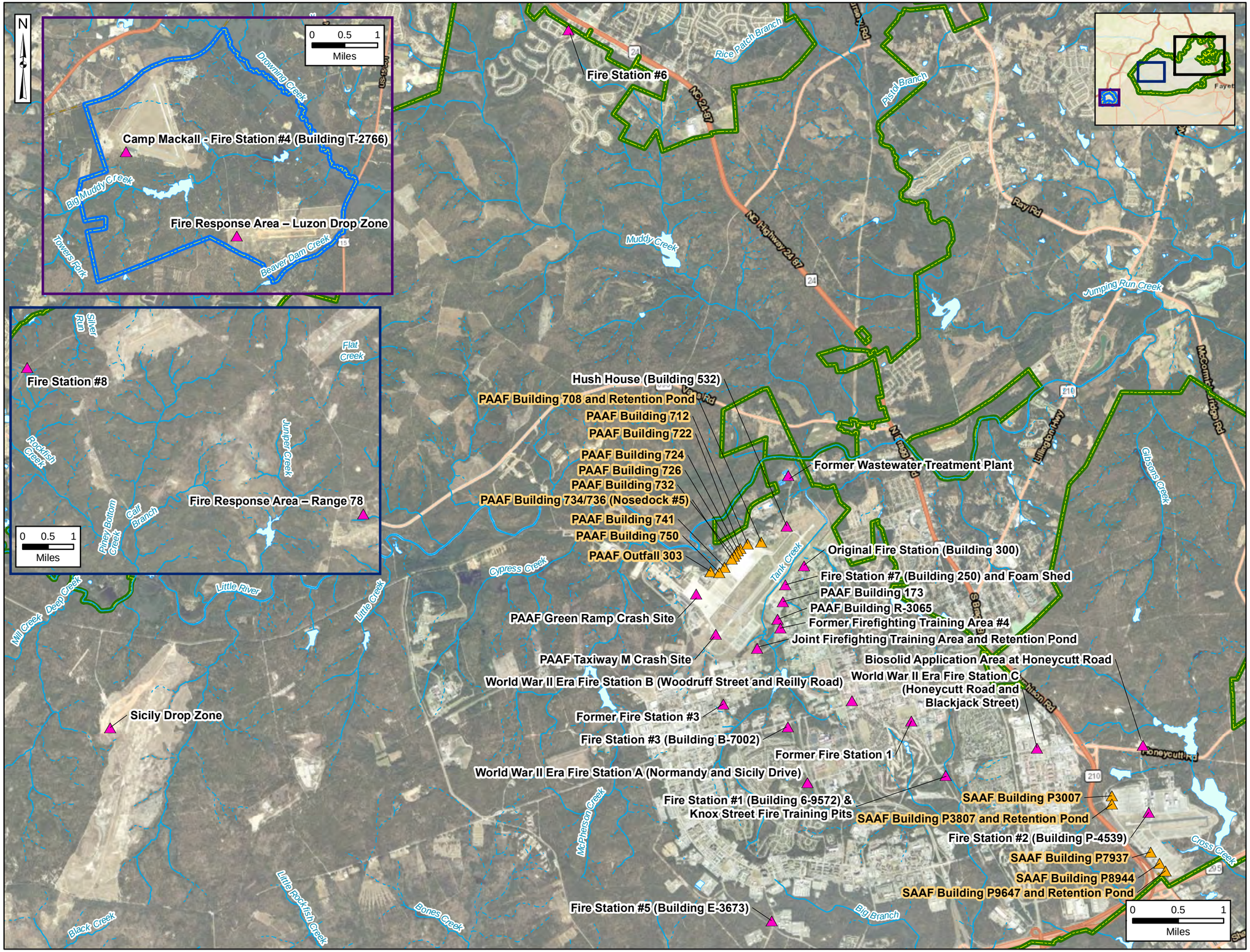
Figure 5-2
AOPI Locations



Legend

- Fort Bragg Installation Boundary
- Camp Mackall
- PA/SI AOPI Location
- AOPI with Established PFAS Contamination
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body

AOPI = area of potential interest
OSD = Office of the Secretary of Defense
PA = Preliminary Assessment
PAAF = Pope Army Airfield
PFAS = per- and polyfluoroalkyl substances
SAAF = Simmons Army Airfield
SI = Site Inspection

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

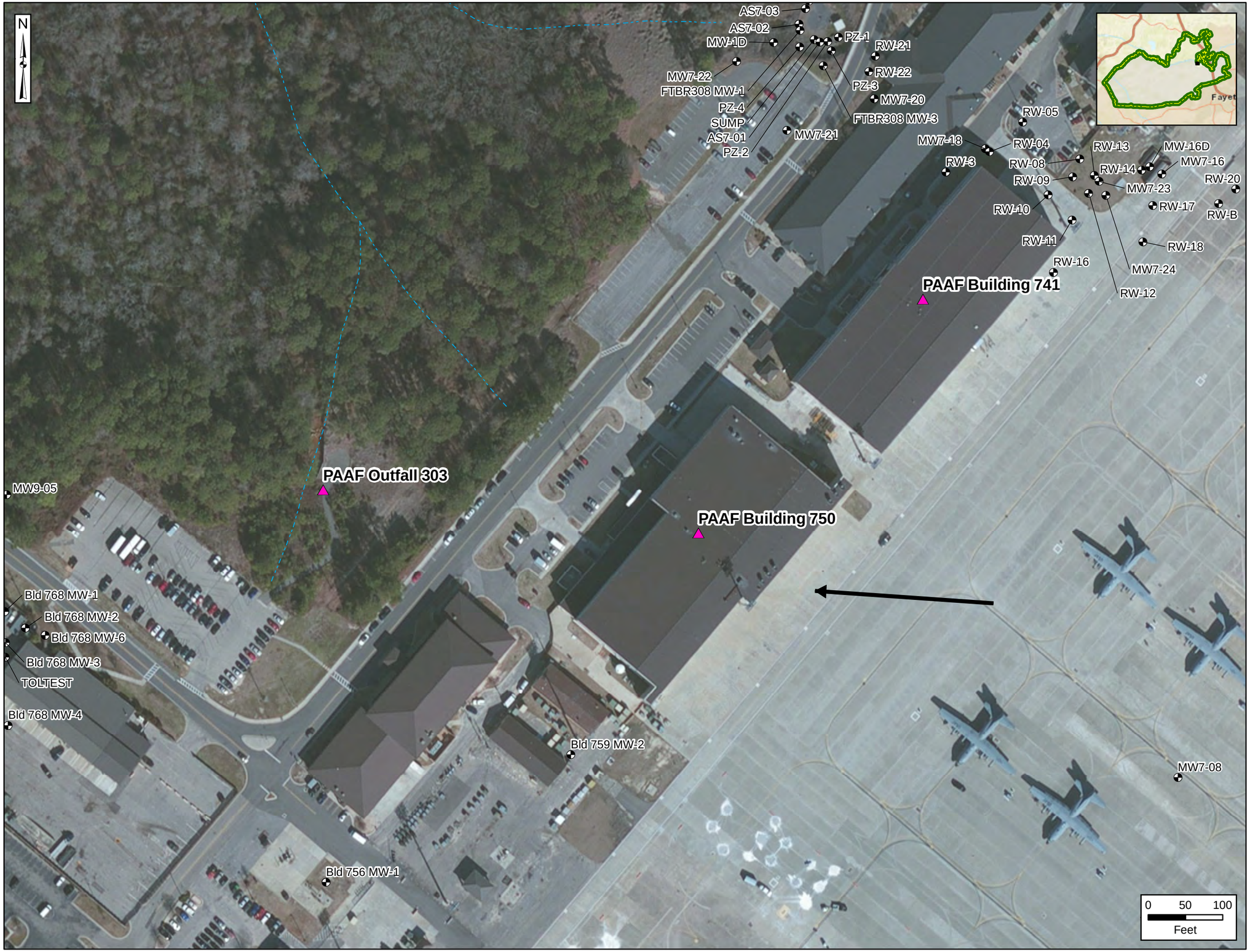


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Figure 5-3
Aerial Photo of PAAF Outfall 303, PAAF Building 750, and PAAF Building 741

Legend

- Installation Boundary
- AOPI Location
- Monitoring Well
- Stream (Intermittent)
- Approximate Groundwater Flow Direction

AOPI = area of potential interest
PAAF = Pope Army Airfield

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
SCFS, 2016
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS Preliminary Assessment / Site Inspection Fort Bragg, NC

Figure 5-4
Aerial Photo of PAAF Buildings 734/736 (Nosedock #5), 732, 726, 724, and 722

Legend

- Installation Boundary
- AOPI Location
- Monitoring Well
- Approximate Groundwater Flow Direction

AOPI = area of potential interest
PAAF = Pope Army Airfield

Data Sources:
Fort Bragg, GIS Data, 2018
SCFS, 2016
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS Preliminary Assessment / Site Inspection Fort Bragg, NC

Figure 5-5
Aerial Photo of PAAF Buildings 712 and 708 and Retention Pond

Legend

- Installation Boundary
- AOPI Location
- Monitoring Well
- Monitoring Well - Abandoned
- Approximate Groundwater Flow Direction

AOPI = area of potential interest
PAAF = Pope Army Airfield

Data Sources:
Fort Bragg, GIS Data, 2018
SCFS, 2016
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Preliminary Assessment / Site Inspection
Fort Bragg, NC

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Figure 5-6
Aerial Photo of
SAAF Building P7937, and
SAAF Building P8944, and
SAAF Building P9647 and
Retention Pond

Legend

- Installation Boundary
- AOPI Location
- Monitoring Well
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Assumed Surface Runoff Flow Direction

AOPI = area of potential interest
SAAF = Simmons Army Airfield

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
SCFS, 2016
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Preliminary Assessment / Site Inspection
Fort Bragg, NC

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Figure 5-7
Aerial Photo of SAAF Building P3807 and Retention Pond and SAAF Building P3007

Legend

- Installation Boundary
- AOPI Location
- Approximate Groundwater Flow Direction

AOPI = area of potential interest
SAAF = Simmons Army Airfield

Data Sources:
Fort Bragg, GIS Data, 2018
SCFS, 2016
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Bragg, NC

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Figure 5-8
Aerial Photo of Fire Station #8

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Water Supply Well

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

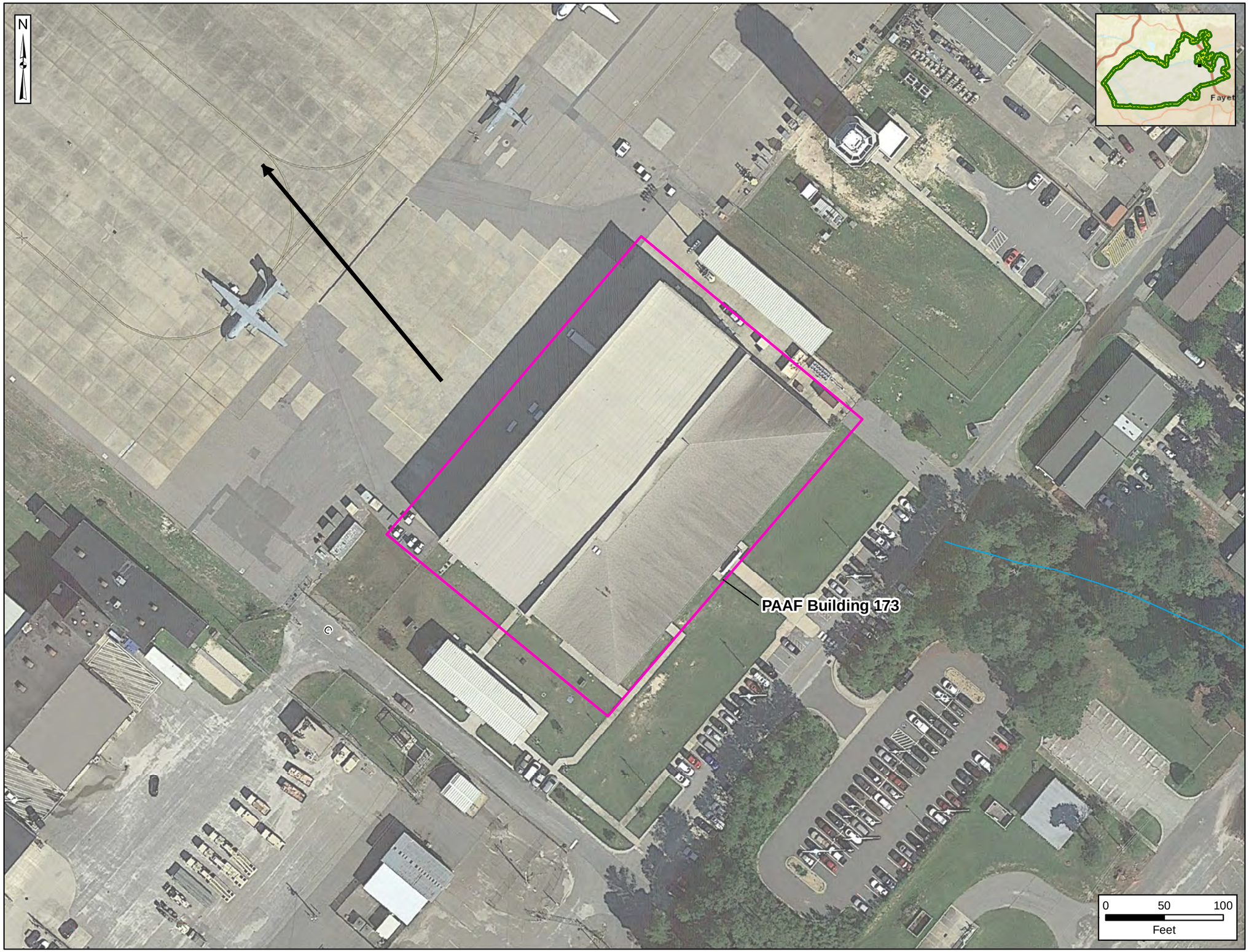

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Figure 5-9
Aerial Photo of
PAAF Building 173

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction

AOPI = area of potential interest
PAAF = Pope Army Airfield

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Bragg, NC

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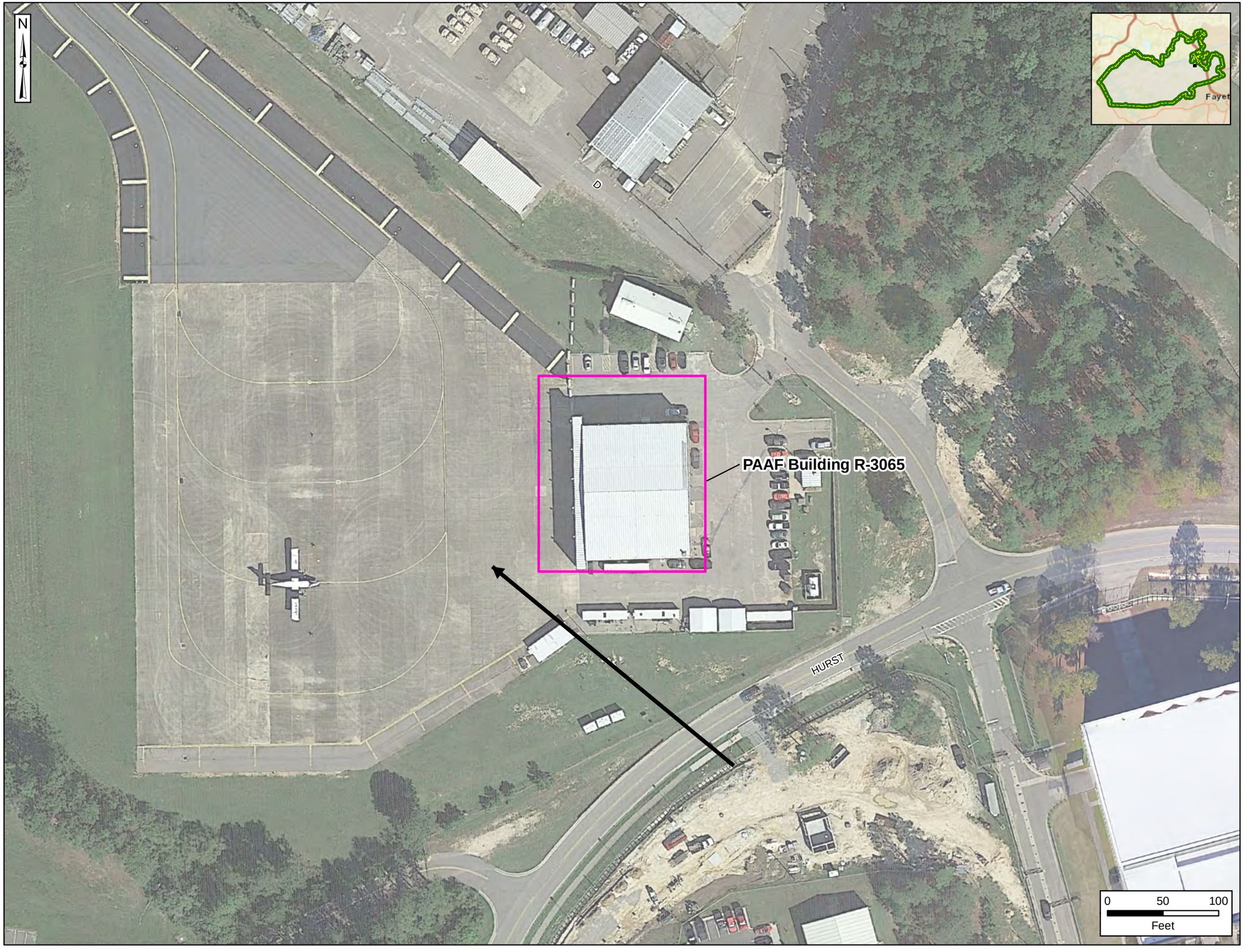
Figure 5-10
Aerial Photo of
PAAF Building R-3065



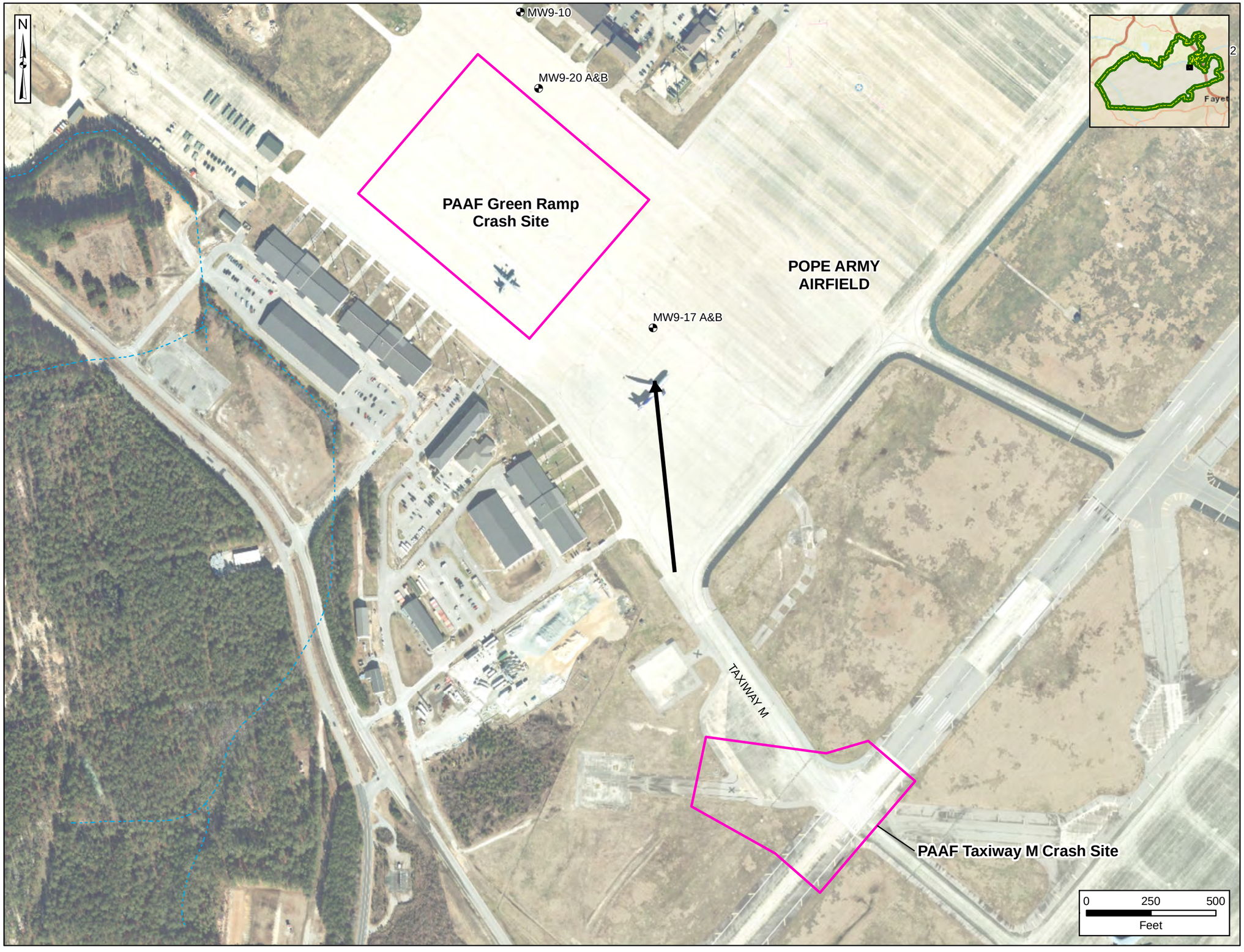
Legend

- Installation Boundary
- AOPI
- Approximate Groundwater Flow Direction

AOPI = area of potential interest
PAAF = Pope Army Airfield

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North



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Fort Bragg, NC

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Figure 5-11
Aerial Photo of PAAF Green Ramp and PAAF Taxiway M Crash Sites

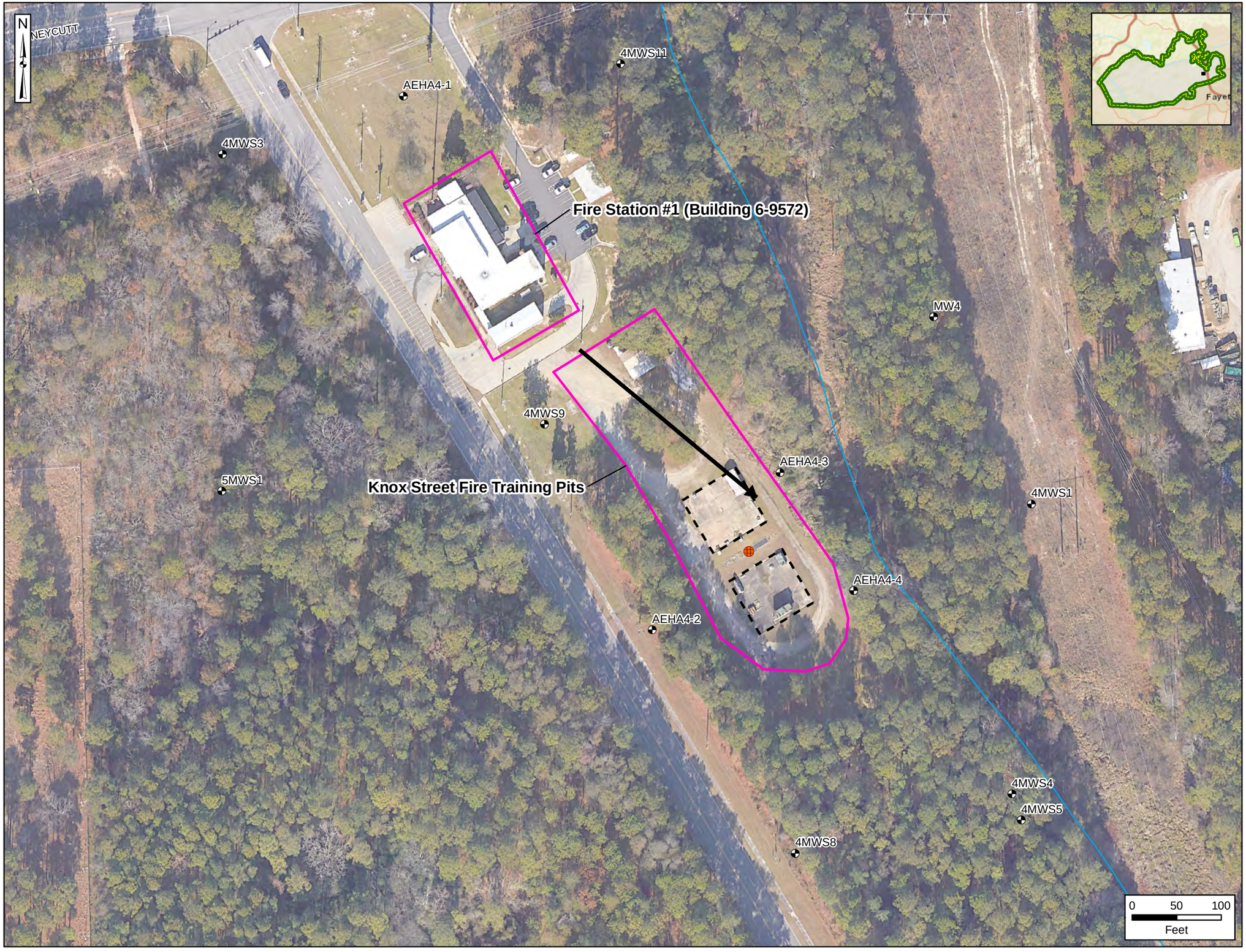
Legend

- Installation Boundary
- AOPI
- Monitoring Well
- Stream (Intermittent)
- Approximate Groundwater Flow Direction

AOPI = area of potential interest
PAAF = Pope Army Airfield

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North



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Fort Bragg, NC

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Figure 5-12
Aerial Photo of
Fire Station #1 (Building 6-9572)
and Knox Street Fire Training Pits

Legend

- Installation Boundary
- AOPI
- Former Fire Training Pit
- Monitoring Well
- Oil/Water Separator
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
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Fort Bragg, NC

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Figure 5-13
Aerial Photo of
Fire Station #2
(Building P-4539)

