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

## Fort Benning, Georgia

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# 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 (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 included multimedia 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 Benning PA/SI was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, National Oil and Hazardous Substances Pollution Contingency Plan, and Army/Department of Defense policy and guidance.

Fort Benning is located in western Georgia and is bounded to the south and west by the Chattahoochee River. The installation occupies an area of approximately 182,500 acres of which approximately 12,500 acres are located within Alabama (Malcolm Pirnie 2007). Fort Benning stretches across three counties – Muscogee and Chattahoochee Counties in Georgia and Russell County in Alabama, and according to the 2000 United States Census more than 11,000 people live fulltime on-post. The Fort Benning main cantonment area lies approximately 8 miles southwest of the business district of Columbus, Georgia (Army 2016).

The Fort Benning PA identified 19 AOPIs for investigation during the SI phase. Two AOPIs were not sampled during the SI. AOPI Biosolid Application Area (BAA) FTBN-033N