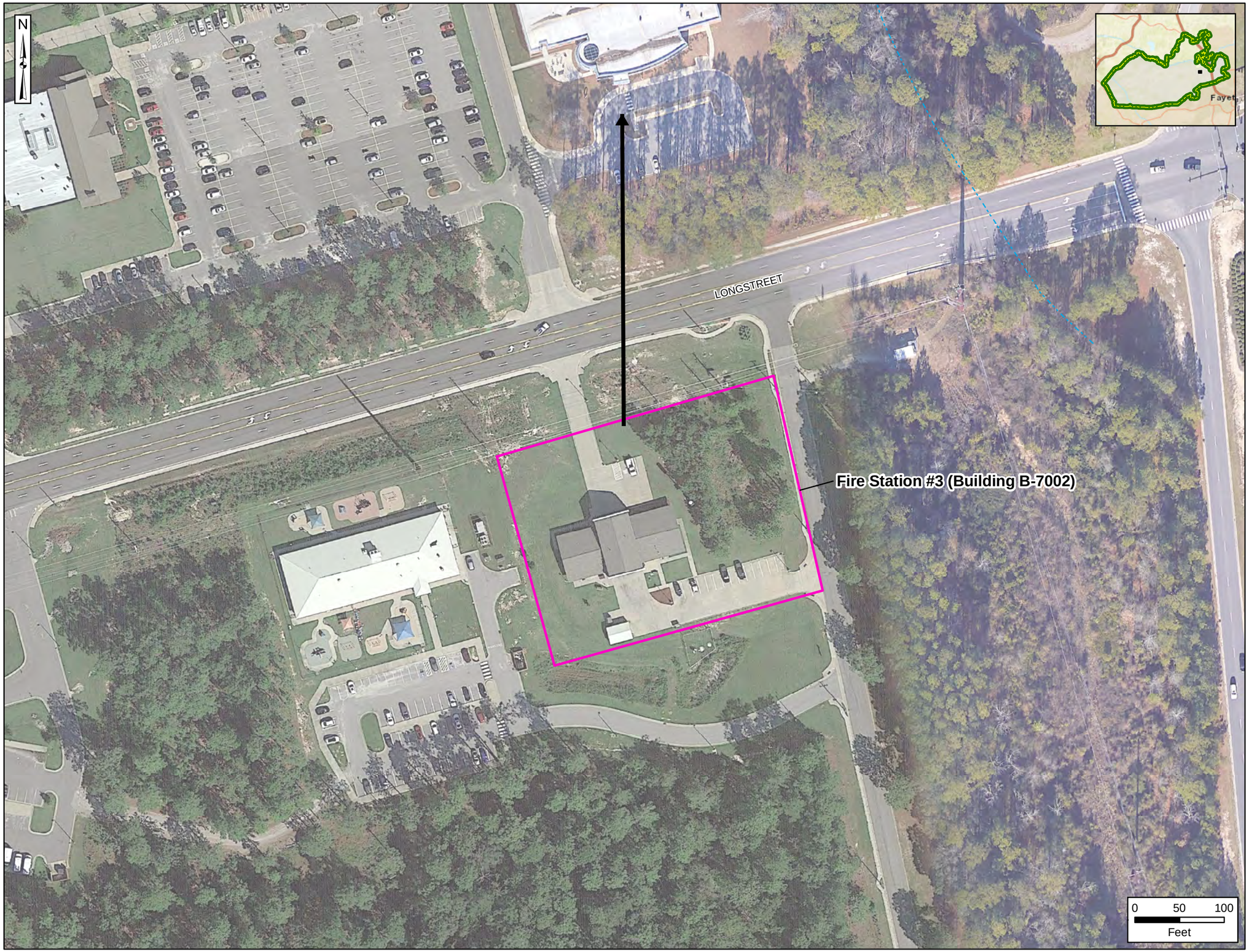
Legend

- Installation Boundary
- AOPI
- Monitoring Well - Status Unknown
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North



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Fort Bragg, NC

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Figure 5-14
Aerial Photo of
Fire Station #3
(Building B-7002)

Legend

- Installation Boundary
- AOPI
- Stream (Intermittent)
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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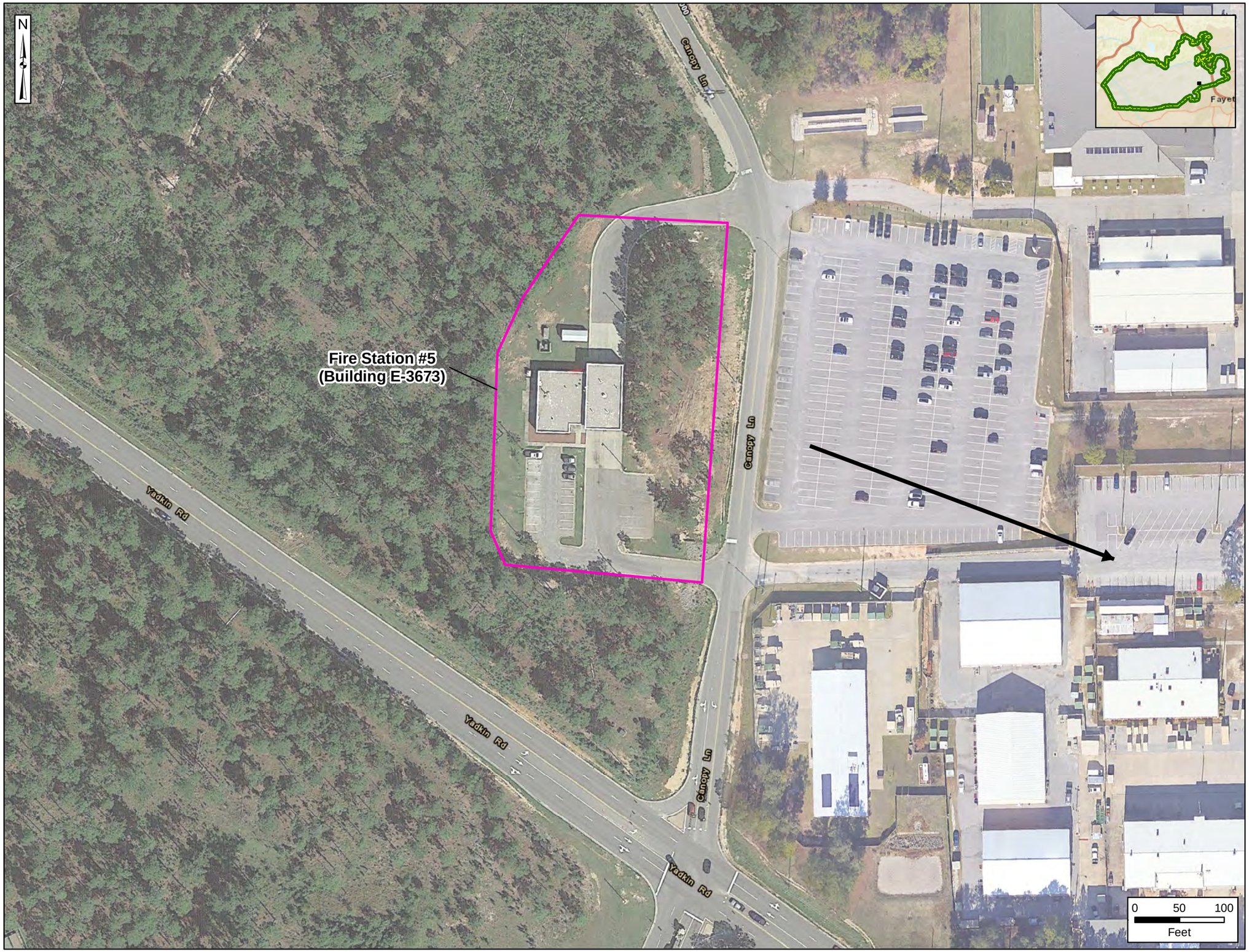

Figure 5-15
Aerial Photo of
Fire Station #5
(Building E-3673)

Legend

- Installation Boundary
- AOPI
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 5-16
Aerial Photo of
Fire Station #7 (Building 250)
and Foam Shed

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Fort Bragg, NC

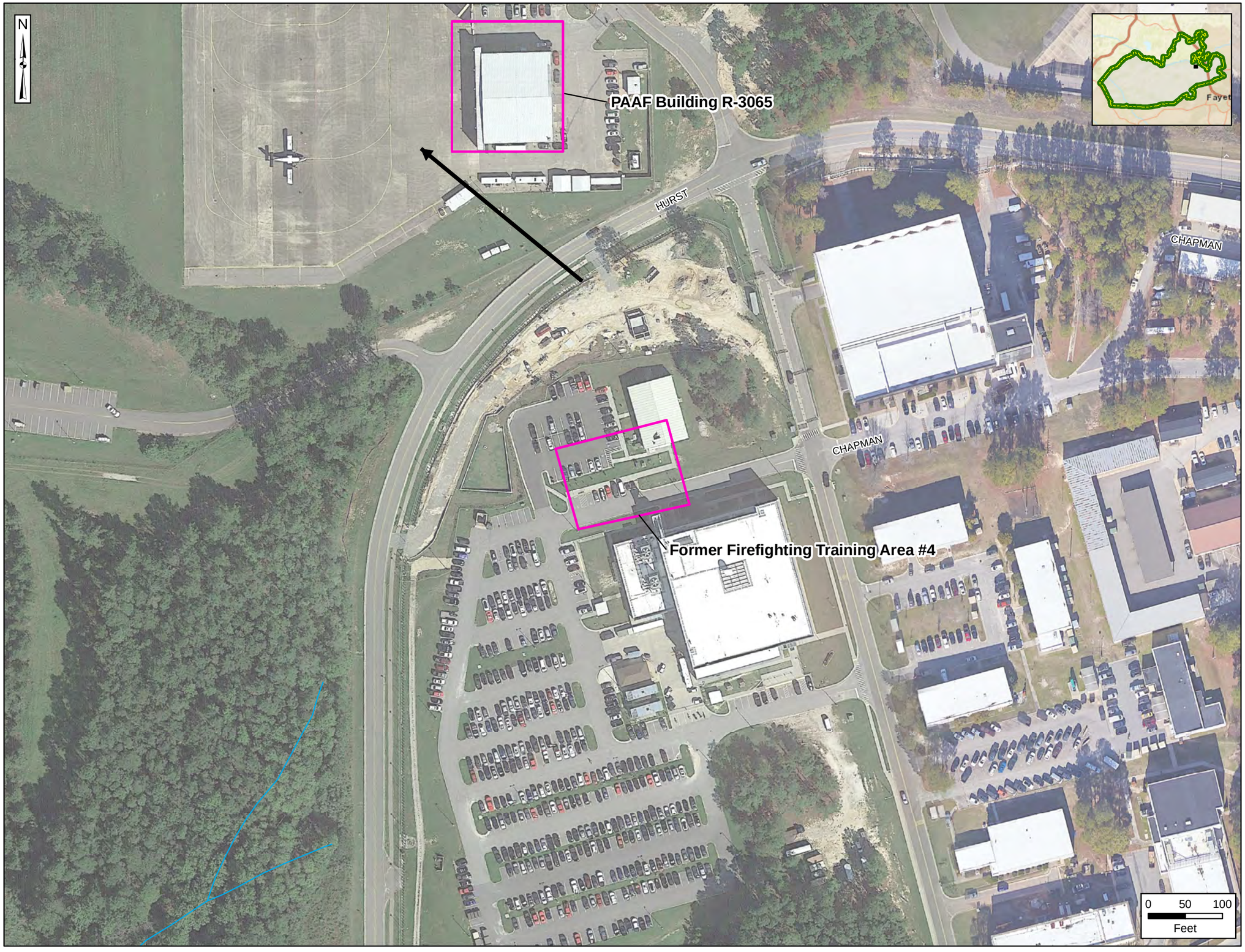

Figure 5-17
Aerial Photo of
Former Firefighting Training Area #4

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction

AOPI = area of potential interest
PAAF = Pope Army Airfield

Note:
The boundary of Former Firefighting Training Area #4 is unknown; the location shown is estimated.

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Preliminary Assessment / Site Inspection
Fort Bragg, NC

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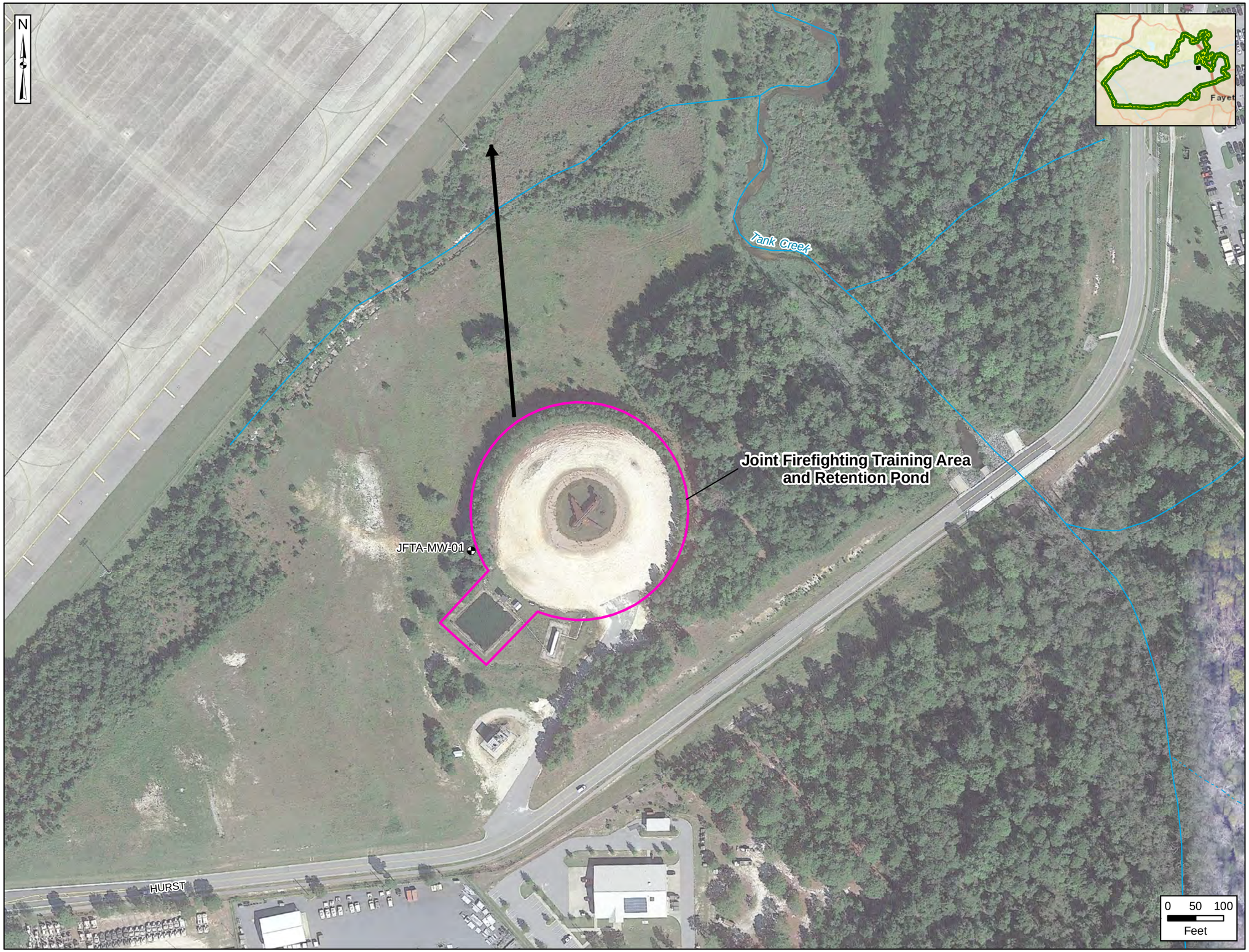
Figure 5-18
Aerial Photo of
Joint Firefighting Training Area and Retention Pond



Legend

- Installation Boundary
- AOPI
- Monitoring Well
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 5-19
Aerial Photo of Biosolid Application Area at Honeycutt Road

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Note:
The extent of biosolid application is unknown.

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Fort Bragg, NC

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Figure 5-20
Aerial Photo of
Camp Mackall - Fire Station #4
(Building T-2766)

Legend

- Camp Mackall
- AOPI
- Water Supply Well
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

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Fort Bragg, NC

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Figure 5-21
Aerial Photo of
Former Wastewater Treatment Plant

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Stream (Intermittent)
- Surface Water Flow Direction
- Approximate Groundwater Flow Direction
- Outfall

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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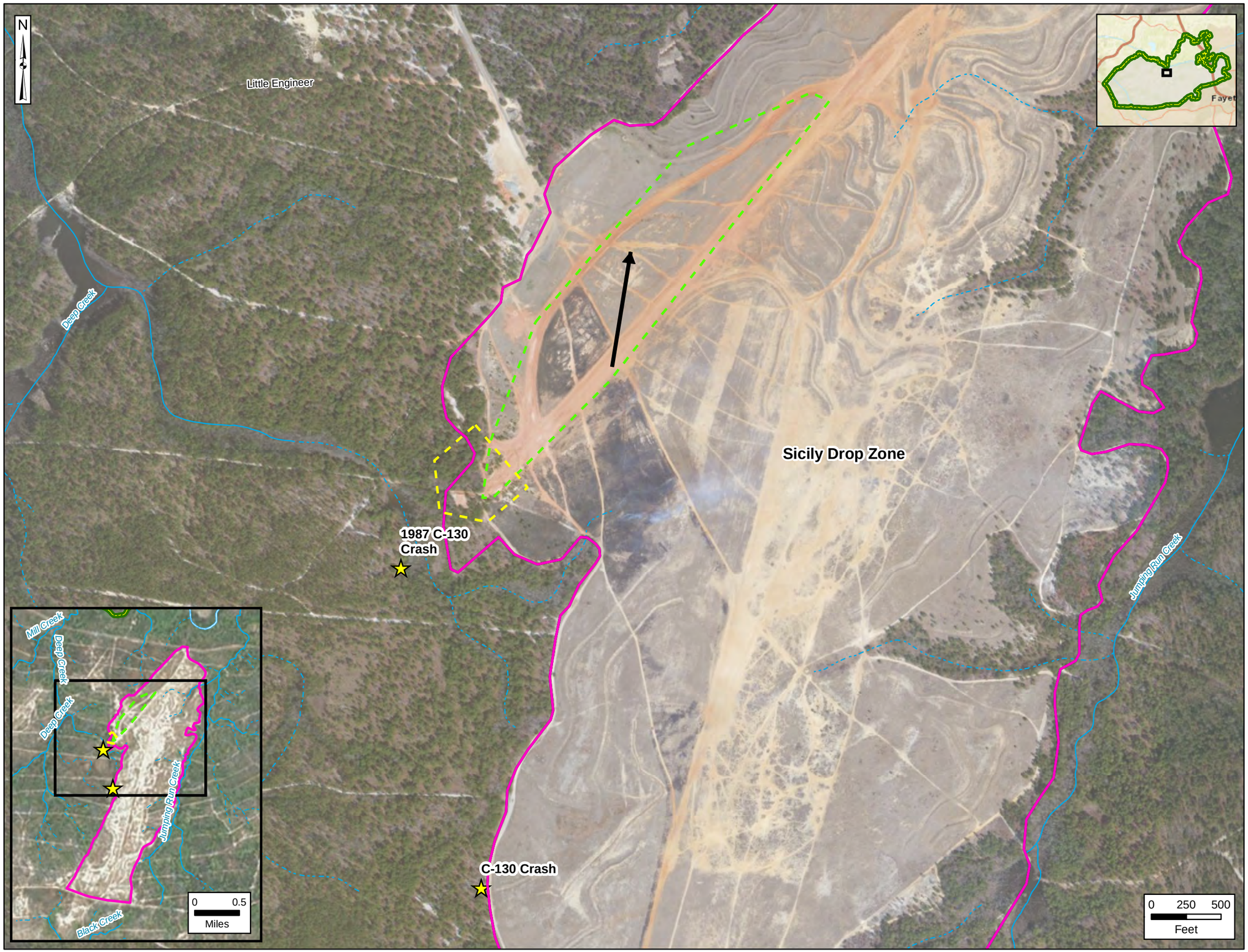
Figure 5-22 Aerial Photo of Sicily Drop Zone



Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Stream (Intermittent)
- Approximate Groundwater Flow Direction
- Historical Aircraft Crash Site
- Presumed Biosolid Application Area
- Crash Site

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 5-23 Aerial Photo of Original Fire Station

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Monitoring Well

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Fort Bragg, NC

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Figure 5-24
Aerial Photo of
Former Fire Station #1

Legend

- Installation Boundary
- AOPI
- Historical Building Footprint
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Fort Bragg, NC

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Figure 5-25
Aerial Photo of
Former Fire Station #3

Legend

- Installation Boundary
- AOPI
- Historical Building Footprint
- Stream (Intermittent)
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Site Investigation
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Figure 5-26
Aerial Photo of
World War II Era Fire Station A
(Normandy and Sicily Drive)

Legend

- Installation Boundary
- AOPI
- Historical Building Footprint
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Fort Bragg, NC

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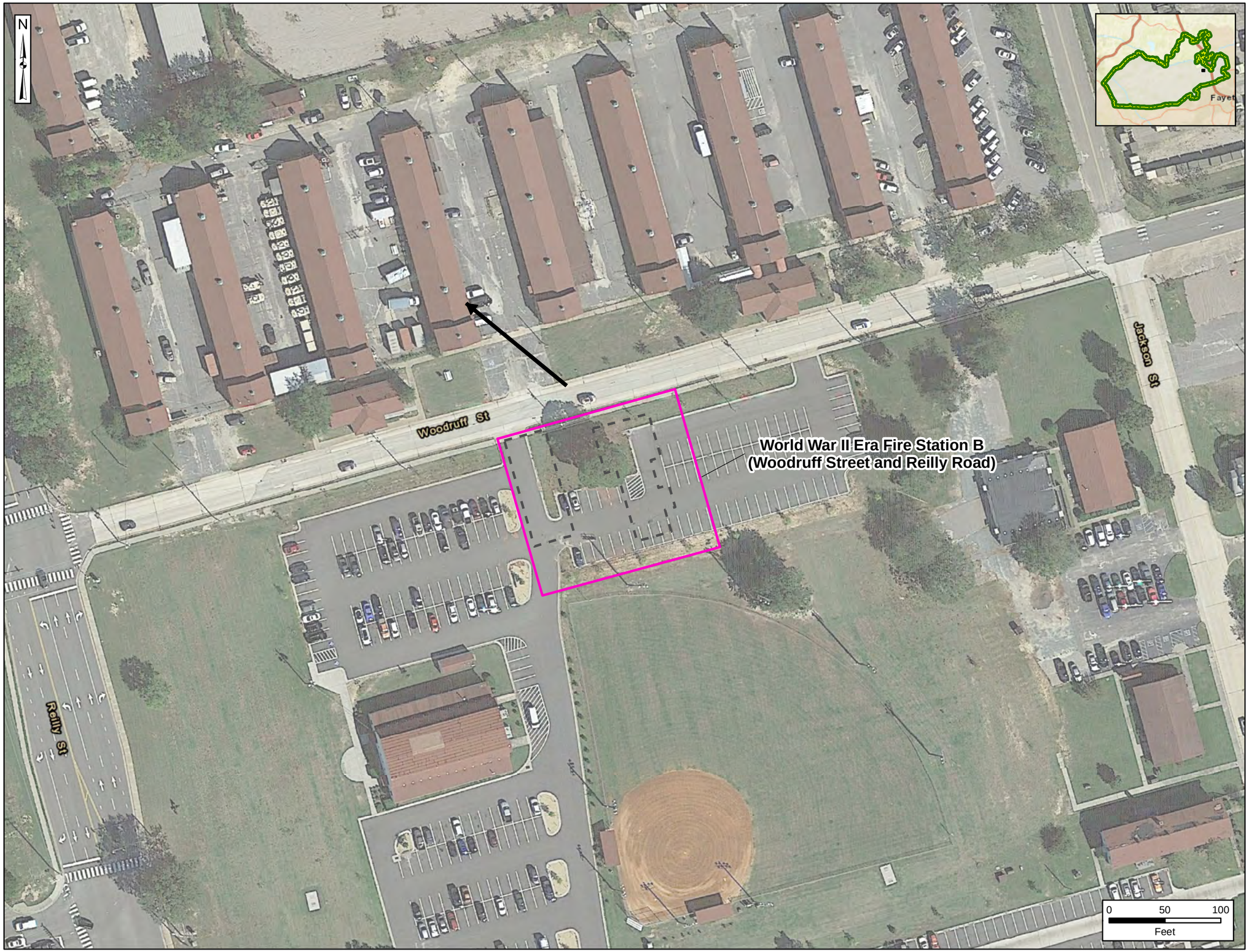
Figure 5-27
Aerial Photo of
World War II Era Fire Station B
(Woodruff Street and Reilly Road)



Legend

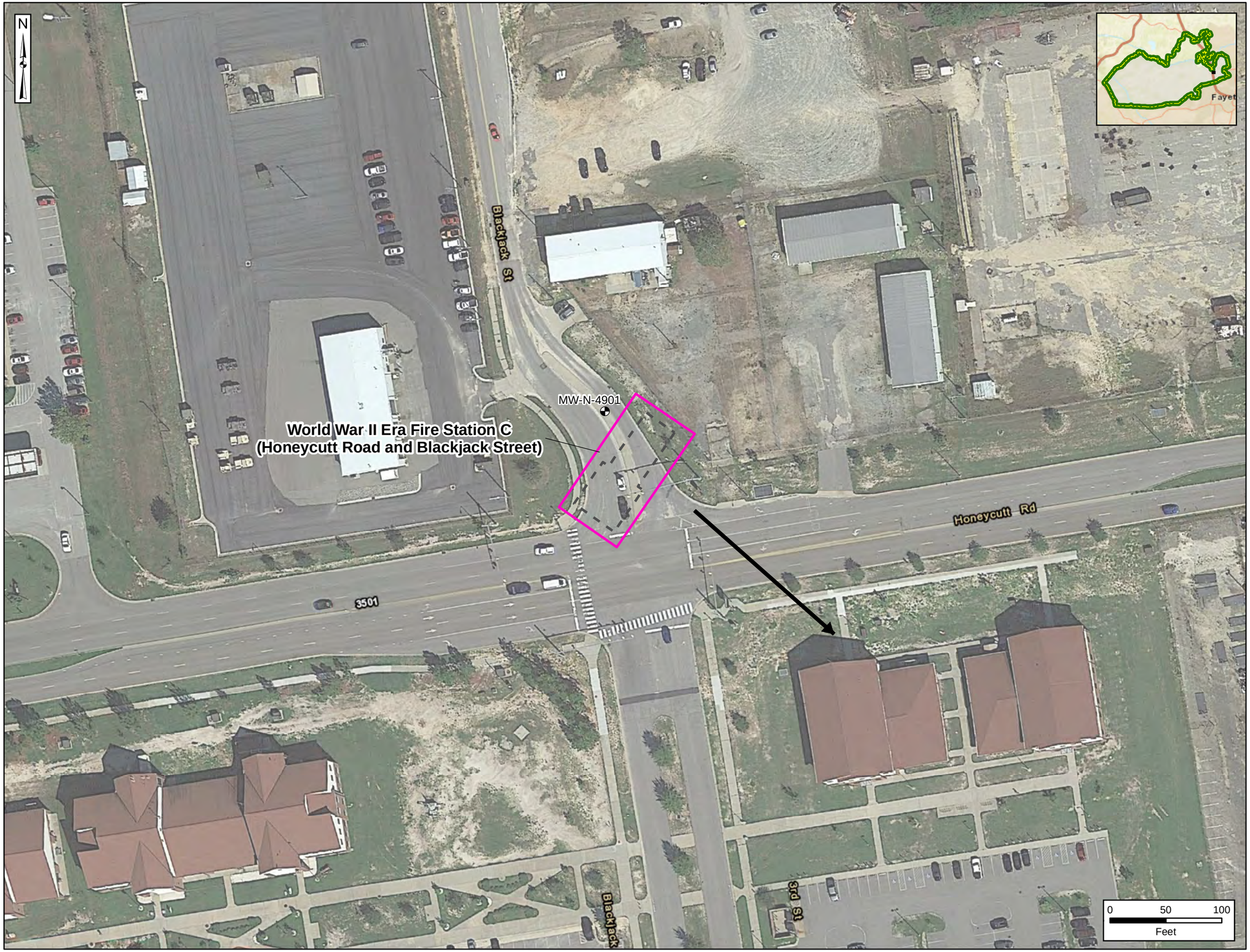
- Installation Boundary
- AOPI
- Approximate Groundwater Flow Direction
- Historical Building Footprint

AOPI = area of potential interest

Note: Unable to identify with certainty which historical building footprint represents Fire Station B.

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



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Preliminary Assessment / Site Inspection
Fort Bragg, NC

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Figure 5-28
Aerial Photo of
World War II Era Fire Station C
(Honeycutt Road and Blackjack Street)

Legend

- Installation Boundary
- AOPI
- Historical Building Footprint
- Monitoring Well
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Fort Bragg, NC

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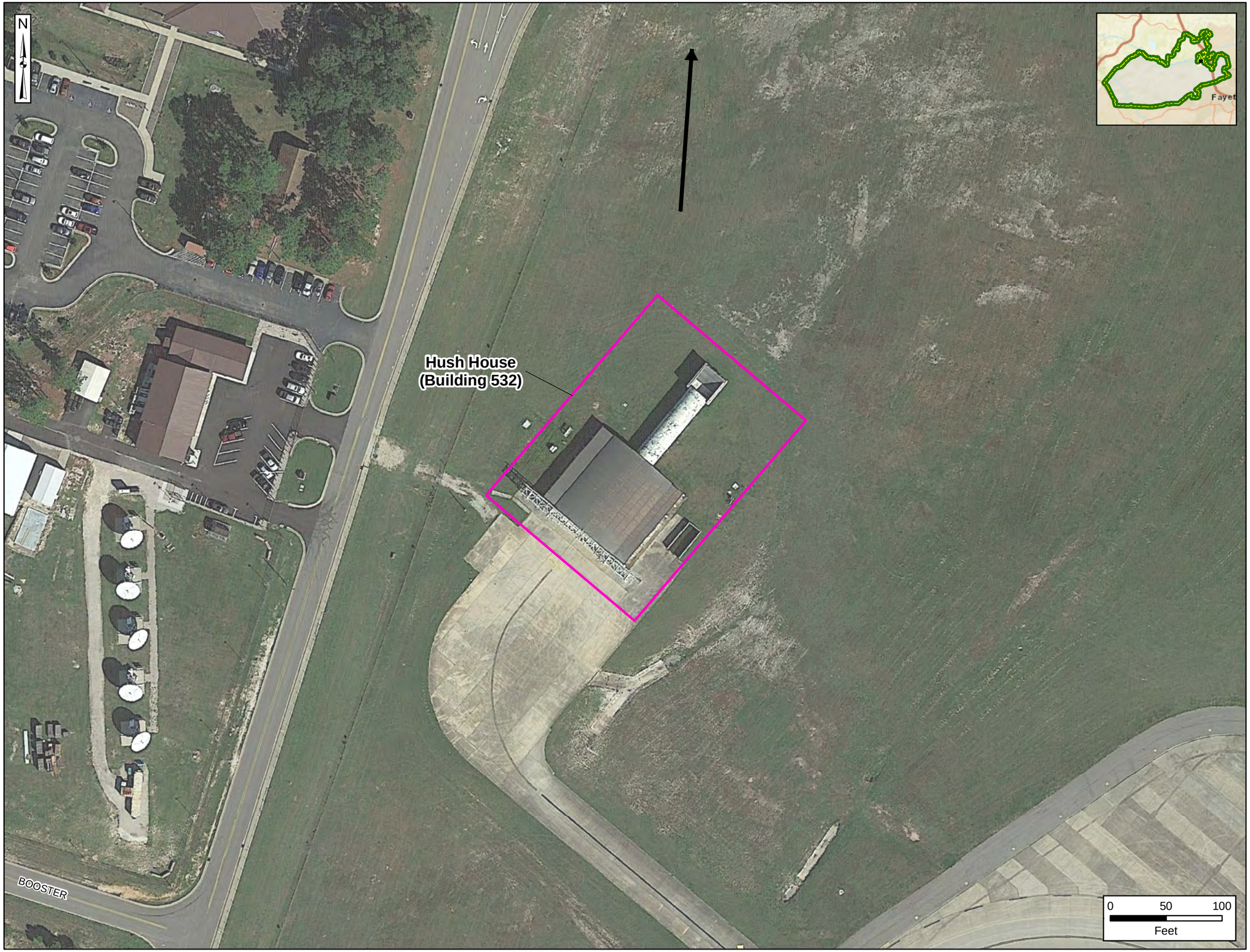
Figure 5-29
Aerial Photo of
Hush House
(Building 532)



Legend

- Installation Boundary
- AOPI
- Approximate Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 5-30 Aerial Photo of Fire Station #6

Legend

- Installation Boundary
- AOPI
- Approximate Groundwater Flow Direction
- Presumed Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Fort Bragg, NC

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Figure 5-31
Aerial Photo of Fire Response Area – Range 78

Legend

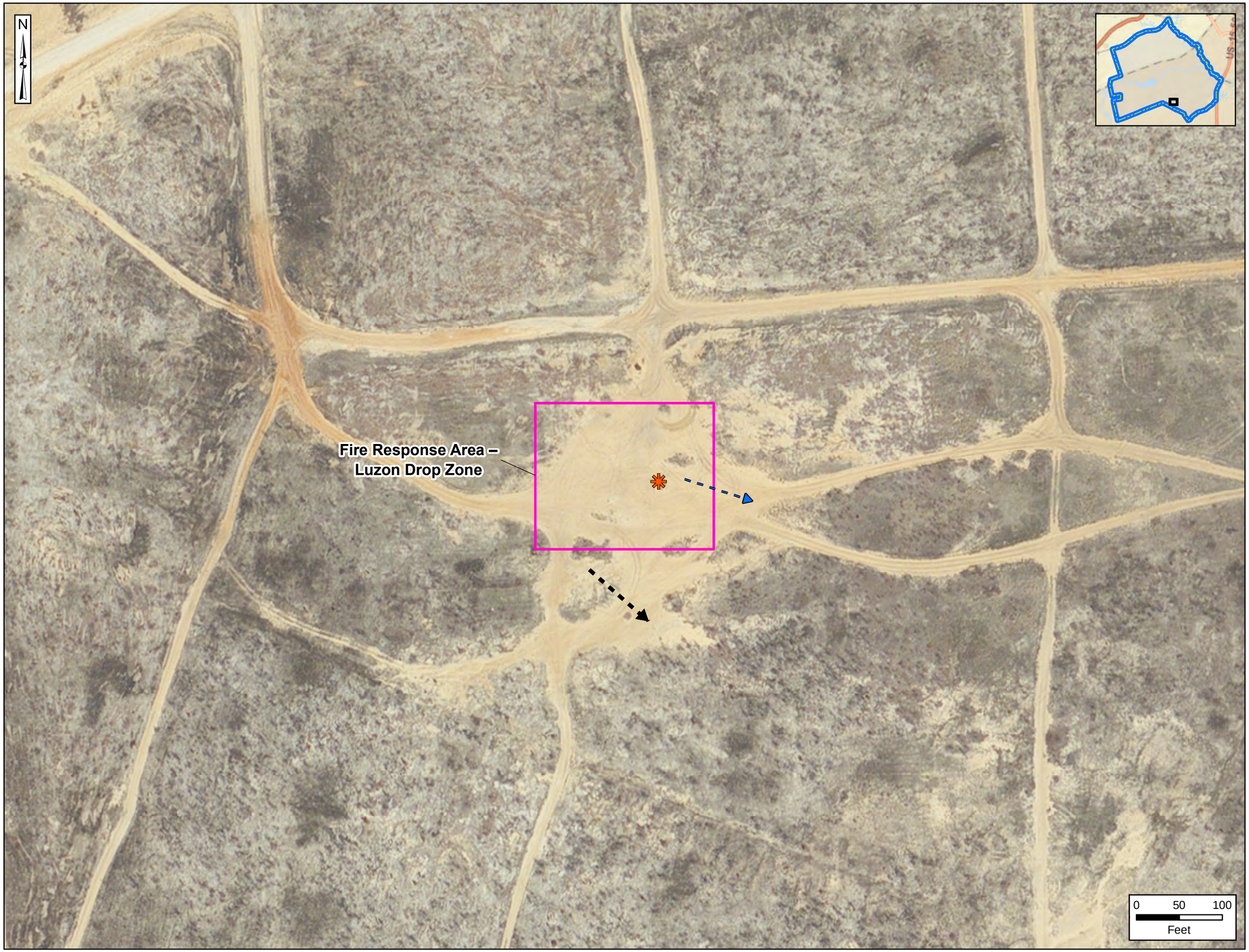
- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Presumed Surface Runoff Flow Direction

AOPI = area of potential interest

Note: The AOPI location was provided by the Fort Bragg Fire Department. The location of the fire should lie somewhere central to drawn boundary.

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North



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Fort Bragg, NC

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Figure 5-32
Aerial Photo of
Fire Response Area – Luzon Drop Zone

Legend

- Camp Mackall
- AOPI
- Fire Location
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Presumed Surface Runoff Flow Direction

AOPI = area of potential interest

Note: The location of the fire was provided by Range personnel eyewitnesses.

Data Sources:
Fort Bragg, GIS Data, 2018
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

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

Legend

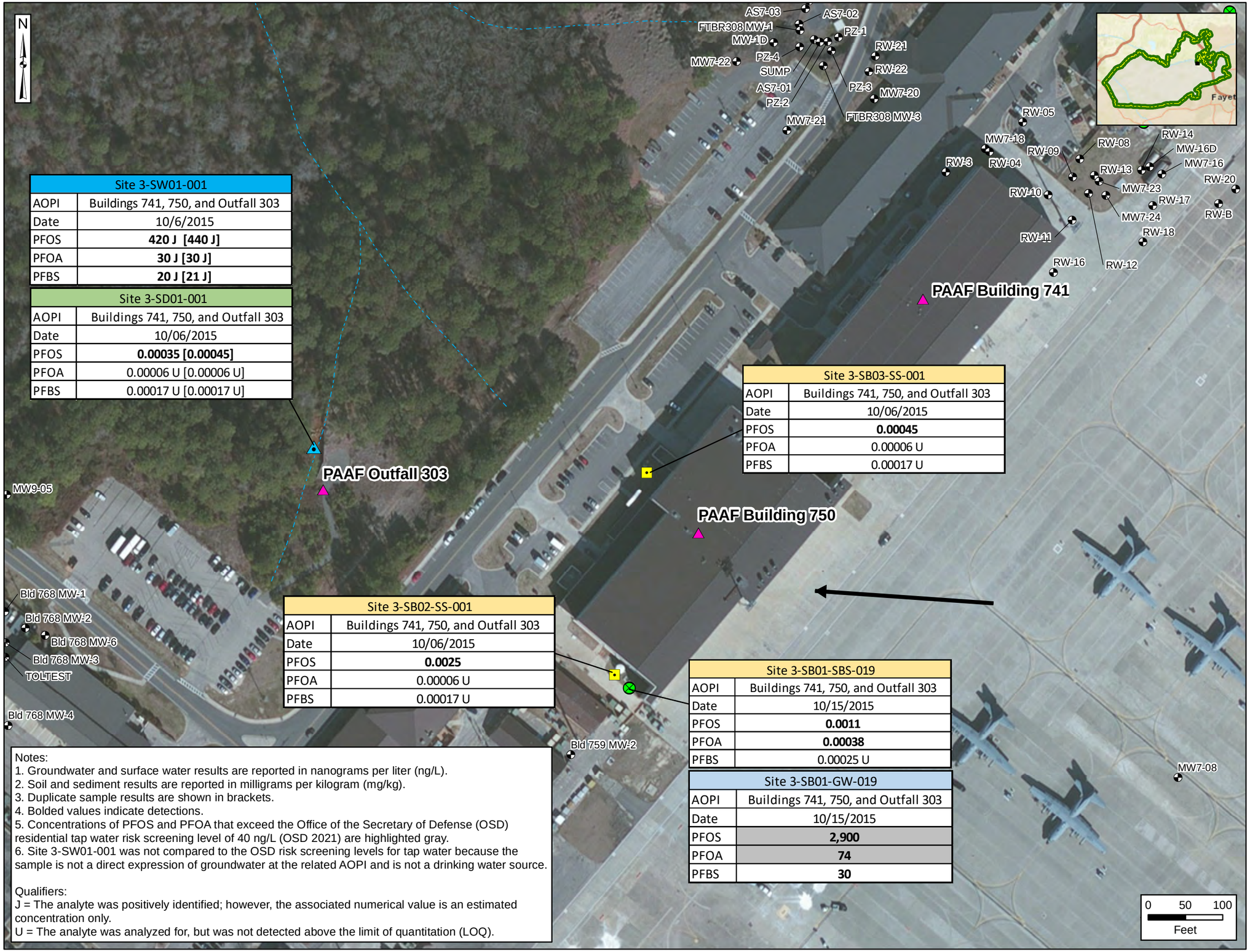
- Fort Bragg Installation Boundary
- Camp Mackall
- AOPI Location
- PA/SI AOPI with OSD Risk Screening Level Exceedance
- AOPI with Established Historical PFAS Contamination
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body

AOPI = area of potential interest
OSD = Office of the Secretary of Defense
PA/SI = Preliminary Assessment/Site Inspection
PAAF = Pope Army Airfield
PFAS = per- and polyfluoroalkyl substances
SAAF = Simmons Army Airfield

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

Camp Mackall - Fire Station #4 (Building T-2766)
Fire Response Area – Luzon Drop Zone
Fire Station #8
Fire Response Area – Range 78
Fire Station #6
Hush House (Building 532)
PAAF Building 708 and Retention Pond
PAAF Building 712
PAAF Building 722
PAAF Building 724
PAAF Building 726
PAAF Building 732
PAAF Building 734/736 (Nosedock #5)
PAAF Building 741
PAAF Building 750
PAAF Outfall 303
PAAF Green Ramp Crash Site
PAAF Taxiway M Crash Site
Former Wastewater Treatment Plant
Original Fire Station (Building 300)
Fire Station #7 (Building 250) and Foam Shed
PAAF Building 173
PAAF Building R-3065
Former Firefighting Training Area #4
Joint Firefighting Training Area and Retention Pond
Biosolid Application Area at Honeycutt Road
World War II Era Fire Station B (Woodruff Street and Reilly Road)
World War II Era Fire Station C (Honeycutt Road and Blackjack Street)
Sicily Drop Zone
Former Fire Station #3
Fire Station #3 (Building B-7002)
Former Fire Station #1
World War II Era Fire Station A (Normandy and Sicily Drive)
Fire Station #1 (Building 6-9572) & Knox Street Fire Training Pits
SAAF Building P3007
SAAF Building P3807 and Retention Pond
Fire Station #2 (Building P-4539)
SAAF Building P7937
SAAF Building P8944
SAAF Building P9647 and Retention Pond
Fire Station #5 (Building E-3673)



Site 3-SW01-001	
AOPI	Buildings 741, 750, and Outfall 303
Date	10/6/2015
PFOS	**420 J [440 J]**
PFOA	**30 J [30 J]**
PFBS	**20 J [21 J]**

Site 3-SD01-001	
AOPI	Buildings 741, 750, and Outfall 303
Date	10/06/2015
PFOS	**0.00035 [0.00045]**
PFOA	0.00006 U [0.00006 U]
PFBS	0.00017 U [0.00017 U]

Site 3-SB03-SS-001	
AOPI	Buildings 741, 750, and Outfall 303
Date	10/06/2015
PFOS	**0.00045**
PFOA	0.00006 U
PFBS	0.00017 U

Site 3-SB02-SS-001	
AOPI	Buildings 741, 750, and Outfall 303
Date	10/06/2015
PFOS	**0.0025**
PFOA	0.00006 U
PFBS	0.00017 U

Site 3-SB01-SBS-019	
AOPI	Buildings 741, 750, and Outfall 303
Date	10/15/2015
PFOS	**0.0011**
PFOA	**0.00038**
PFBS	0.00025 U

Site 3-SB01-GW-019	
AOPI	Buildings 741, 750, and Outfall 303
Date	10/15/2015
PFOS	**2,900**
PFOA	**74**
PFBS	**30**

Notes:
1. Groundwater and surface water results are reported in nanograms per liter (ng/L).
2. Soil and sediment results are reported in milligrams per kilogram (mg/kg).
3. Duplicate sample results are shown in brackets.
4. Bolded values indicate detections.
5. 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.
6. Site 3-SW01-001 was not compared to the OSD risk screening levels for tap water because the sample is not a direct expression of groundwater at the related AOPI and is not a drinking water source.

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).

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Figure 7-2 PAAF Outfall 303, PAAF Building 750, and PAAF Building 741 PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI Location
- Monitoring Well
- Stream (Intermittent)
- Approximate Groundwater Flow Direction

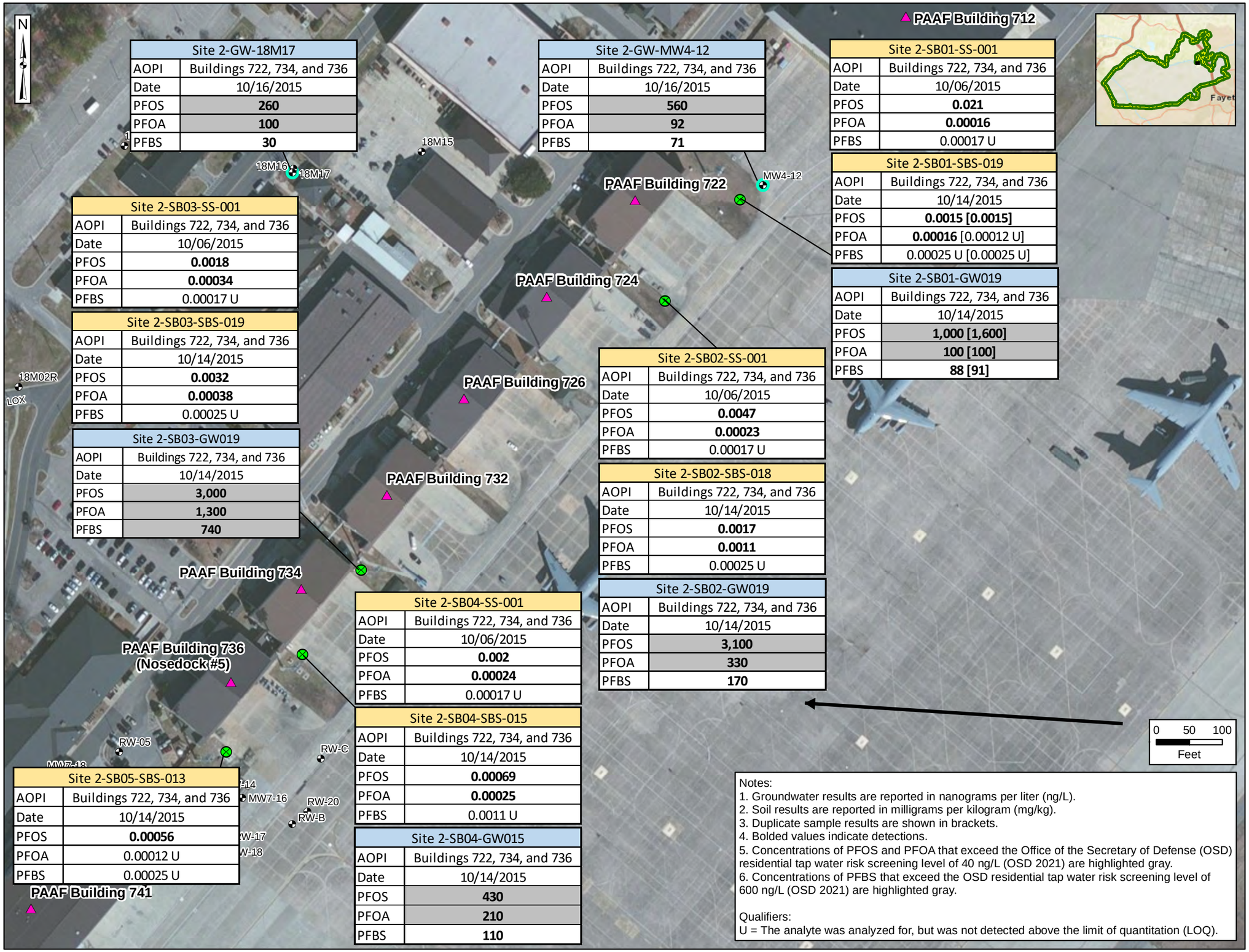
Historical Sampling Locations

- Surface Water / Sediment
- Surface Soil
- Soil/Groundwater

AOPI = area of potential interest
GW = groundwater
PAAF = Pope Army Airfield
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SBS = subsurface soil
SD = sediment
SS = surface soil
SW = surface water

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
SCFS, 2016
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North



Site 2-GW-18M17	
AOPI	Buildings 722, 734, and 736
Date	10/16/2015
PFOS	**260**
PFOA	**100**
PFBS	**30**

Site 2-GW-MW4-12	
AOPI	Buildings 722, 734, and 736
Date	10/16/2015
PFOS	**560**
PFOA	**92**
PFBS	**71**

Site 2-SB01-SS-001	
AOPI	Buildings 722, 734, and 736
Date	10/06/2015
PFOS	**0.021**
PFOA	**0.00016**
PFBS	0.00017 U

Site 2-SB01-SBS-019	
AOPI	Buildings 722, 734, and 736
Date	10/14/2015
PFOS	**0.0015 [0.0015]**
PFOA	**0.00016** [0.00012 U]
PFBS	0.00025 U [0.00025 U]

Site 2-SB01-GW019	
AOPI	Buildings 722, 734, and 736
Date	10/14/2015
PFOS	**1,000 [1,600]**
PFOA	**100 [100]**
PFBS	**88 [91]**

Site 2-SB03-SS-001	
AOPI	Buildings 722, 734, and 736
Date	10/06/2015
PFOS	**0.0018**
PFOA	**0.00034**
PFBS	0.00017 U

Site 2-SB03-SBS-019	
AOPI	Buildings 722, 734, and 736
Date	10/14/2015
PFOS	**0.0032**
PFOA	**0.00038**
PFBS	0.00025 U

Site 2-SB03-GW019	
AOPI	Buildings 722, 734, and 736
Date	10/14/2015
PFOS	**3,000**
PFOA	**1,300**
PFBS	**740**

Site 2-SB02-SS-001	
AOPI	Buildings 722, 734, and 736
Date	10/06/2015
PFOS	**0.0047**
PFOA	**0.00023**
PFBS	0.00017 U

Site 2-SB02-SBS-018	
AOPI	Buildings 722, 734, and 736
Date	10/14/2015
PFOS	**0.0017**
PFOA	**0.0011**
PFBS	0.00025 U

Site 2-SB02-GW019	
AOPI	Buildings 722, 734, and 736
Date	10/14/2015
PFOS	**3,100**
PFOA	**330**
PFBS	**170**

Site 2-SB04-SS-001	
AOPI	Buildings 722, 734, and 736
Date	10/06/2015
PFOS	**0.002**
PFOA	**0.00024**
PFBS	0.00017 U

Site 2-SB04-SBS-015	
AOPI	Buildings 722, 734, and 736
Date	10/14/2015
PFOS	**0.00069**
PFOA	**0.00025**
PFBS	0.0011 U

Site 2-SB04-GW015	
AOPI	Buildings 722, 734, and 736
Date	10/14/2015
PFOS	**430**
PFOA	**210**
PFBS	**110**

Site 2-SB05-SBS-013	
AOPI	Buildings 722, 734, and 736
Date	10/14/2015
PFOS	**0.00056**
PFOA	0.00012 U
PFBS	0.00025 U

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.
5. 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.
6. Concentrations of PFBS that exceed the OSD residential tap water risk screening level of 600 ng/L (OSD 2021) are highlighted gray.

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

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Figure 7-3
PAAF Buildings 734/736 (Nosedock #5), 732, 726, 724, and 722 PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI Location
- Monitoring Well
- Approximate Groundwater Flow Direction

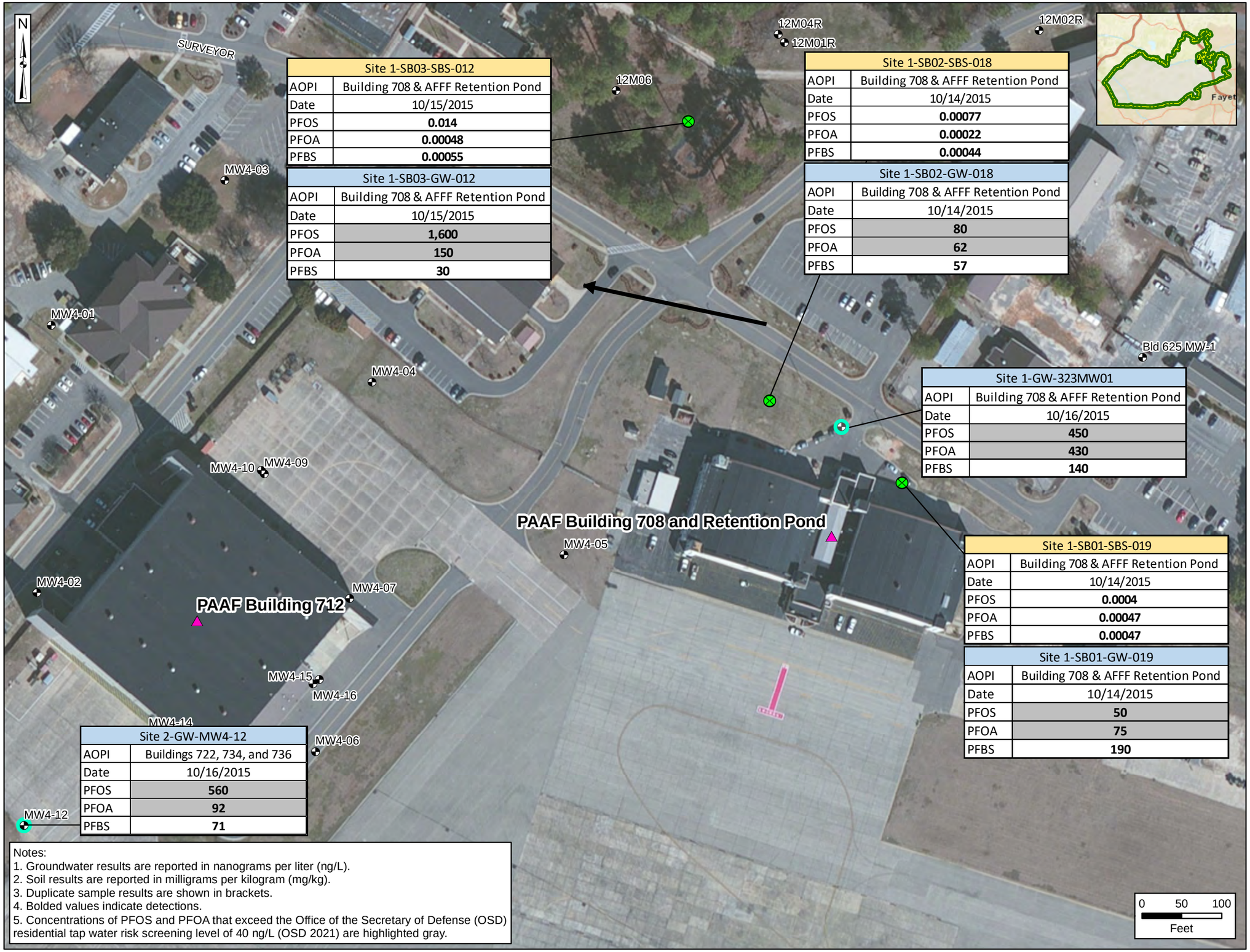
Historical Sampling Locations

- Soil/Groundwater
- Groundwater (Well)

AOPI = area of potential interest
GW = groundwater
PAAF = Pope Army Airfield
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SBS = subsurface soil
SS = surface soil

Data Sources:
Fort Bragg, GIS Data, 2018
SCFS, 2016
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North



Site 1-SB03-SBS-012	
AOPI	Building 708 & AFFF Retention Pond
Date	10/15/2015
PFOS	**0.014**
PFOA	**0.00048**
PFBS	**0.00055**

Site 1-SB03-GW-012	
AOPI	Building 708 & AFFF Retention Pond
Date	10/15/2015
PFOS	**1,600**
PFOA	**150**
PFBS	**30**

Site 1-SB02-SBS-018	
AOPI	Building 708 & AFFF Retention Pond
Date	10/14/2015
PFOS	**0.00077**
PFOA	**0.00022**
PFBS	**0.00044**

Site 1-SB02-GW-018	
AOPI	Building 708 & AFFF Retention Pond
Date	10/14/2015
PFOS	**80**
PFOA	**62**
PFBS	**57**

Site 1-GW-323MW01	
AOPI	Building 708 & AFFF Retention Pond
Date	10/16/2015
PFOS	**450**
PFOA	**430**
PFBS	**140**

Site 1-SB01-SBS-019	
AOPI	Building 708 & AFFF Retention Pond
Date	10/14/2015
PFOS	**0.0004**
PFOA	**0.00047**
PFBS	**0.00047**

Site 1-SB01-GW-019	
AOPI	Building 708 & AFFF Retention Pond
Date	10/14/2015
PFOS	**50**
PFOA	**75**
PFBS	**190**

Site 2-GW-MW4-12	
AOPI	Buildings 722, 734, and 736
Date	10/16/2015
PFOS	**560**
PFOA	**92**
PFBS	**71**

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.
5. 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.

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Figure 7-4
PAAF Buildings 712 and 708 and Retention Pond PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI Location
- Monitoring Well
- Monitoring Well - Abandoned
- Approximate Groundwater Flow Direction

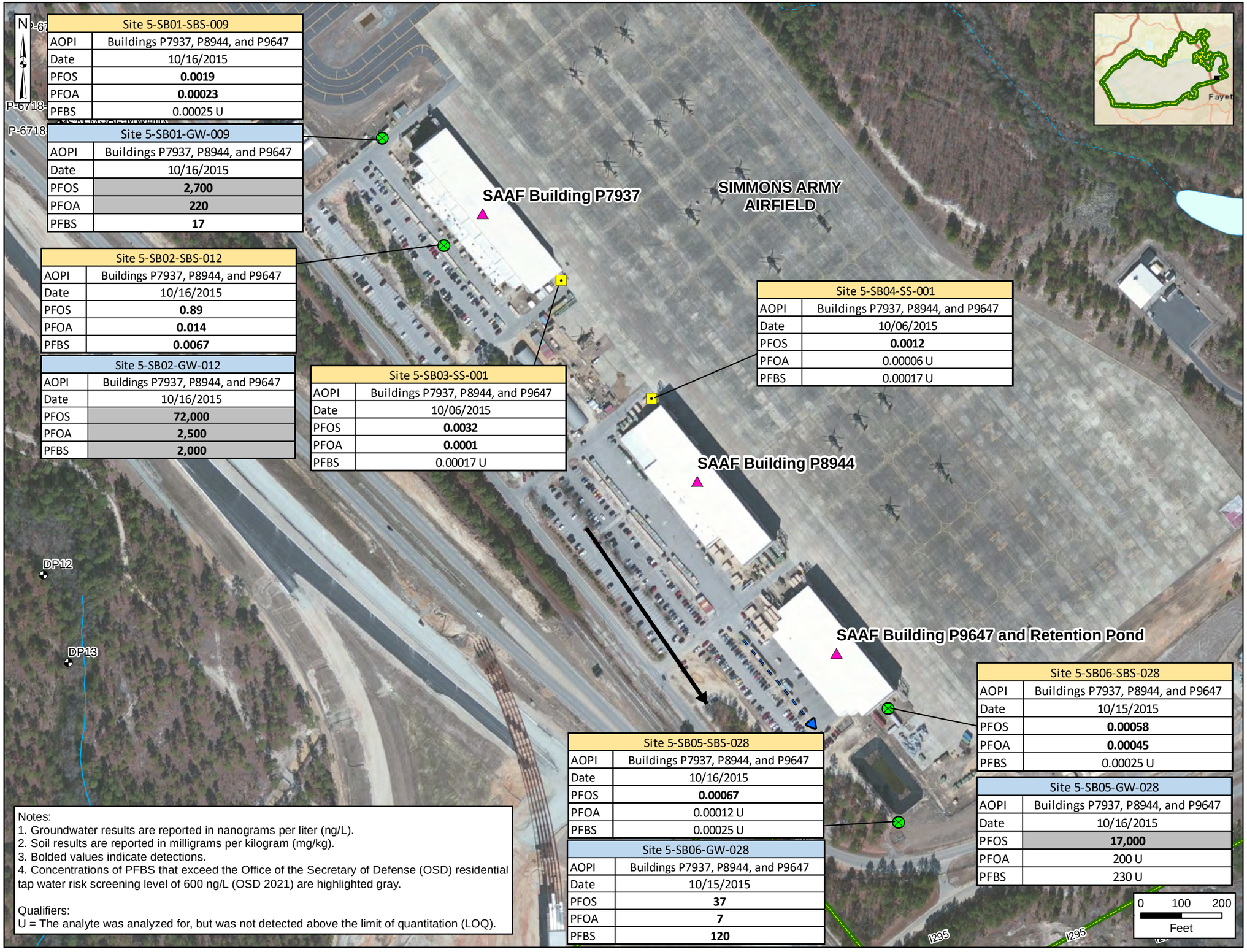
Historical Sampling Locations

- Soil/Groundwater
- Groundwater (Well)

AOPI = area of potential interest
GW = groundwater
PAAF = Pope Army Airfield
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SBS = subsurface soil

Data Sources:
Fort Bragg, GIS Data, 2018
SCFS, 2016
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North



Site 5-SB01-SBS-009	
AOPI	Buildings P7937, P8944, and P9647
Date	10/16/2015
PFOS	**0.0019**
PFOA	**0.00023**
PFBS	0.00025 U

Site 5-SB01-GW-009	
AOPI	Buildings P7937, P8944, and P9647
Date	10/16/2015
PFOS	**2,700**
PFOA	**220**
PFBS	**17**

Site 5-SB02-SBS-012	
AOPI	Buildings P7937, P8944, and P9647
Date	10/16/2015
PFOS	**0.89**
PFOA	**0.014**
PFBS	**0.0067**

Site 5-SB02-GW-012	
AOPI	Buildings P7937, P8944, and P9647
Date	10/16/2015
PFOS	**72,000**
PFOA	**2,500**
PFBS	**2,000**

Site 5-SB03-SS-001	
AOPI	Buildings P7937, P8944, and P9647
Date	10/06/2015
PFOS	**0.0032**
PFOA	**0.0001**
PFBS	0.00017 U

Site 5-SB04-SS-001	
AOPI	Buildings P7937, P8944, and P9647
Date	10/06/2015
PFOS	**0.0012**
PFOA	0.00006 U
PFBS	0.00017 U

Site 5-SB05-SBS-028	
AOPI	Buildings P7937, P8944, and P9647
Date	10/16/2015
PFOS	**0.00067**
PFOA	0.00012 U
PFBS	0.00025 U

Site 5-SB05-GW-028	
AOPI	Buildings P7937, P8944, and P9647
Date	10/16/2015
PFOS	**17,000**
PFOA	200 U
PFBS	230 U

Site 5-SB06-SBS-028	
AOPI	Buildings P7937, P8944, and P9647
Date	10/15/2015
PFOS	**0.00058**
PFOA	**0.00045**
PFBS	0.00025 U

Site 5-SB06-GW-028	
AOPI	Buildings P7937, P8944, and P9647
Date	10/15/2015
PFOS	**37**
PFOA	**7**
PFBS	**120**

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 PFBS that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 600 ng/L (OSD 2021) are highlighted gray.

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

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Figure 7-5
SAAF Building P7937, SAAF Building P8944, and SAAF Building P9647 and Retention Pond
PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI Location
- Monitoring Well
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Assumed Surface Runoff Flow Direction

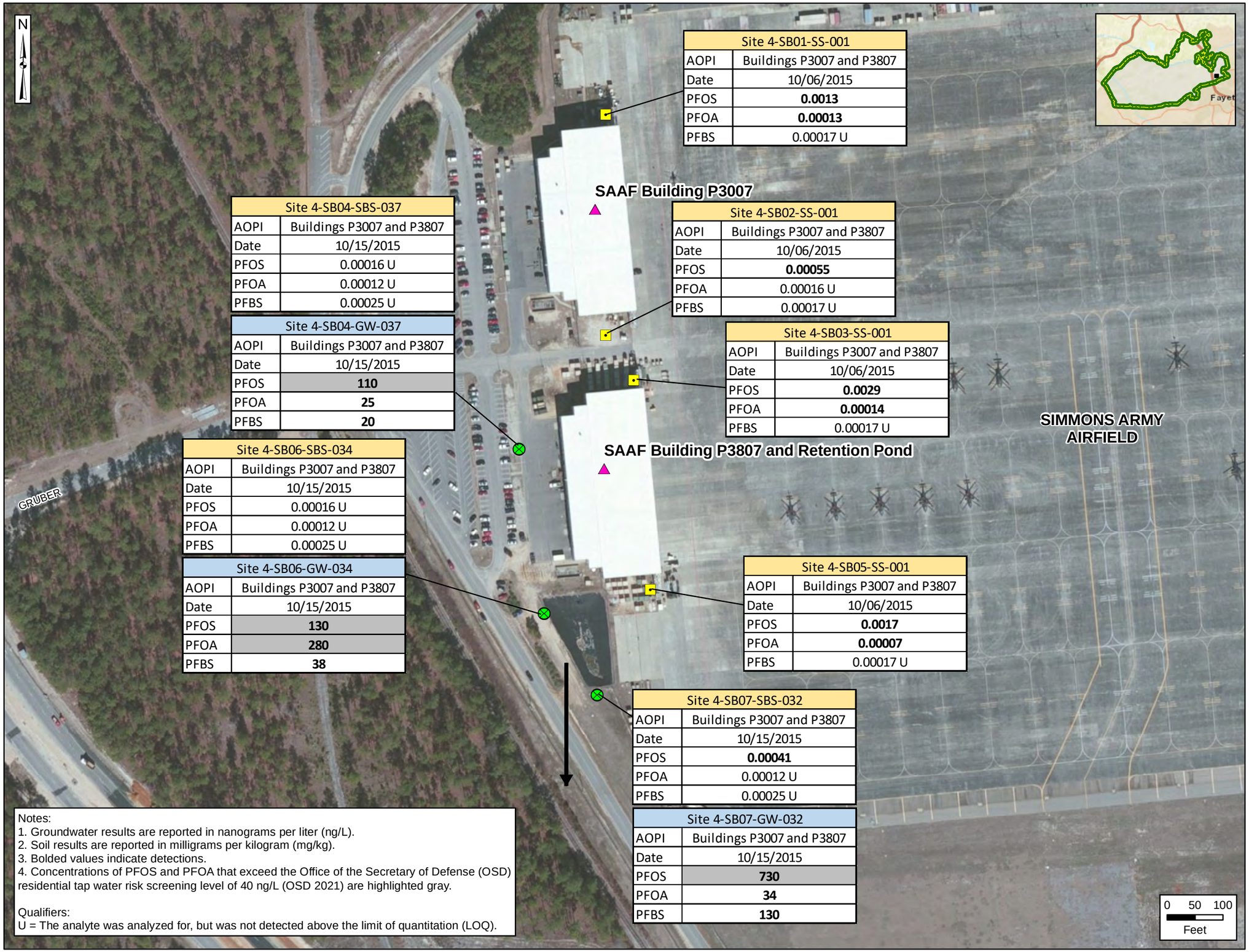
Historical Sampling Locations

- Surface Soil
- Soil/Groundwater

AOPI = area of potential interest
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SAAF = Simmons Army Airfield
SBS = subsurface soil
SS = surface soil

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
SCFS, 2016
Google Earth, Aerial Imagery, 2019

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

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Figure 7-6
SAAF Building P3807 and Retention Pond and SAAF Building P3007 PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI Location
- Approximate Groundwater Flow Direction

Historical Sampling Locations

- Surface Soil
- Soil/Groundwater

AOPI = area of potential interest
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SAAF = Simmons Army Airfield
SBS = subsurface soil
SS = surface soil

Data Sources:
Fort Bragg, GIS Data, 2018
SCFS, 2016
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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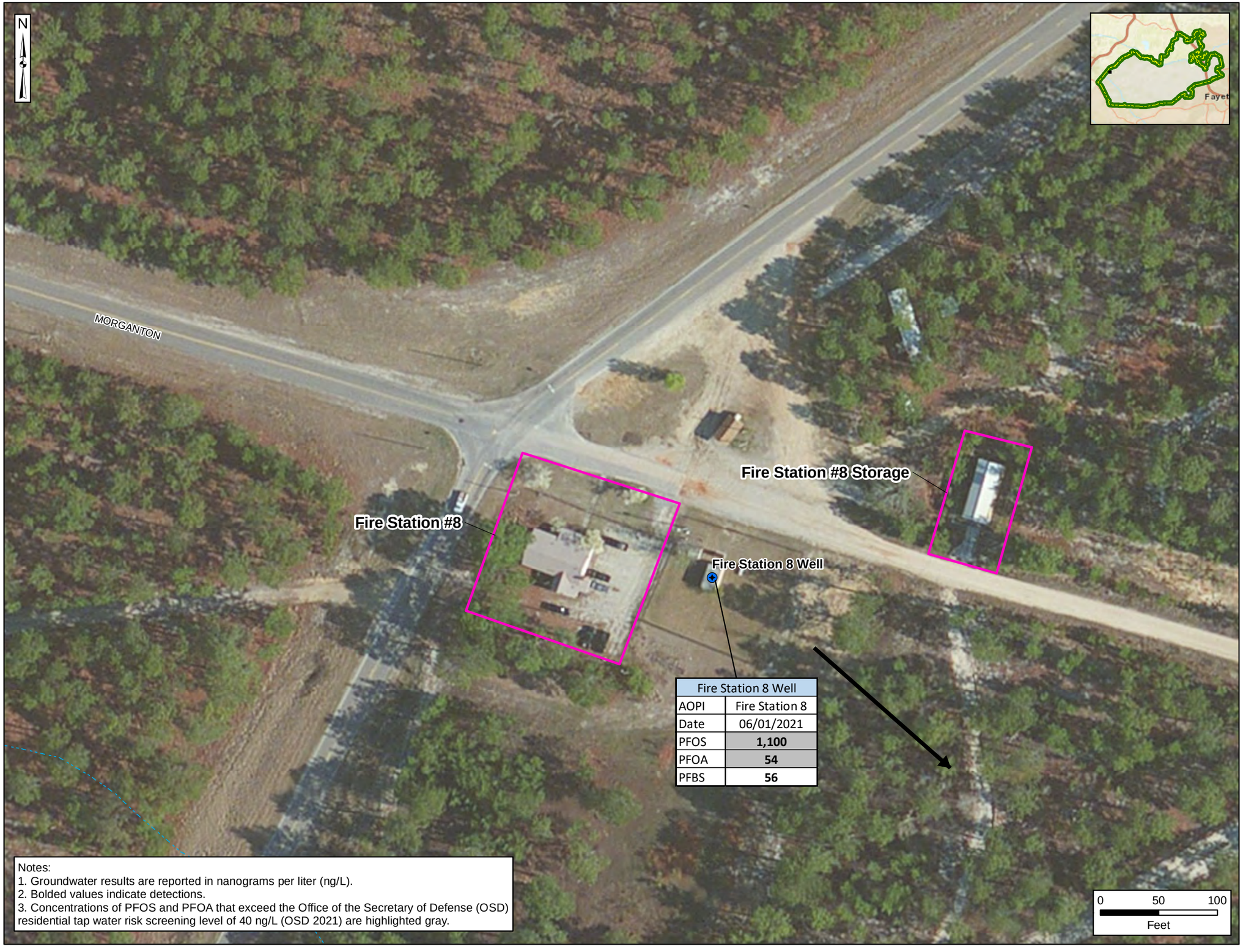
Figure 7-7
Fire Station #8
PFOS, PFOA, and PFBS Analytical Results



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Bolded values indicate detections.
3. 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.

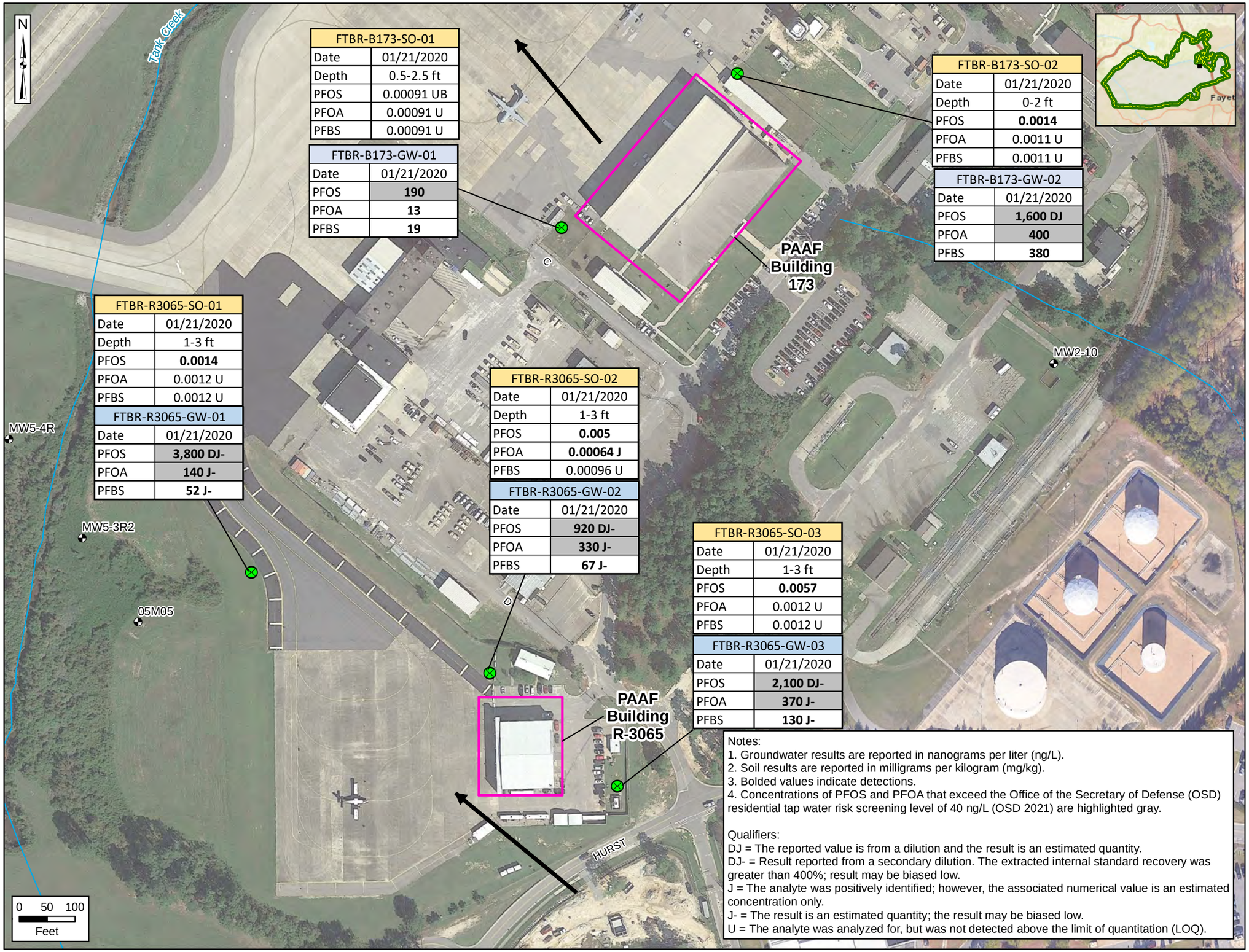
Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Water Supply Well

AOPI = area of potential interest

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

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:
DJ = The reported value is from a dilution and the result is an estimated quantity.
DJ- = 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 low.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

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Figure 7-8
PAAF Building R-3065 and PAAF Building 173 PFOS, PFOA, and PFBS Analytical Results

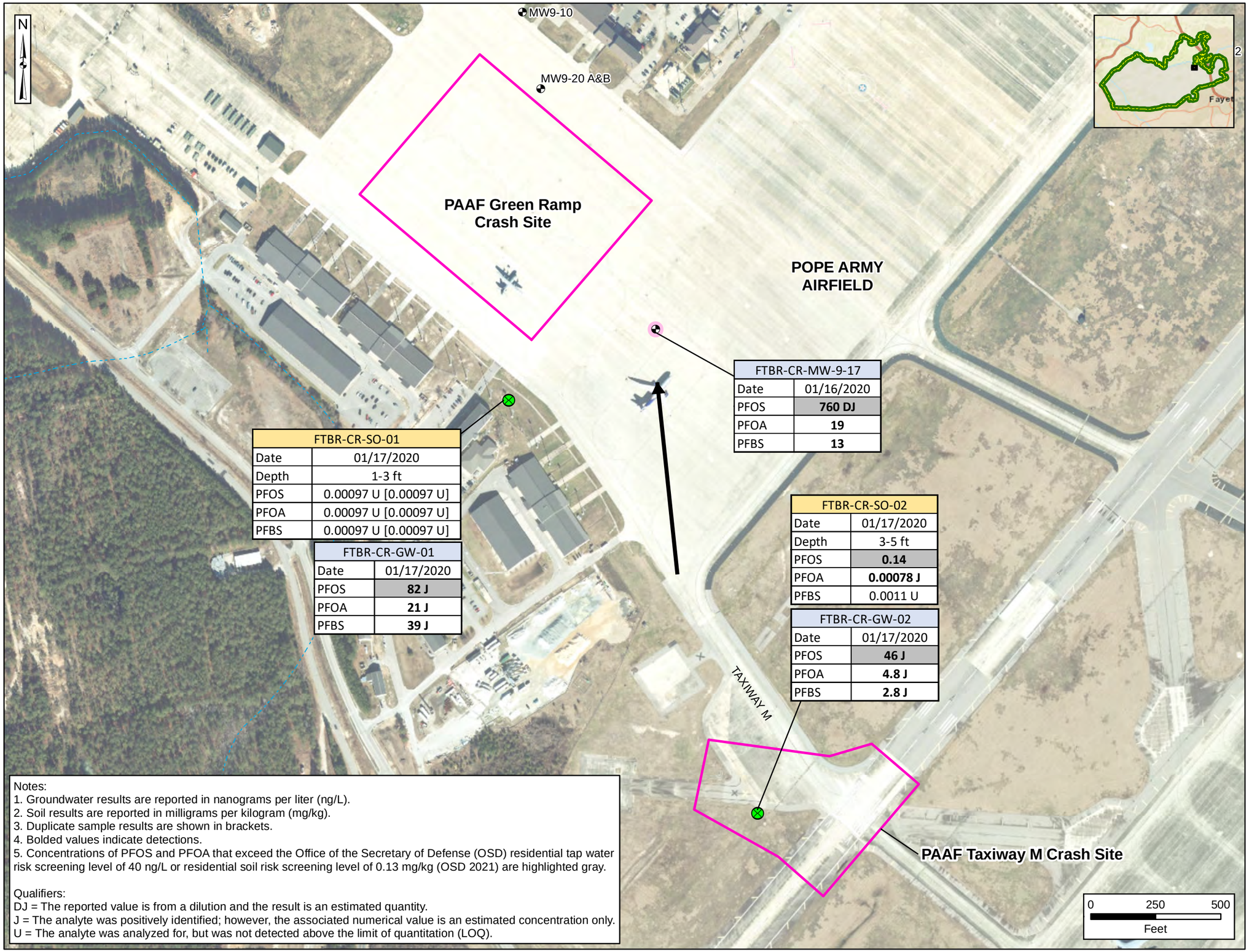
Legend

- Installation Boundary
- AOPI
- Monitoring Well
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Soil and Groundwater Sampling Location

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

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North



FTBR-CR-SO-01	
Date	01/17/2020
Depth	1-3 ft
PFOS	0.00097 U [0.00097 U]
PFOA	0.00097 U [0.00097 U]
PFBS	0.00097 U [0.00097 U]

FTBR-CR-GW-01	
Date	01/17/2020
PFOS	**82 J**
PFOA	**21 J**
PFBS	**39 J**

FTBR-CR-MW-9-17	
Date	01/16/2020
PFOS	**760 DJ**
PFOA	**19**
PFBS	**13**

FTBR-CR-SO-02	
Date	01/17/2020
Depth	3-5 ft
PFOS	**0.14**
PFOA	**0.00078 J**
PFBS	0.0011 U

FTBR-CR-GW-02	
Date	01/17/2020
PFOS	**46 J**
PFOA	**4.8 J**
PFBS	**2.8 J**

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.
5. 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.

Qualifiers:
DJ = The reported value is from a dilution and the result is an estimated quantity.
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).

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Figure 7-9
PAAF Green Ramp and PAAF Taxiway M Crash Sites PFOS, PFOA, and PFBS Analytical Results

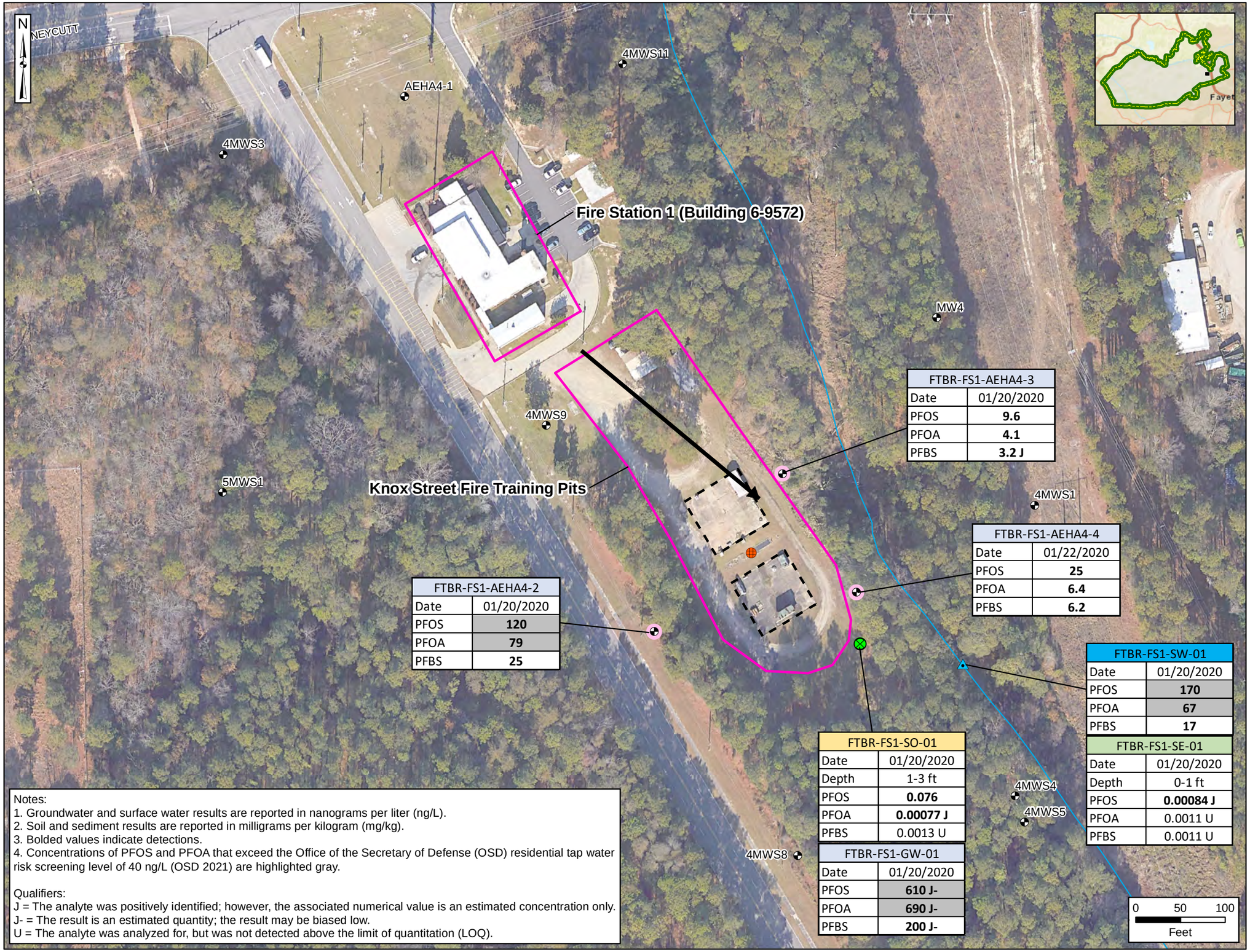
Legend

- Installation Boundary
- AOPI
- Monitoring Well
- Stream (Intermittent)
- Approximate Groundwater Flow Direction
- Soil and Groundwater Sampling Location
- Groundwater Sampling Location (Existing Monitoring Well)

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

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 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 and sediment 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.
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).

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Figure 7-10
Fire Station #1 (Building 6-9572) and Knox Street Fire Training Pits
PFOS, PFOA, and PFBS Analytical Results

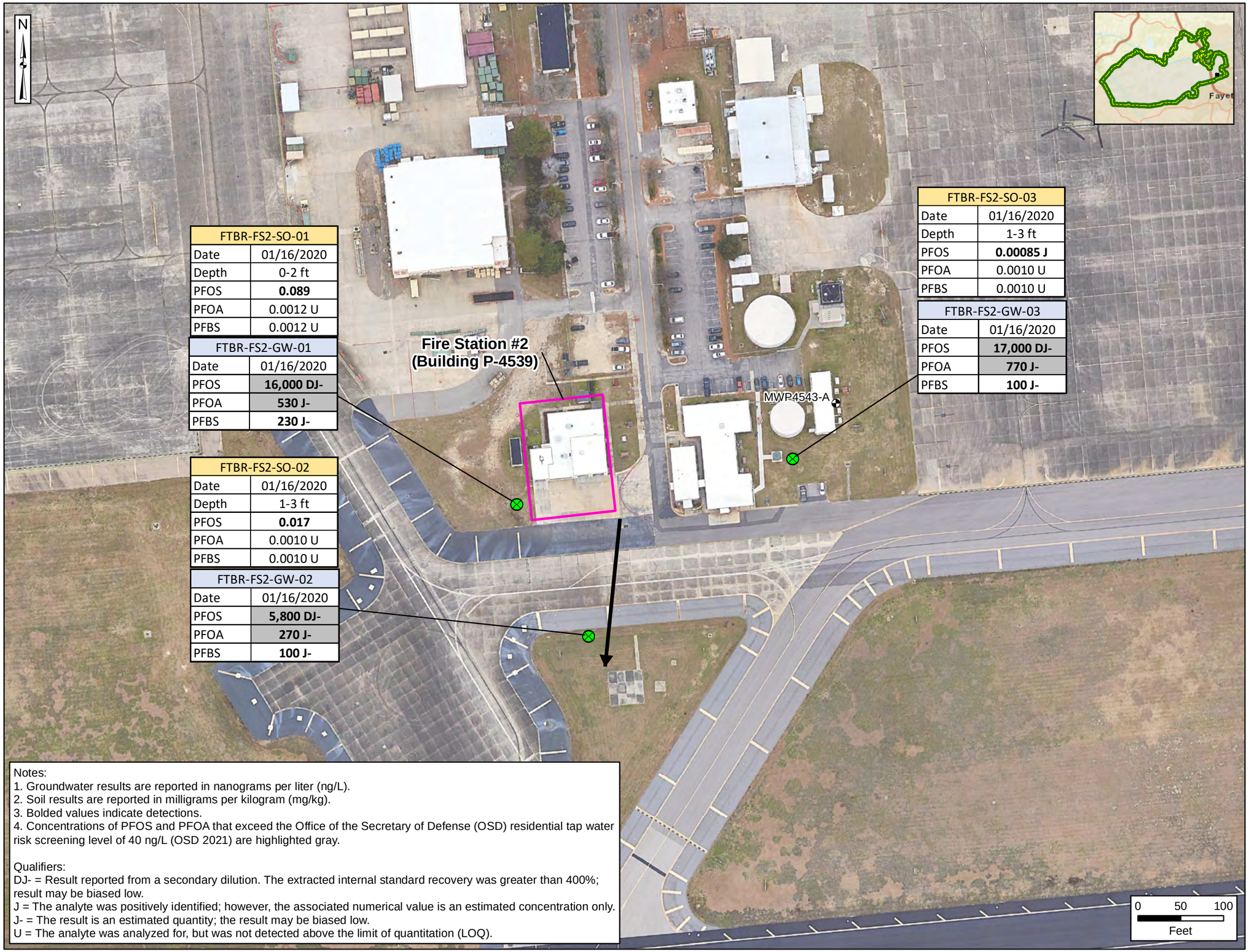
Legend

- Installation Boundary
- AOPI
- Former Fire Training Pit
- Monitoring Well
- Oil/Water Separator
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Soil and Groundwater Sampling Location
- Groundwater Sampling Location (Existing Monitoring Well)

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

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North



FTBR-FS2-SO-01	
Date	01/16/2020
Depth	0-2 ft
PFOS	**0.089**
PFOA	0.0012 U
PFBS	0.0012 U

FTBR-FS2-GW-01	
Date	01/16/2020
PFOS	**16,000 DJ-**
PFOA	**530 J-**
PFBS	**230 J-**

FTBR-FS2-SO-02	
Date	01/16/2020
Depth	1-3 ft
PFOS	**0.017**
PFOA	0.0010 U
PFBS	0.0010 U

FTBR-FS2-GW-02	
Date	01/16/2020
PFOS	**5,800 DJ-**
PFOA	**270 J-**
PFBS	**100 J-**

FTBR-FS2-SO-03	
Date	01/16/2020
Depth	1-3 ft
PFOS	**0.00085 J**
PFOA	0.0010 U
PFBS	0.0010 U

FTBR-FS2-GW-03	
Date	01/16/2020
PFOS	**17,000 DJ-**
PFOA	**770 J-**
PFBS	**100 J-**

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

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Figure 7-11
Fire Station #2 (Building P-4539) PFOS, PFOA, and PFBS Analytical Results

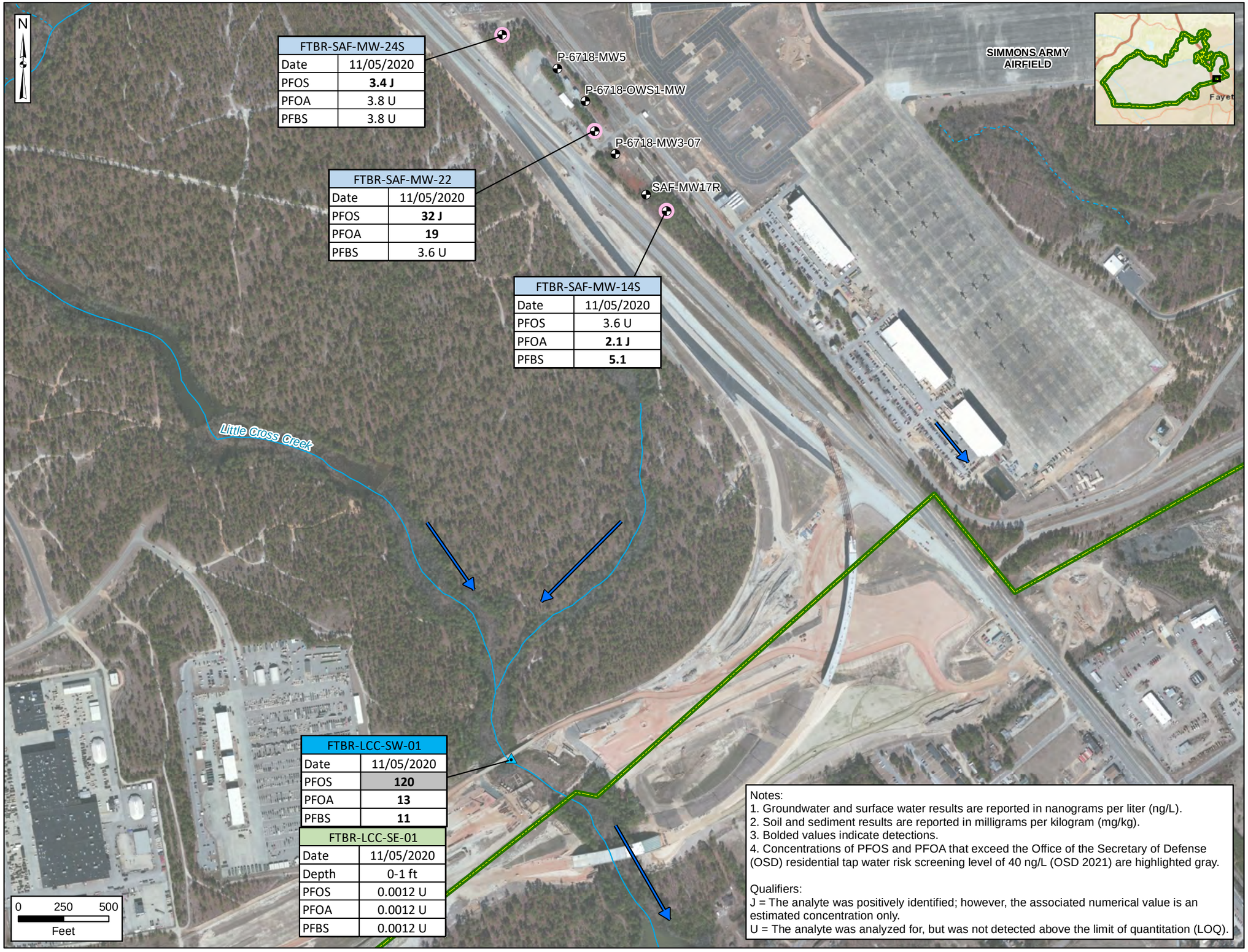
Legend

- Installation Boundary
- AOPI
- Monitoring Well - Status Unknown
- Approximate Groundwater Flow Direction
- Soil and 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:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

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 and sediment 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).

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Figure 7-12 Little Cross Creek PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- River/Stream (Perennial)
- Stream (Intermittent)
- Surface Water Flow Direction
- Monitoring Well
- Surface Water and Sediment Sampling Location
- Groundwater Sampling Location (Existing Monitoring Well)

ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil
SW = surface water

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

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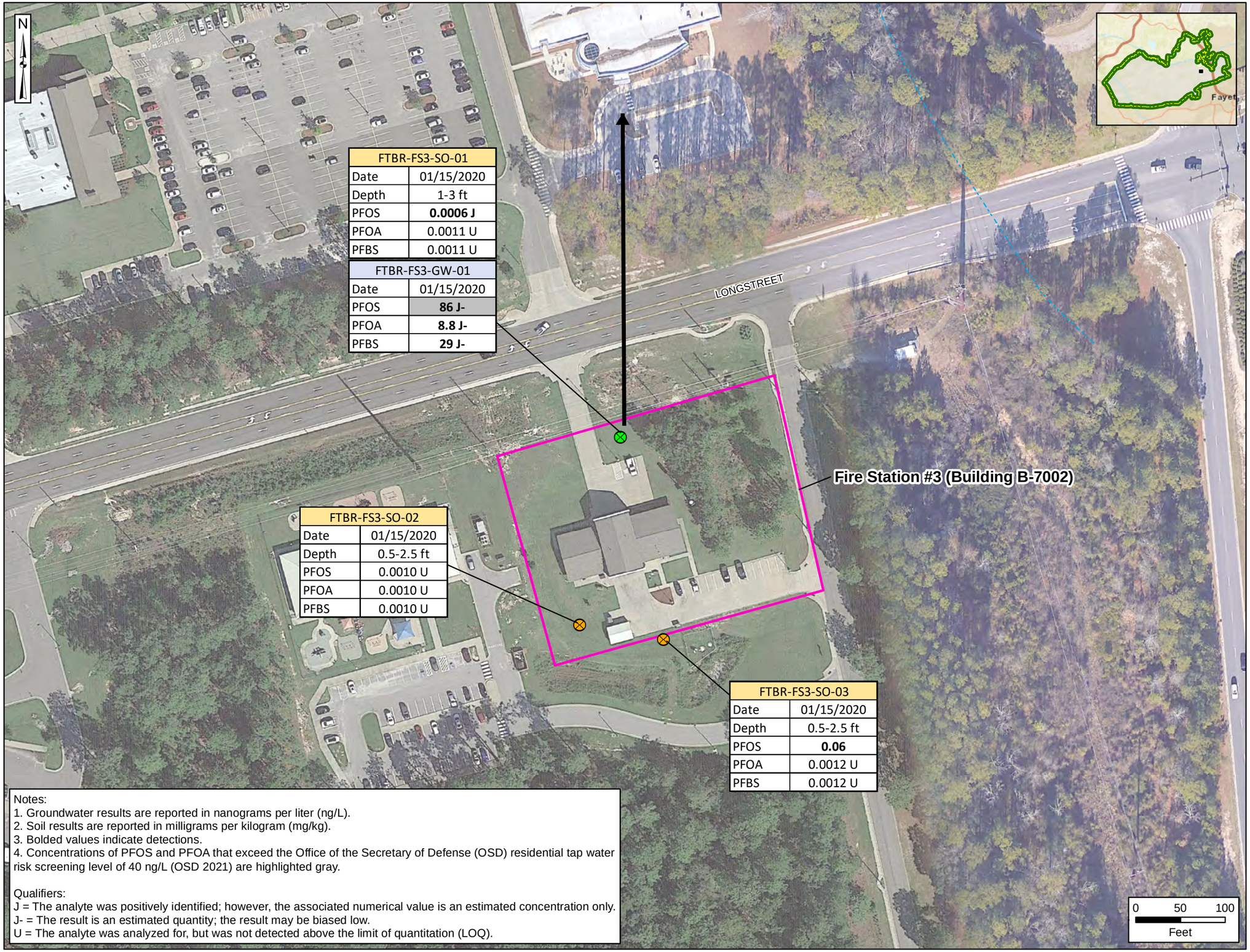
Figure 7-13
Fire Station #3 (Building B-7002) PFOS, PFOA, and PFBS Analytical Results



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.
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).

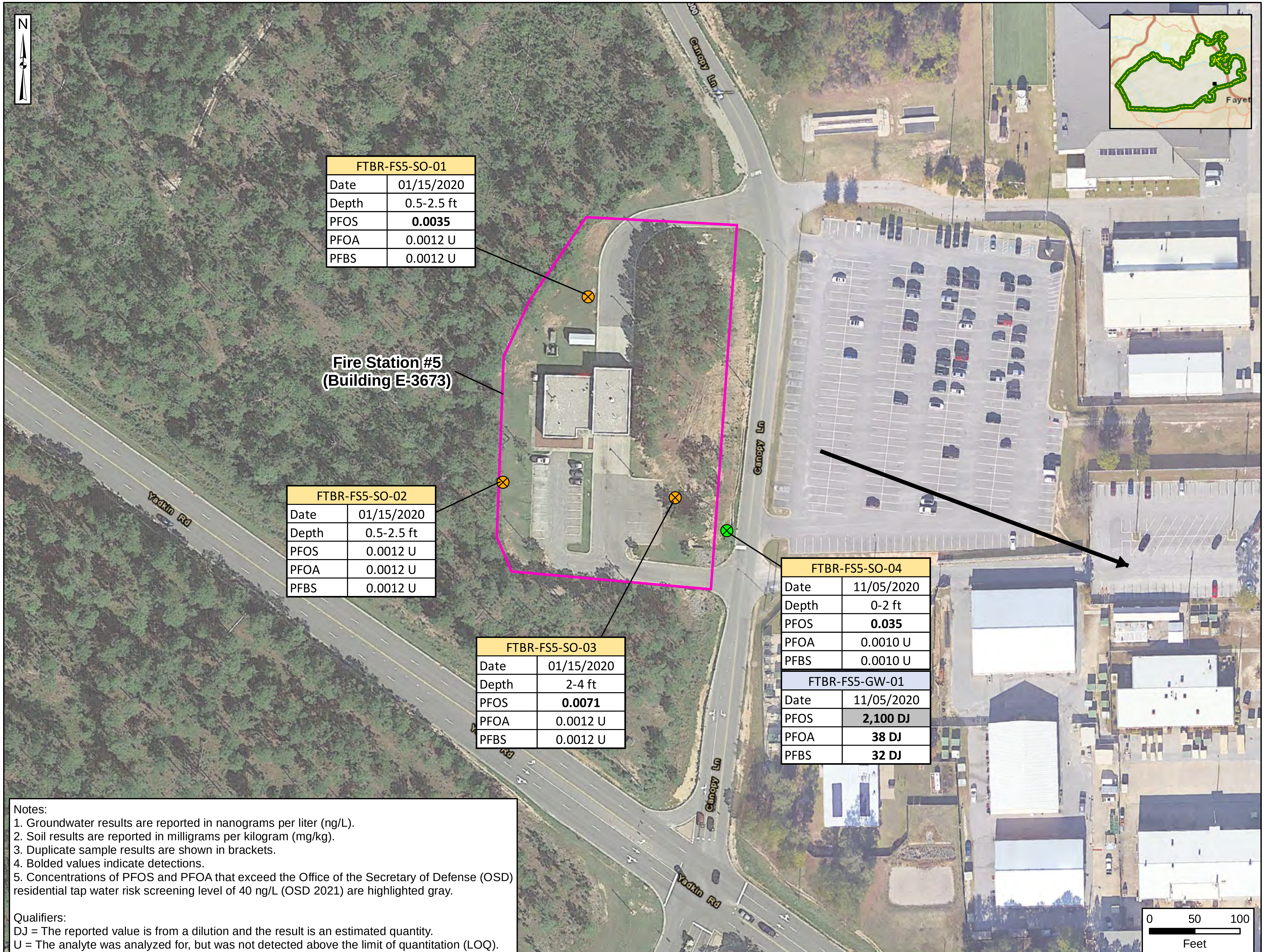
Legend

- Installation Boundary
- AOPI
- Stream (Intermittent)
- Approximate Groundwater Flow Direction
- Soil Sampling Location
- Soil and 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:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North



FTBR-FS5-SO-01	
Date	01/15/2020
Depth	0.5-2.5 ft
PFOS	**0.0035**
PFOA	0.0012 U
PFBS	0.0012 U

FTBR-FS5-SO-02	
Date	01/15/2020
Depth	0.5-2.5 ft
PFOS	0.0012 U
PFOA	0.0012 U
PFBS	0.0012 U

FTBR-FS5-SO-03	
Date	01/15/2020
Depth	2-4 ft
PFOS	**0.0071**
PFOA	0.0012 U
PFBS	0.0012 U

FTBR-FS5-SO-04	
Date	11/05/2020
Depth	0-2 ft
PFOS	**0.035**
PFOA	0.0010 U
PFBS	0.0010 U

FTBR-FS5-GW-01	
Date	11/05/2020
PFOS	**2,100 DJ**
PFOA	**38 DJ**
PFBS	**32 DJ**

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.
5. 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:
DJ = The reported value is from a dilution and the result is an estimated quantity.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

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Figure 7-14
Fire Station #5 (Building E-3673)
PFOS, PFOA, and PFBS
Analytical Results

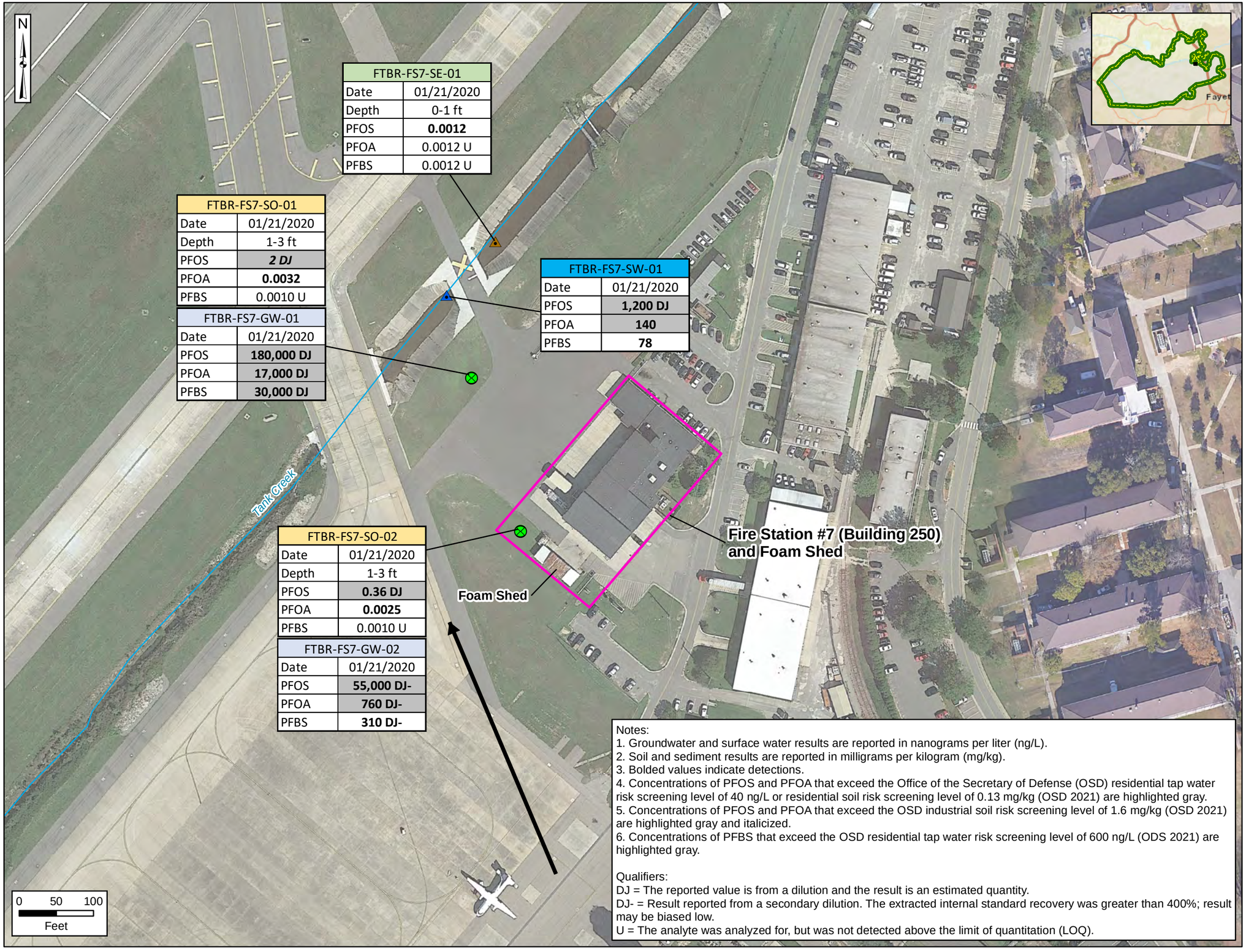
Legend

- Installation Boundary
- AOPI
- Approximate Groundwater Flow Direction
- Soil Sampling Location
- Soil and 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:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

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 and sediment 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 PFOS and PFOA that exceed the OSD industrial soil risk screening level of 1.6 mg/kg (OSD 2021) are highlighted gray and italicized.
6. Concentrations of PFBS that exceed the OSD residential tap water risk screening level of 600 ng/L (ODS 2021) are highlighted gray.

Qualifiers:
DJ = The reported value is from a dilution and the result is an estimated quantity.
DJ- = Result reported from a secondary dilution. The extracted internal standard recovery was greater than 400%; result may be biased low.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

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Figure 7-15
Fire Station #7 (Building 250) and Foam Shed
PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Soil and Groundwater Sampling Location
- Surface Water Sampling Location
- Sediment Sampling Location

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

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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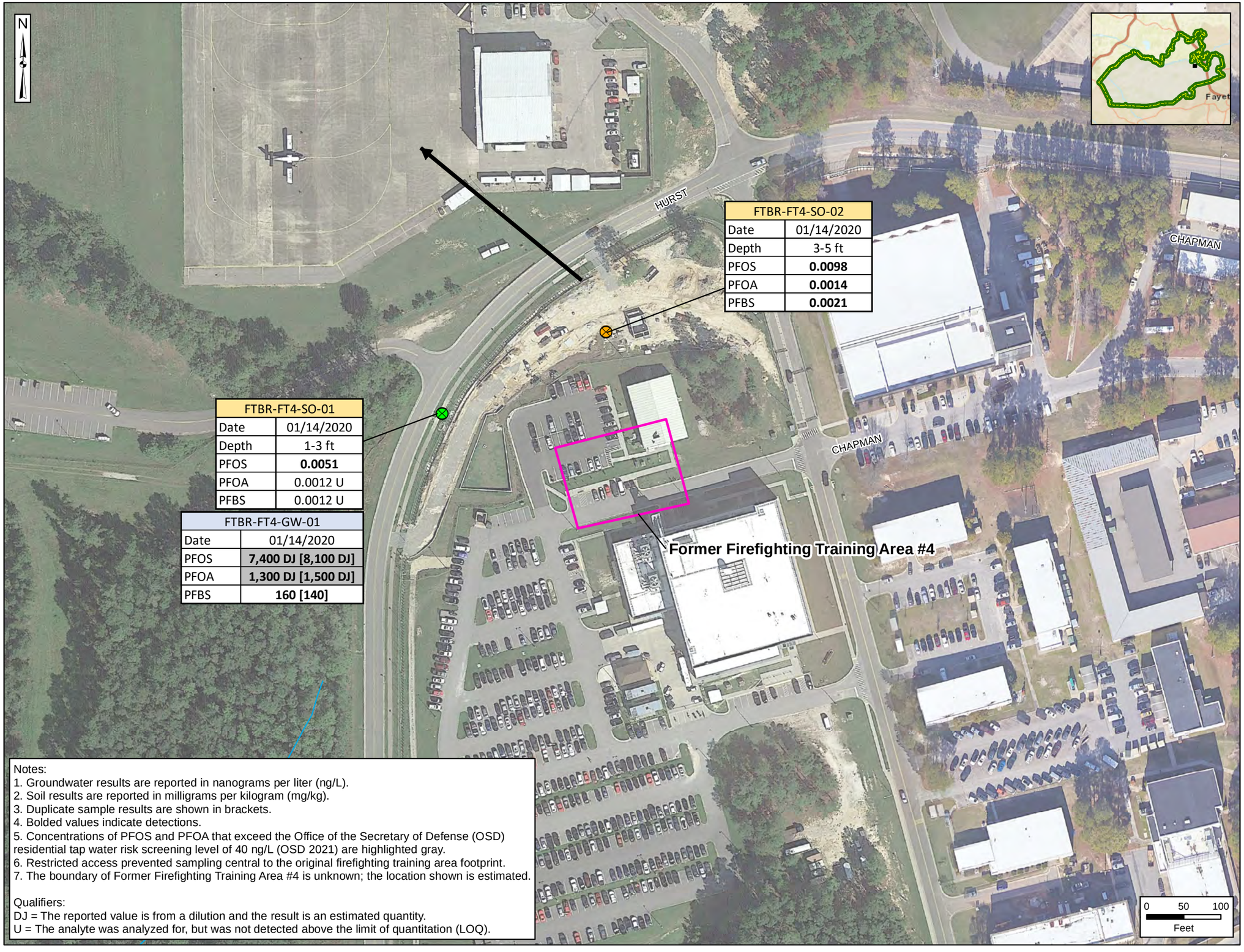
Figure 7-16
Former Firefighting Training Area #4
PFOS, PFOA, and PFBS Analytical Results



Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Soil Sampling Location
- Soil and Groundwater Sampling Location

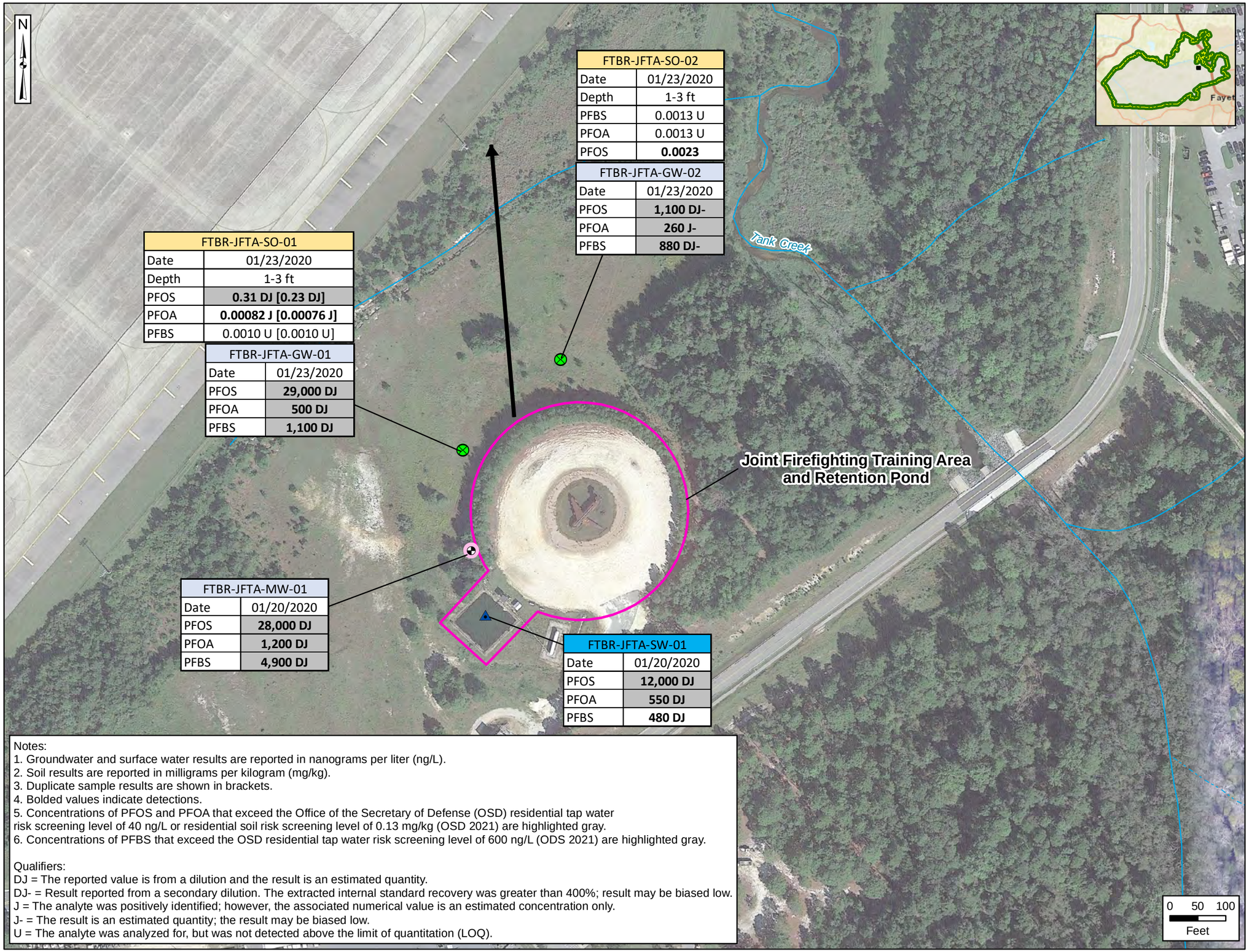
AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

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.
5. 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.
6. Restricted access prevented sampling central to the original firefighting training area footprint.
7. The boundary of Former Firefighting Training Area #4 is unknown; the location shown is estimated.

Qualifiers:
DJ = The reported value is from a dilution and the result is an estimated quantity.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

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. Duplicate sample results are shown in brackets.
4. Bolded values indicate detections.
5. 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.
6. Concentrations of PFBS that exceed the OSD residential tap water risk screening level of 600 ng/L (ODS 2021) are highlighted gray.

Qualifiers:
DJ = The reported value is from a dilution and the result is an estimated quantity.
DJ- = 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 low.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

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Figure 7-17
Joint Firefighting Training Area and Retention Pond PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI
- Monitoring Well - Active
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Surface Water Sampling Location
- Soil and Groundwater Sampling Location
- Groundwater Sampling Location (Existing Monitoring Well)

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:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 7-18
Biosolid Application Area at Honeycutt Road
PFOS, PFOA, and PFBS Analytical Results

FTBR-HC-SO-01	
Date	01/16/2020
Depth	0.5-2.5 ft
PFOS	**0.0077**
PFOA	**0.00056 J**
PFBS	0.0011 U

FTBR-HC-GW-01	
Date	01/16/2020
PFOS	**1,400 DJ**
PFOA	**31**
PFBS	**6.8**

FTBR-HC-SO-02	
Date	01/16/2020
Depth	0.5-2.5 ft
PFOS	**0.0025**
PFOA	0.0012 U
PFBS	0.0012 U

FTBR-HC-GW-02	
Date	01/16/2020
PFOS	**340 J**
PFOA	**120 J**
PFBS	**3.3 J**

FTBR-HC-SO-03	
Date	01/16/2020
Depth	1-3 ft
PFOS	**0.00073 J**
PFOA	0.0012 U
PFBS	0.0012 U

FTBR-HC-GW-03	
Date	01/16/2020
PFOS	**550 J**
PFOA	**83 J**
PFBS	**1.9 J**

Biosolid Application Area at Honeycutt Road

Pond

Texas Pond

HONEYCUTT

PARHAM

0 100 200
Feet

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Approximate Groundwater Flow Direction
- Soil and Groundwater Sampling Location

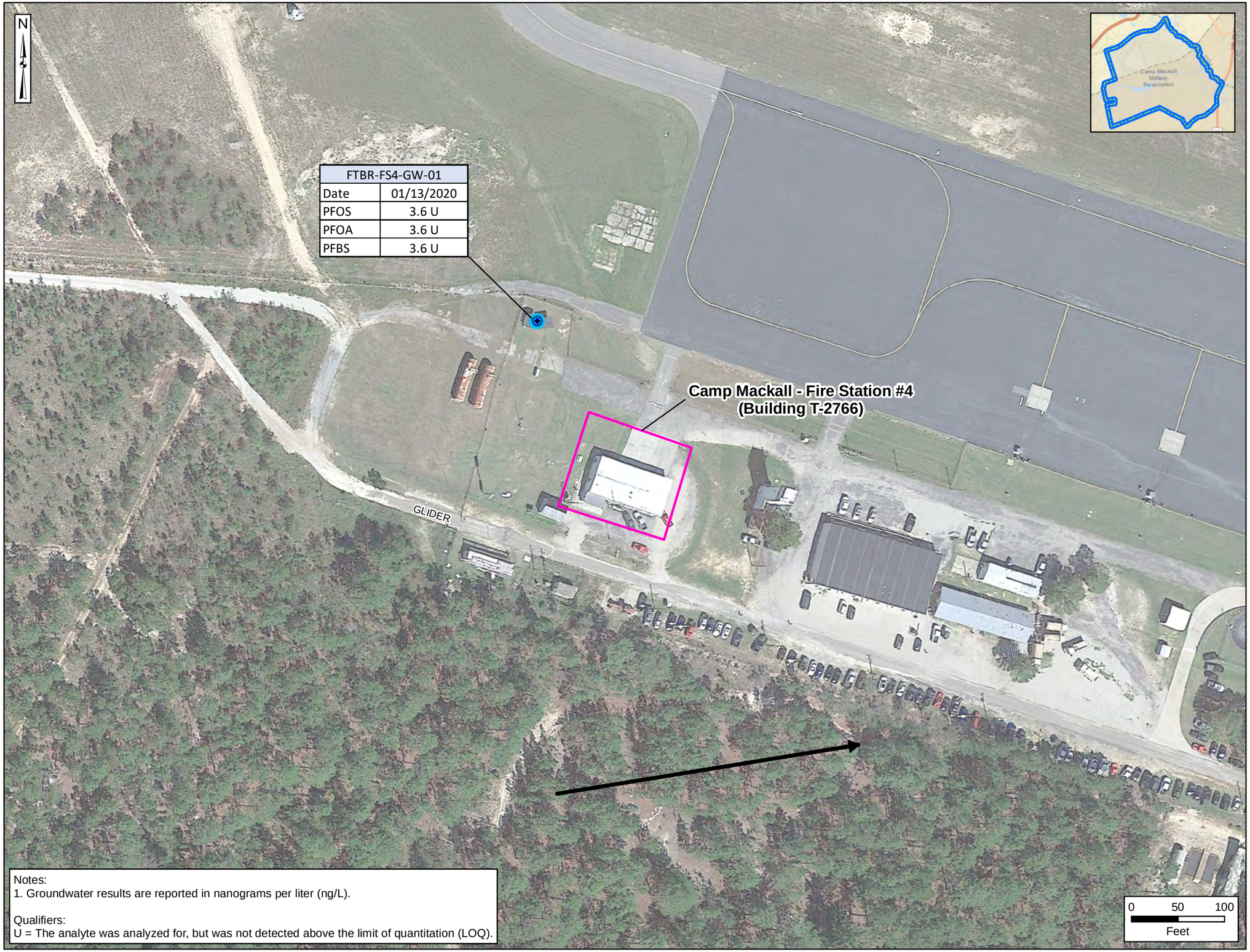
AOPI = area of potential interest
ft = feet
GW = groundwater
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

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.
5. 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:
DJ = The reported value is from a dilution and the result is an estimated quantity.
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).

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

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).

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Figure 7-19
Camp Mackall - Fire Station #4 (Building T-2766)
PFOS, PFOA, and PFBS Analytical Results

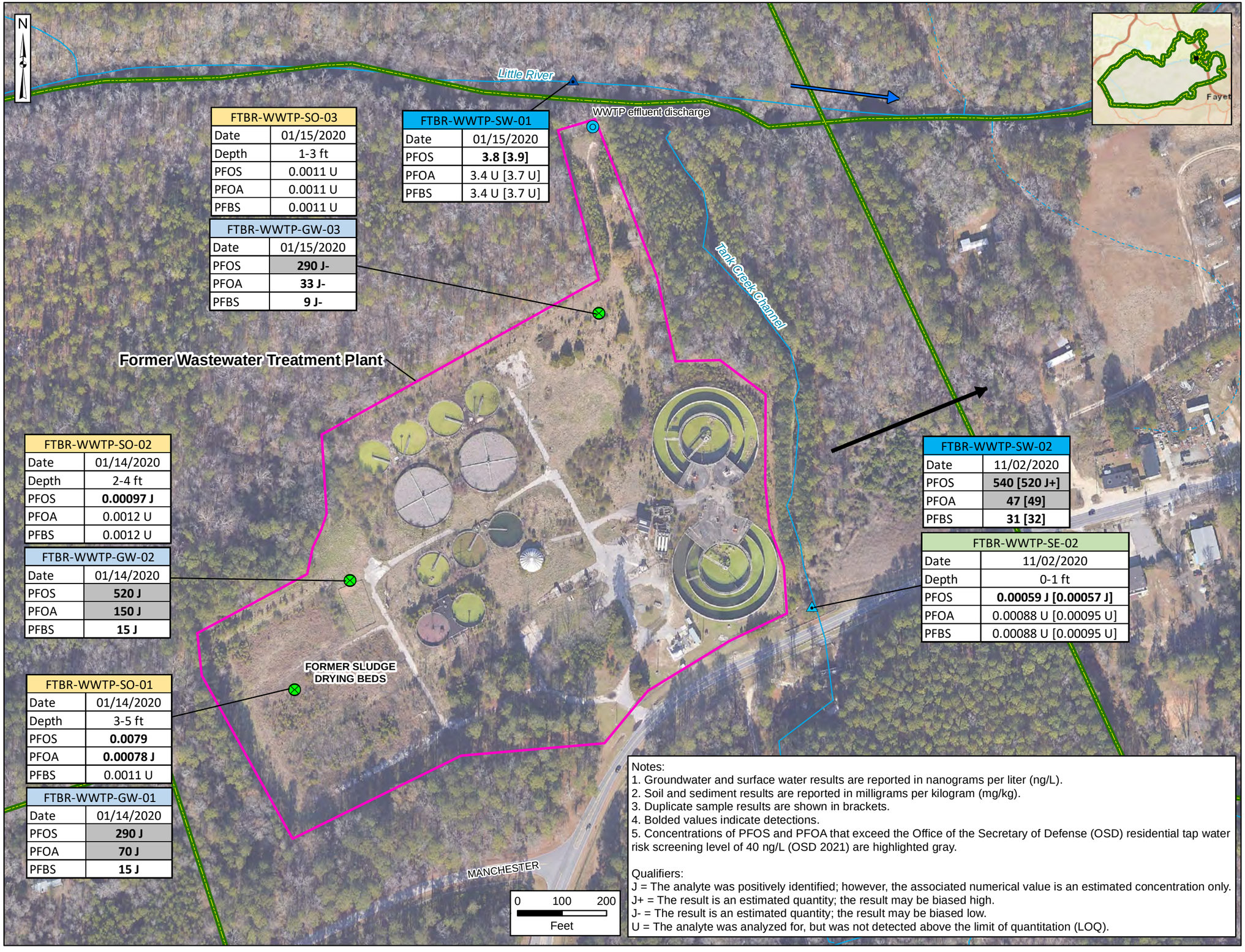
Legend

- Camp Mackall
- AOPI
- Water Supply Well
- Approximate Groundwater Flow Direction
- Groundwater Sampling Location (Existing Well)

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

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



FTBR-WWTP-SO-03	
Date	01/15/2020
Depth	1-3 ft
PFOS	0.0011 U
PFOA	0.0011 U
PFBS	0.0011 U

FTBR-WWTP-SW-01	
Date	01/15/2020
PFOS	**3.8 [3.9]**
PFOA	3.4 U [3.7 U]
PFBS	3.4 U [3.7 U]

FTBR-WWTP-GW-03	
Date	01/15/2020
PFOS	**290 J-**
PFOA	**33 J-**
PFBS	**9 J-**

FTBR-WWTP-SO-02	
Date	01/14/2020
Depth	2-4 ft
PFOS	**0.00097 J**
PFOA	0.0012 U
PFBS	0.0012 U

FTBR-WWTP-GW-02	
Date	01/14/2020
PFOS	**520 J**
PFOA	**150 J**
PFBS	**15 J**

FTBR-WWTP-SO-01	
Date	01/14/2020
Depth	3-5 ft
PFOS	**0.0079**
PFOA	**0.00078 J**
PFBS	0.0011 U

FTBR-WWTP-GW-01	
Date	01/14/2020
PFOS	**290 J**
PFOA	**70 J**
PFBS	**15 J**

FTBR-WWTP-SW-02	
Date	11/02/2020
PFOS	**540 [520 J+]**
PFOA	**47 [49]**
PFBS	**31 [32]**

FTBR-WWTP-SE-02	
Date	11/02/2020
Depth	0-1 ft
PFOS	**0.00059 J [0.00057 J]**
PFOA	0.00088 U [0.00095 U]
PFBS	0.00088 U [0.00095 U]

Notes:
1. Groundwater and surface water results are reported in nanograms per liter (ng/L).
2. Soil and sediment results are reported in milligrams per kilogram (mg/kg).
3. Duplicate sample results are shown in brackets.
4. Bolded values indicate detections.
5. 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.
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 was not detected above the limit of quantitation (LOQ).

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Figure 7-20
Former Wastewater Treatment Plant
PFOS, PFOA, and PFBS
Analytical Results

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Stream (Intermittent)
- Surface Water Flow Direction
- Approximate Groundwater Flow Direction
- Outfall
- Soil and Groundwater Sampling Location
- Surface Water Sampling Location
- Surface Water and Sediment Sampling Location

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

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 7-21
Sicily Drop Zone
PFOS, PFOA, and PFBS Analytical Results

FTBR-SDZ-SO-04	
Date	01/23/2020
Depth	1-3 ft
PFOS	**0.0041**
PFOA	0.0011 U
PFBS	0.0011 U

FTBR-SDZ-GW-04	
Date	01/23/2020
PFOS	**110 J-**
PFOA	**28 J-**
PFBS	**3.9 J-**

FTBR-SDZ-SO-03	
Date	01/23/2020
Depth	1-3 ft
PFOS	0.00097 UB
PFOA	0.00097 U
PFBS	0.00097 U

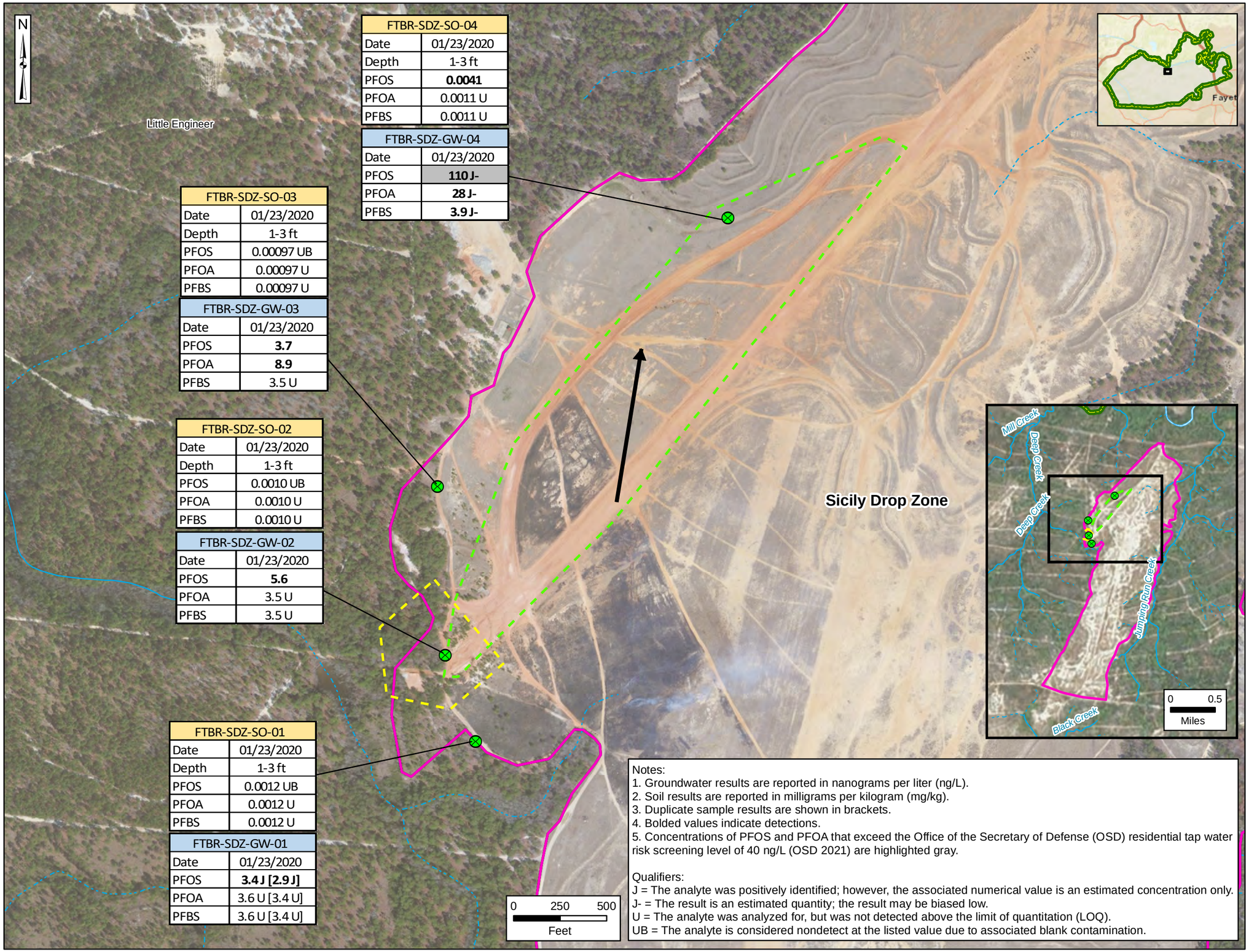
FTBR-SDZ-GW-03	
Date	01/23/2020
PFOS	**3.7**
PFOA	**8.9**
PFBS	3.5 U

FTBR-SDZ-SO-02	
Date	01/23/2020
Depth	1-3 ft
PFOS	0.0010 UB
PFOA	0.0010 U
PFBS	0.0010 U

FTBR-SDZ-GW-02	
Date	01/23/2020
PFOS	**5.6**
PFOA	3.5 U
PFBS	3.5 U

FTBR-SDZ-SO-01	
Date	01/23/2020
Depth	1-3 ft
PFOS	0.0012 UB
PFOA	0.0012 U
PFBS	0.0012 U

FTBR-SDZ-GW-01	
Date	01/23/2020
PFOS	**3.4 J [2.9 J]**
PFOA	3.6 U [3.4 U]
PFBS	3.6 U [3.4 U]



Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Stream (Intermittent)
- Approximate Groundwater Flow Direction
- Historical Aircraft Crash Site
- Presumed Biosolid Application Area
- Soil and Groundwater Sampling Location

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

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.
5. 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.
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).
UB = The analyte is considered nondetect at the listed value due to associated blank contamination.

Data Sources:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

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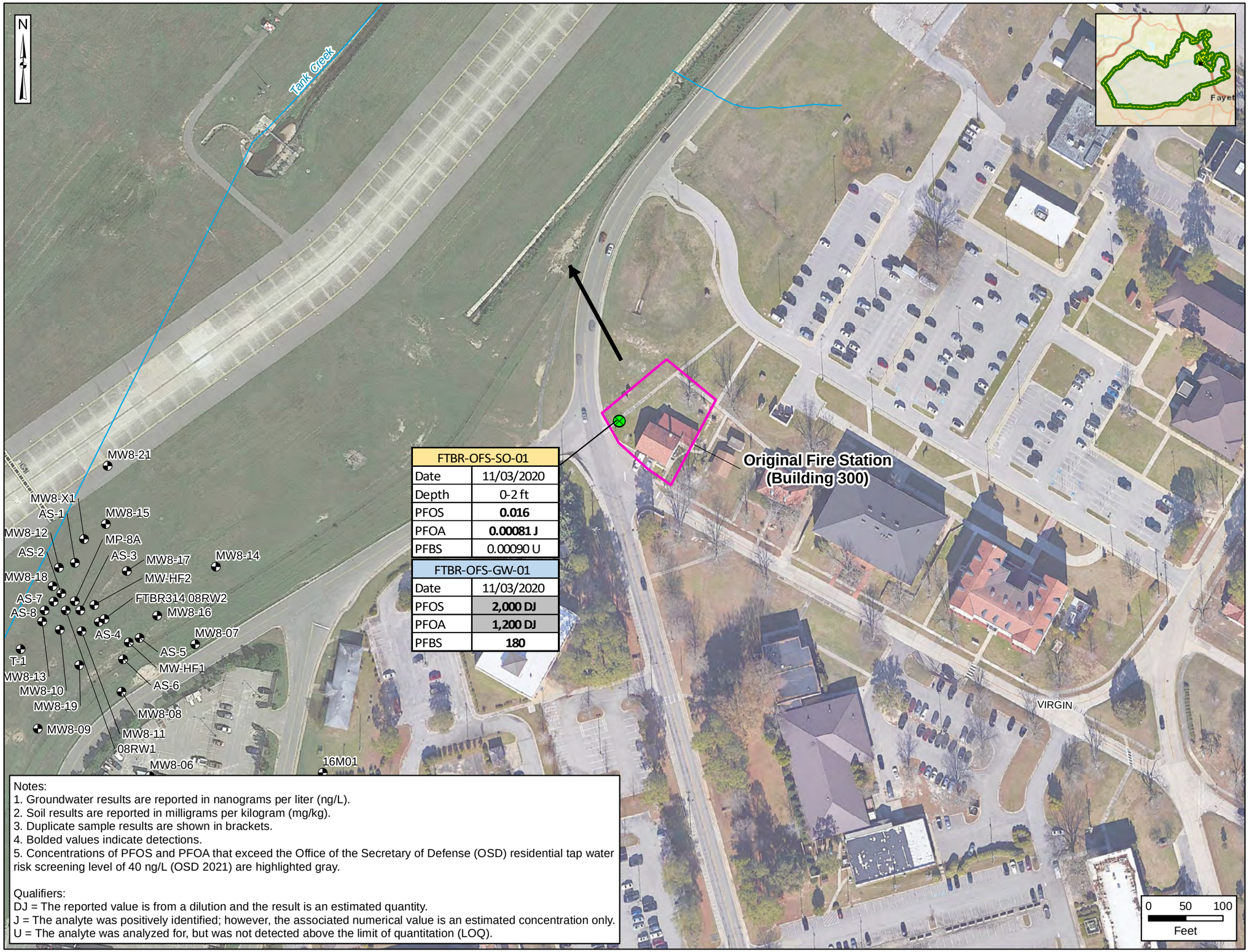
Figure 7-22
Original Fire Station (Building 300)
PFOS, PFOA, and PFBS Analytical Results



FTBR-OFS-SO-01	
Date	11/03/2020
Depth	0-2 ft
PFOS	**0.016**
PFOA	**0.00081 J**
PFBS	0.00090 U

FTBR-OFS-GW-01	
Date	11/03/2020
PFOS	**2,000 DJ**
PFOA	**1,200 DJ**
PFBS	**180**

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.
5. 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:
DJ = The reported value is from a dilution and the result is an estimated quantity.
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).

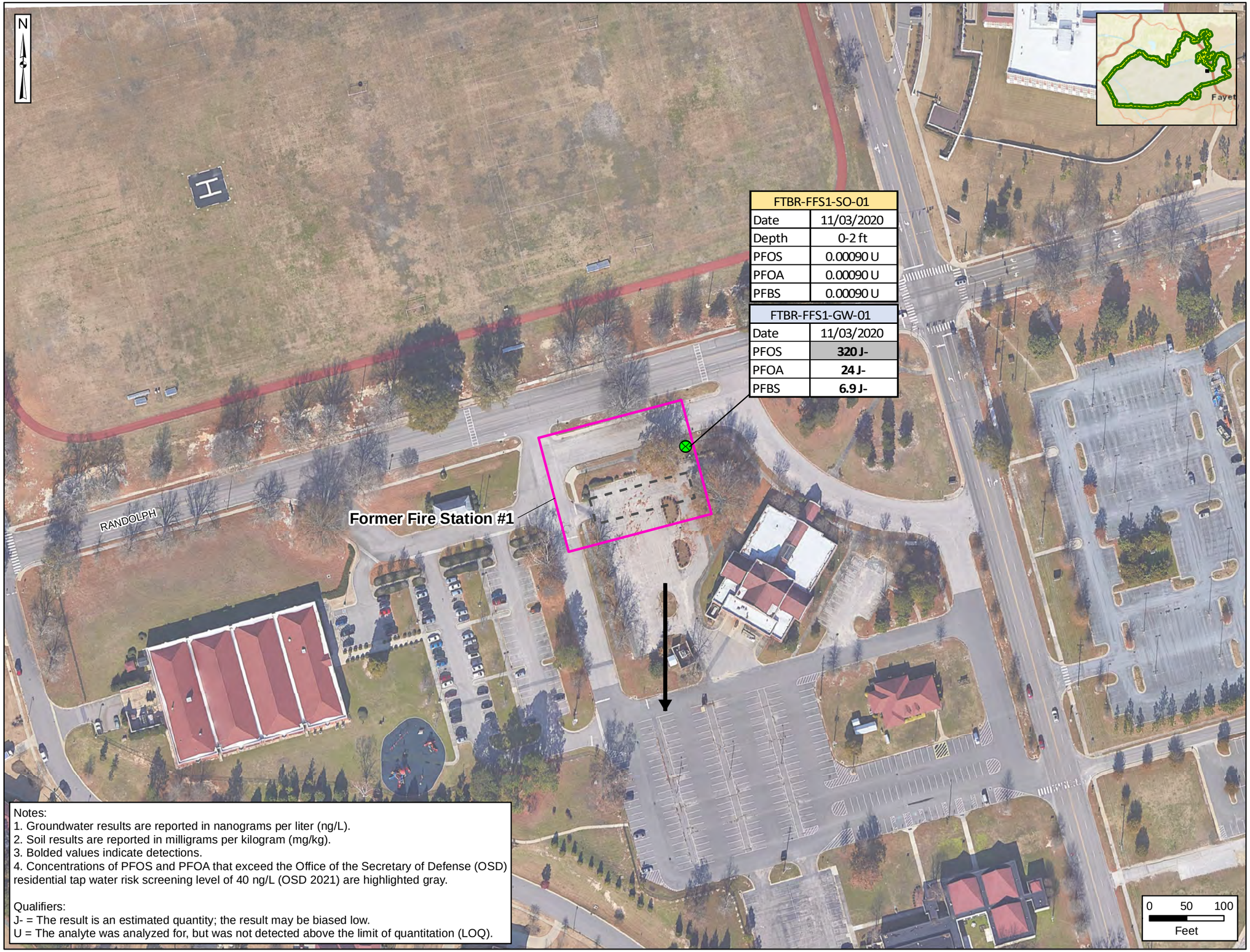
Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Monitoring Well
- Soil and 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:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North



FTBR-FFS1-SO-01	
Date	11/03/2020
Depth	0-2 ft
PFOS	0.00090 U
PFOA	0.00090 U
PFBS	0.00090 U

FTBR-FFS1-GW-01	
Date	11/03/2020
PFOS	**320 J-**
PFOA	**24 J-**
PFBS	**6.9 J-**

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 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).

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Figure 7-23
Former Fire Station #1
PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI
- Historical Building Footprint
- Approximate Groundwater Flow Direction
- Soil and 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:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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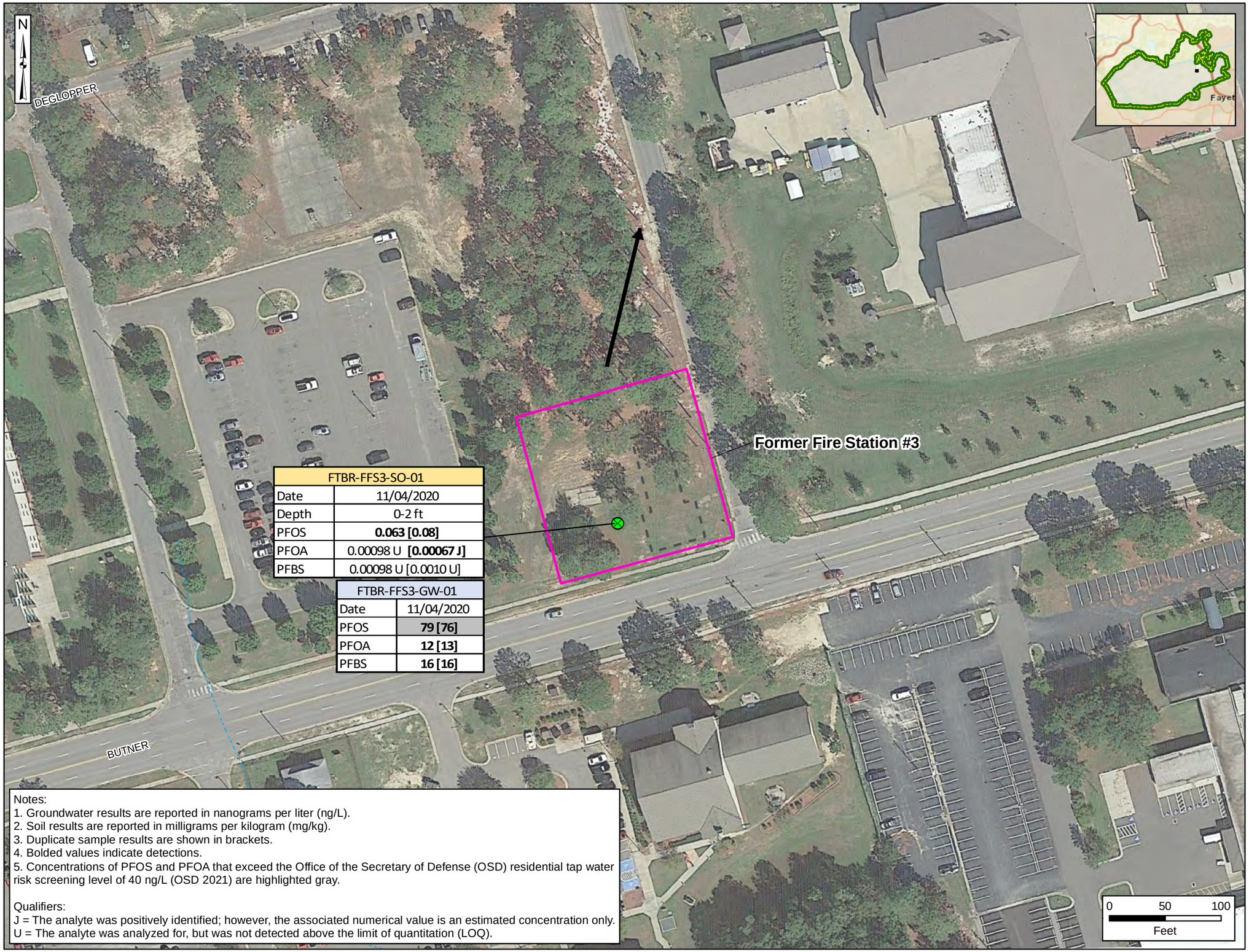
Figure 7-24
Former Fire Station #3
PFOS, PFOA, and PFBS Analytical Results



FTBR-FFS3-SO-01	
Date	11/04/2020
Depth	0-2 ft
PFOS	**0.063 [0.08]**
PFOA	0.00098 U **[0.00067 J]**
PFBS	0.00098 U [0.0010 U]

FTBR-FFS3-GW-01	
Date	11/04/2020
PFOS	**79 [76]**
PFOA	**12 [13]**
PFBS	**16 [16]**

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.
5. 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).

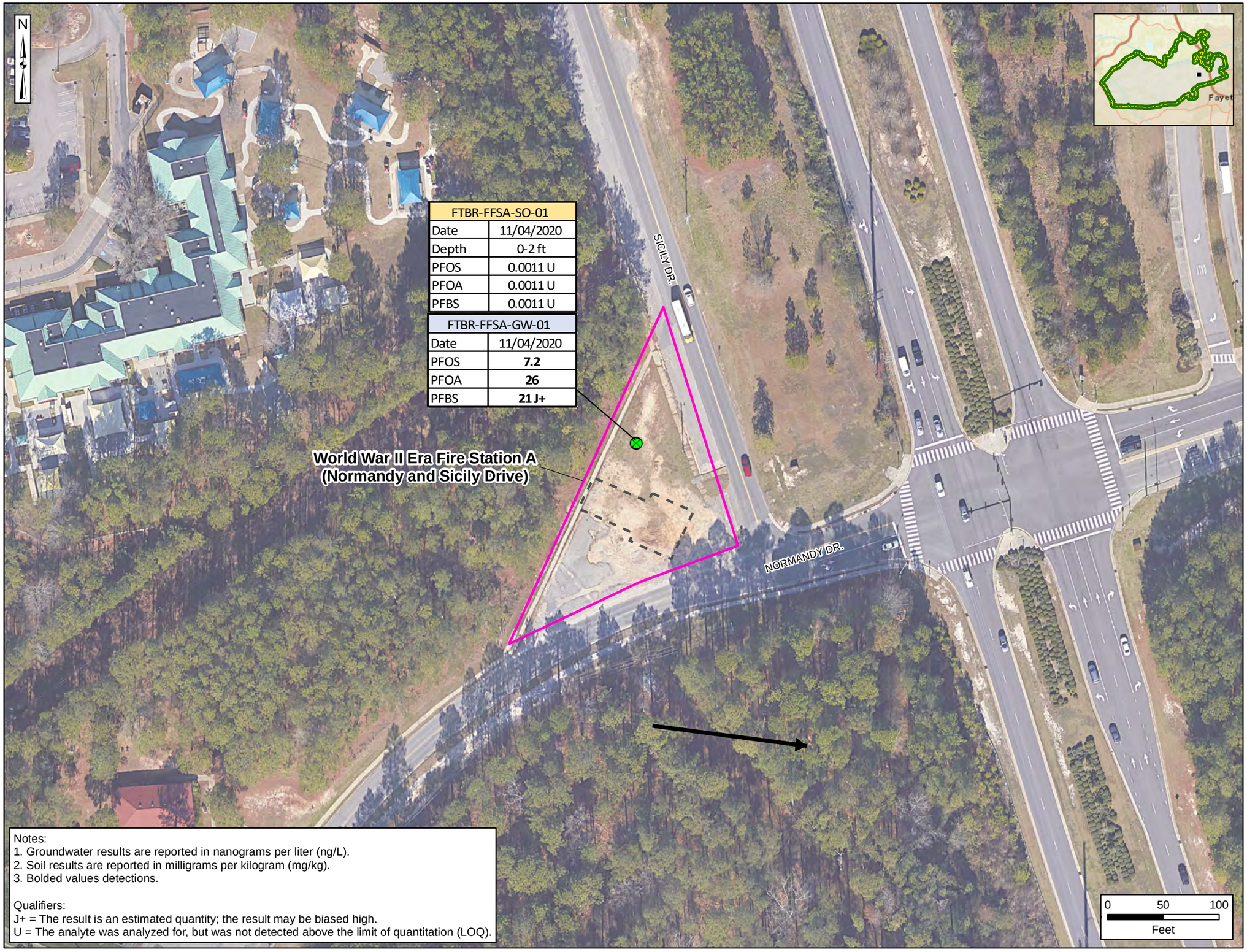
Legend

- Installation Boundary
- AOPI
- Historical Building Footprint
- Stream (Intermittent)
- Approximate Groundwater Flow Direction
- Soil and 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:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

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 detections.

Qualifiers:
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).

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Figure 7-25
World War II Era Fire Station A (Normandy and Sicily Drive) PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI
- Historical Building Footprint
- Approximate Groundwater Flow Direction
- Soil and 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:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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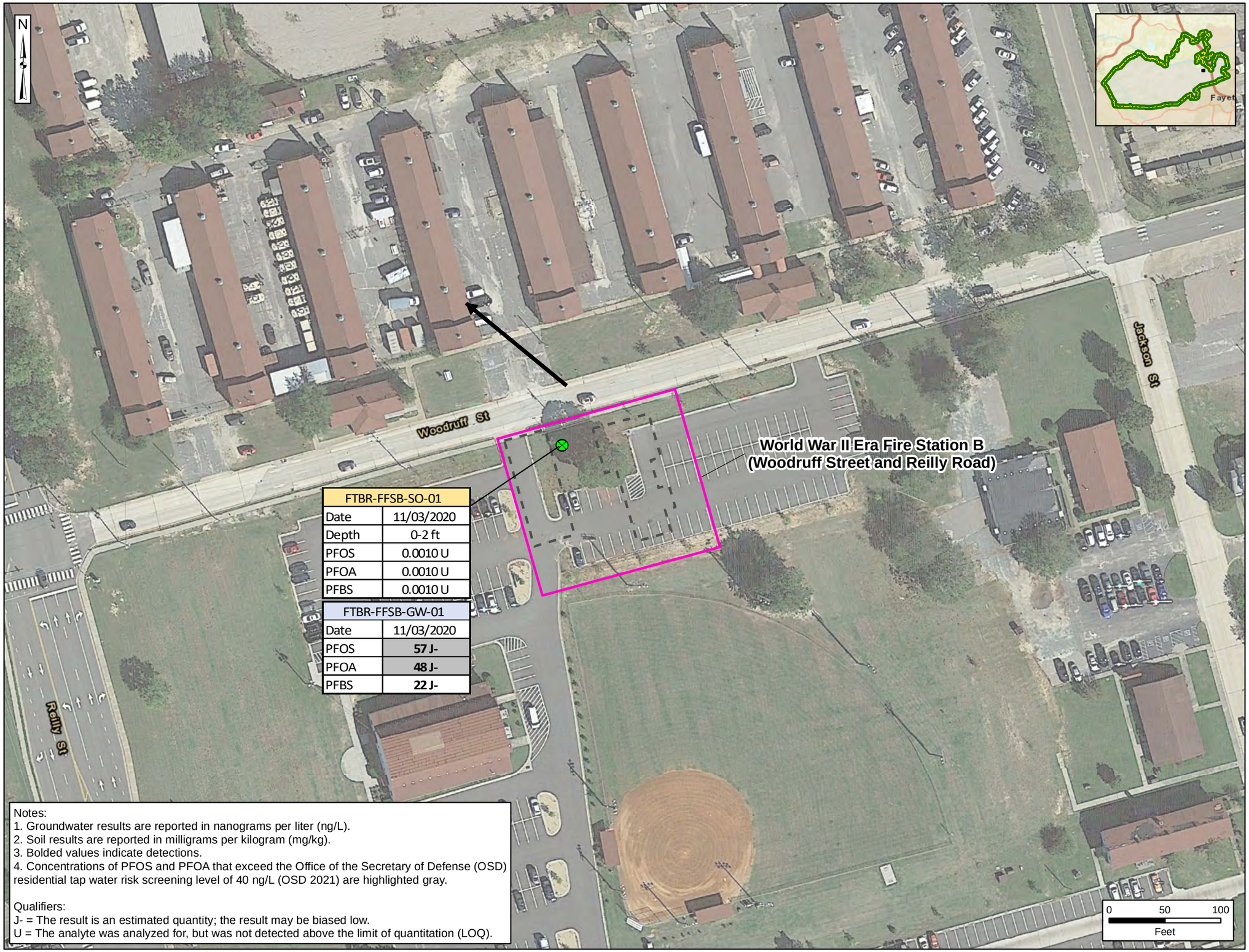
Figure 7-26
World War II Era Fire Station B (Woodruff Street and Reilly Road)
PFOS, PFOA, and PFBS Analytical Results



FTBR-FFSB-SO-01	
Date	11/03/2020
Depth	0-2 ft
PFOS	0.0010 U
PFOA	0.0010 U
PFBS	0.0010 U

FTBR-FFSB-GW-01	
Date	11/03/2020
PFOS	**57 J-**
PFOA	**48 J-**
PFBS	**22 J-**

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 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).

Legend

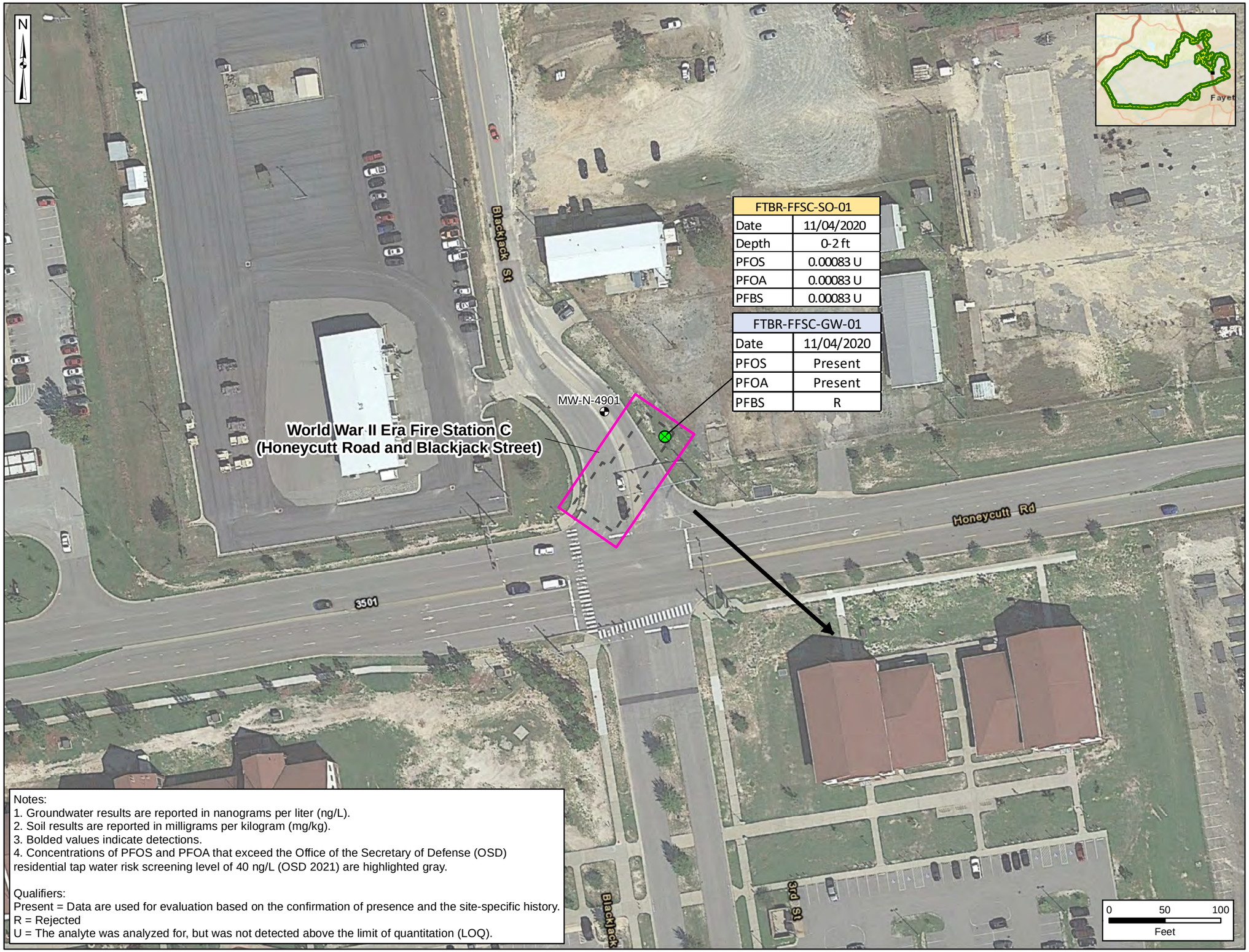
- Installation Boundary
- AOPI
- Approximate Groundwater Flow Direction
- Historical Building Footprint
- Soil and Groundwater Sampling Location

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

Note: Unable to identify with certainty which historical building footprint represents Fire Station B.

Data Sources:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2018

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:
Present = Data are used for evaluation based on the confirmation of presence and the site-specific history.
R = Rejected
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

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Figure 7-27
World War II Era Fire Station C (Honeycutt Road and Blackjack Street) PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI
- Historical Building Footprint
- Approximate Groundwater Flow Direction
- Monitoring Well
- Soil and 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:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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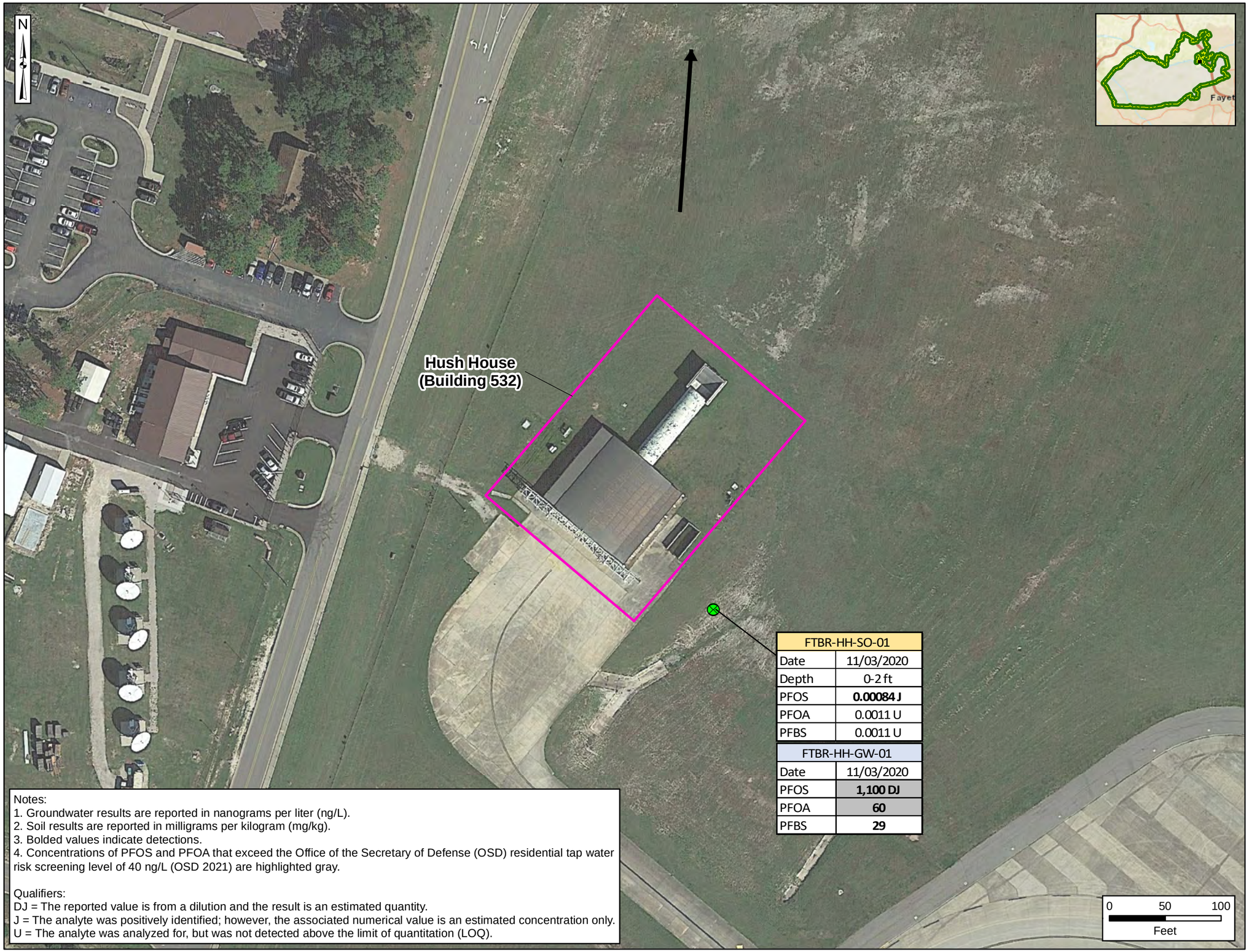
Figure 7-28
Hush House (Building 532)
PFOS, PFOA, and PFBS Analytical Results



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:
DJ = The reported value is from a dilution and the result is an estimated quantity.
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).

Legend

- Installation Boundary
- AOPI
- Approximate Groundwater Flow Direction
- Soil and 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:
Fort Bragg, GIS Data, 2018
Google Earth, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

FTBR-FS6-SO-01	
Date	01/11/2022
Depth	0-2 ft
PFOS	0.0011 U
PFOA	0.0011 U
PFBS	0.0011 U

FTBR-FS6-GW-01	
Date	01/11/2022
PFOS	3.7 U [4.3 U]
PFOA	3.7 U [4.3 U]
PFBS	**4.4 [4.8]**

FTBR-FS6-SO-02	
Date	01/11/2022
Depth	0-2 ft
PFOS	**0.013**
PFOA	**0.00056 J**
PFBS	0.0010 U

FTBR-FS6-SO-03	
Date	01/11/2022
Depth	0-2 ft
PFOS	**0.013**
PFOA	0.00099 U
PFBS	0.00099 U

Fire Station #6

0 50 100
Feet

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:
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).

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Figure 7-29
Fire Station #6
PFOS, PFOA, and PFBS Analytical Results

Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Presumed Surface Runoff Flow Direction
- Soil Sampling Location
- Soil and 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:
Fort Bragg, GIS Data, 2018
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery, 2019

Coordinate System:
WGS 1984, UTM Zone 17 North

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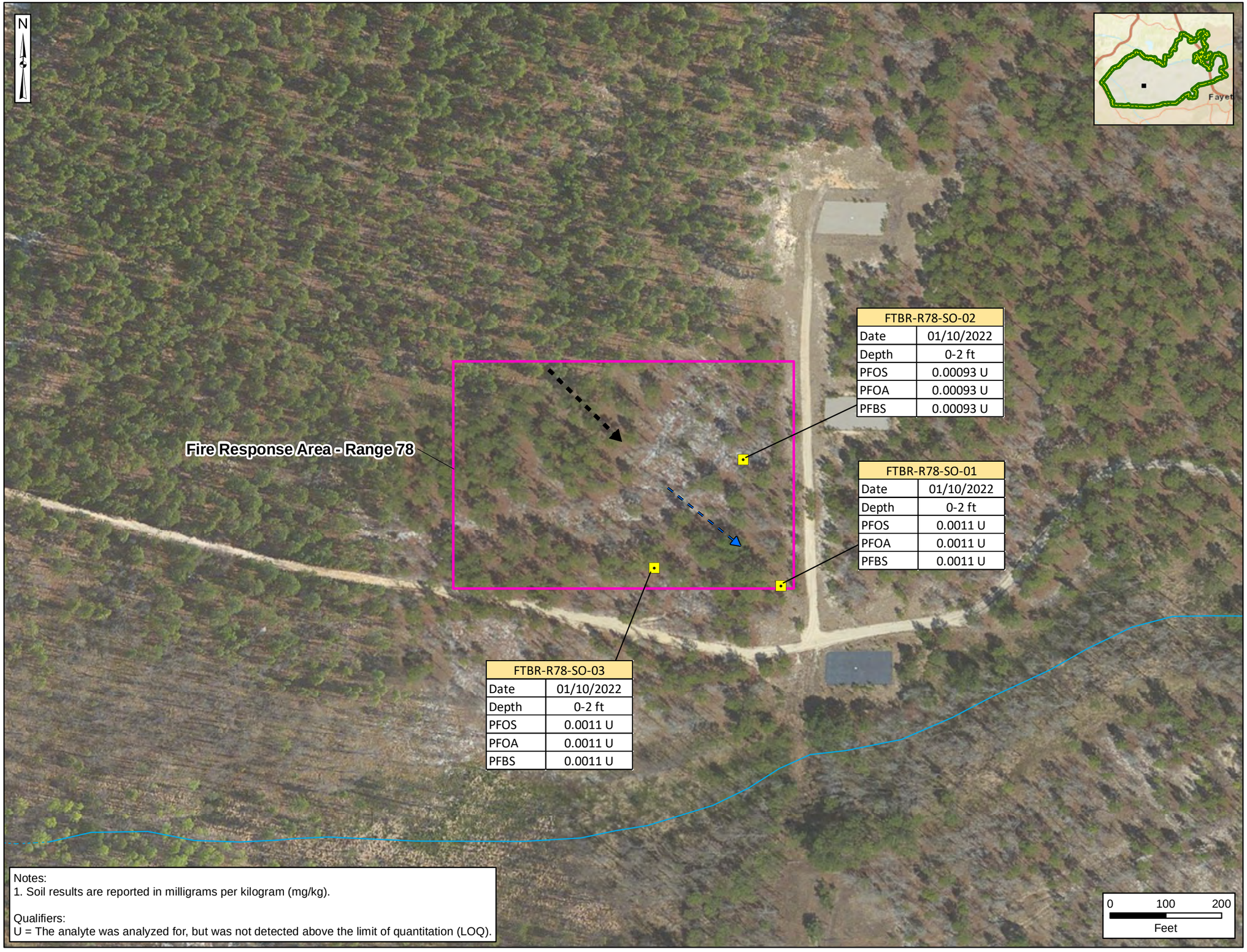
Figure 7-30
Fire Response Area - Range 78
PFOS, PFOA, and PFBS Analytical Results



Legend

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Presumed Surface Runoff Flow Direction
- Soil Sampling Location

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

Note: The AOPI location was provided by the Fort Bragg Fire Department. The location of the fire should lie somewhere central to drawn boundary.

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).

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

Data Sources:
Fort Bragg, GIS Data, 2018
USAEC, GIS Data, 2005
NHD, Water Bodies, 2019
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 7-31
Fire Response Area - Luzon Drop Zone
PFOS, PFOA, and PFBS Analytical Results

FTBR-LDZ-3-SO	
Date	01/10/2022
Depth	0-2 ft
PFOS	**0.0016**
PFOA	0.00088 U
PFBS	0.00088 U

FTBR-LDZ-2-SO	
Date	01/10/2022
Depth	0-2 ft
PFOS	**0.0028**
PFOA	0.00093 U
PFBS	0.00093 U

Fire Response Area - Luzon Drop Zone

FTBR-LDZ-1-SO	
Date	01/10/2022
Depth	0-2 ft
PFOS	0.00093 U
PFOA	0.00093 U
PFBS	0.00093 U

FTBR-LDZ-GW-01	
Date	01/15/2022
PFOS	40 U
PFOA	40 U
PFBS	**32 J**

0 50 100
Feet

Legend

- Camp Mackall
- AOPI
- Fire Location
- River/Stream (Perennial)
- Approximate Groundwater Flow Direction
- Presumed Surface Runoff Flow Direction
- Soil Sampling Location
- Soil and Groundwater Sampling Location

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

Note: The location of the fire was provided by Range personnel eyewitnesses.

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).

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

Coordinate System:
WGS 1984, UTM Zone 17 North

Source Medium	Release / Transport Mechanisms	Environmental Media	Release / Transport Mechanisms	Exposure Media	Exposure Route	Human Receptors: On-Installation: Site Worker	On-Installation: Resident	On-Installation: Recreational User	Off-Installation: All Types of Receptors [2]
Releases of stormwater and surface runoff potentially containing AFFF	Discharge via Outfall	Surface Water	Recharge	Groundwater	Ingestion	◐	◐	○	◐
					Dermal Contact	◐	◐	○	◐
				Surface Water [1]	Ingestion	◐	○	◐	◐
					Dermal Contact	◐	○	◐	◐
			Adsorption / Desorption	Sediment	Ingestion	◐	○	◐	◐
					Dermal Contact	◐	○	◐	◐

Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Notes:

[1] Surface water and sediment exposure pathways for Site Workers and Recreational Users describe incidental ingestion and dermal contact during outdoor work activities and outdoor recreational activities, respectively.

[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model for Pope Army Airfield Outfall 303 AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Fort Bragg, North Carolina

Figure 7-32

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

Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Notes:

[1] Surface water and sediment exposure pathways for Site Workers and Recreational Users describe incidental ingestion and dermal contact during outdoor work activities and outdoor recreational activities, respectively.

[2] All types of off-installation human receptors include drinking water receptors and recreational users.

This conceptual site model is for the following 19 AOPIs: Buildings 750, 741, 734/736 (Nosedock #5), 732, 726, 724, 722, 712, 708 & Retention Pond, 173, R-3065; Green Ramp Crash Site; Taxiway M Crash Site; Fire Station 7/8 & Foam Shed; Former Firefighting Training Area #4; Joint Firefighting Training Area; Former Wastewater Treatment Plant; Building 532 (Hush House); and Building 300 (Original Fire Station).

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Conceptual Site Model for Nineteen Pope Army Airfield AOPIs
USAEC PFAS Preliminary Assessment / Site Inspection
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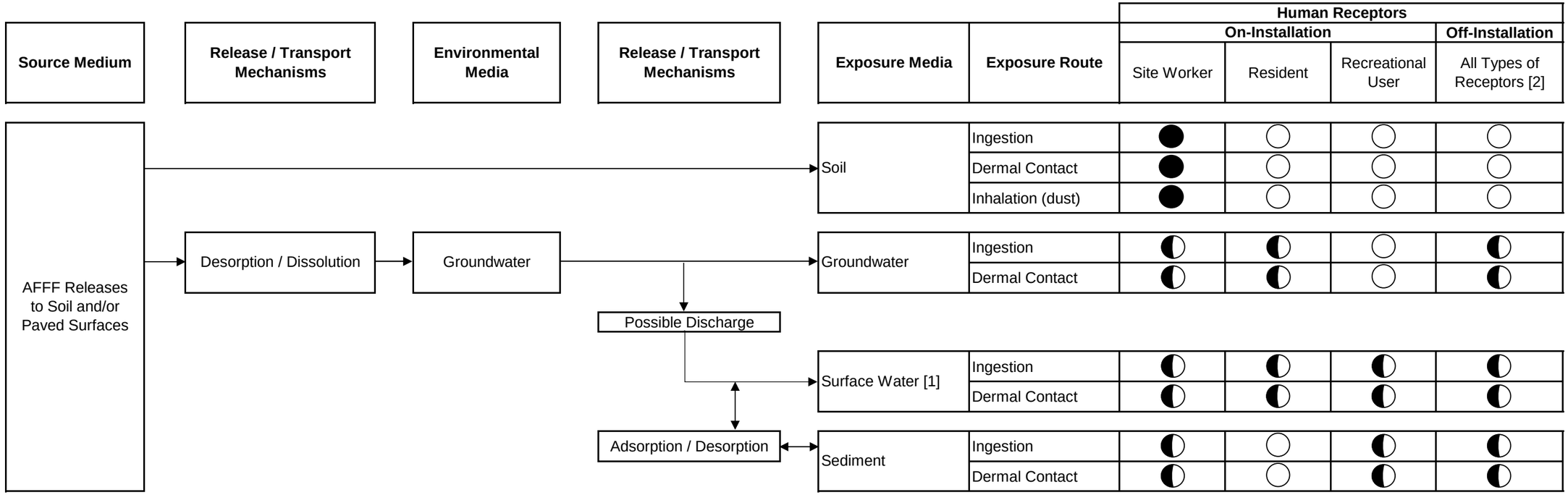
Figure 7-33



Legend:

- ● = Complete Exposure Pathway
- ◐ = Potentially Complete Exposure Pathway
- ○ = Incomplete Exposure Pathway

Notes:
[1] Surface water exposure pathway for Site Workers and Residents describes a drinking water (tapwater ingestion and dermal contact) scenario. Surface water and sediment exposure pathways for Site Workers also describe potential incidental ingestion and dermal contact during outdoor work activities. Surface water and sediment exposure pathways for Recreational Users describe an outdoor recreational exposure scenario.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.
This conceptual site model is for the following 6 AOPIs: Buildings P7937, P8944, P9647, P3807, P3007, and Fire Station 2.

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Conceptual Site Model for Simmons Army Airfield AOPIs
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Fort Bragg, North Carolina

Figure 7-34

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

Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Notes:

[1] Surface water and sediment exposure pathways for Site Workers and Recreational Users describe incidental ingestion and dermal contact during outdoor work activities and outdoor recreational activities, respectively.

[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model for Fire Station #1, Knox Street Fire Training Pits, Fire Station #3, Biosolid Application Area at Honeycutt Road, Former Fire Station #3 and Fire Response Area - Luzon Drop Zone AOPIs

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Fort Bragg, North Carolina

Figure 7-35

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

Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Notes:

[1] Surface water and sediment exposure pathways for Site Workers and Recreational Users describe incidental ingestion and dermal contact during outdoor work activities and outdoor recreational activities, respectively.

[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model for Former Fire Station #1 and World War II Era Fire Stations A, B, and C AOPIs

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Fort Bragg, North Carolina

Figure 7-36

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

Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

◯ = Incomplete Exposure Pathway

Notes:

[1] Surface water and sediment exposure pathways for Site Workers and Recreational Users describe incidental ingestion and dermal contact during outdoor work activities and outdoor recreational activities, respectively.

[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model for Camp Mackall - Fire Station #4 and Fire Response Area - Range 78 AOPIs

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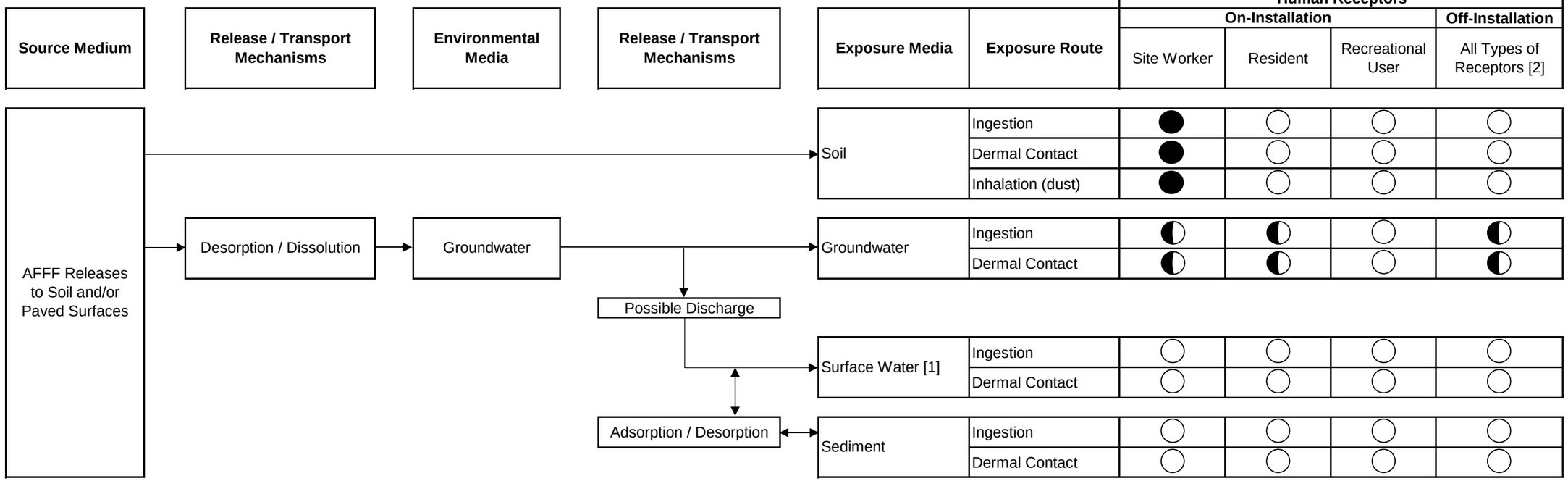
Figure 7-37



Legend:

- = Complete Exposure Pathway
- = Potentially Complete Exposure Pathway
- = Incomplete Exposure Pathway

Notes:
[1] Surface water and sediment exposure pathways for Site Workers and Recreational Users describe incidental ingestion and dermal contact during outdoor work activities and outdoor recreational activities, respectively.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model for Fire Station #5 and Fire Station #6 AOPIs
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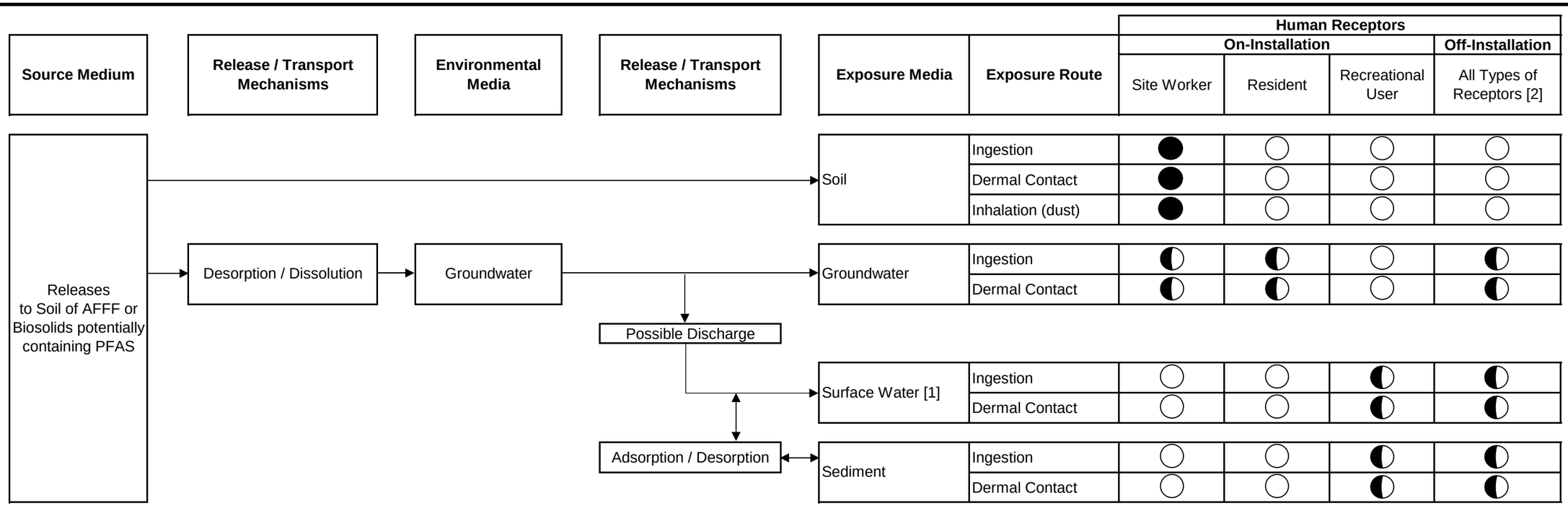
Fort Bragg, North Carolina

Figure 7-38



Legend:

- ● = Complete Exposure Pathway
- ◐ = Potentially Complete Exposure Pathway
- ○ = Incomplete Exposure Pathway

Notes:
[1] Surface water and sediment exposure pathways for Site Workers and Recreational Users describe incidental ingestion and dermal contact during outdoor work activities and outdoor recreational activities, respectively.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model for Sicily Drop Zone (Biosolid Application and Crash Site) AOPI
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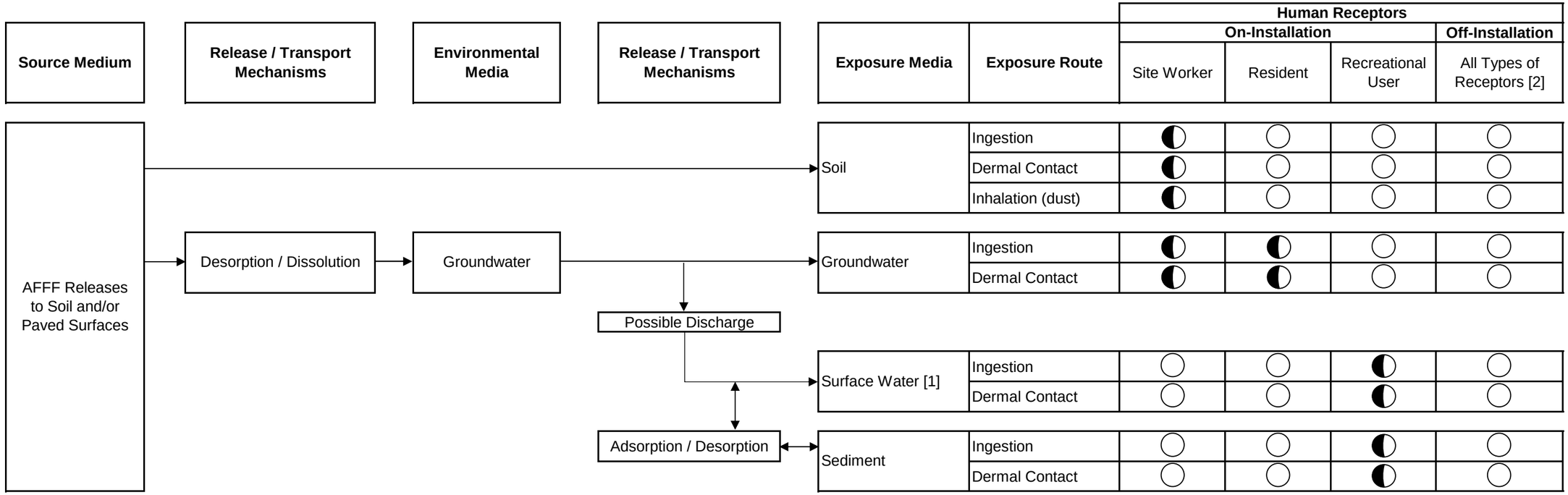
Figure 7-39



Legend:

- ● = Complete Exposure Pathway
- ◐ = Potentially Complete Exposure Pathway
- ○ = Incomplete Exposure Pathway

Notes:
[1] Surface water and sediment exposure pathways for Site Workers and Recreational Users describe incidental ingestion and dermal contact during outdoor work activities and outdoor recreational activities, respectively.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model for Fire Station #8 AOPI
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Figure 7-40

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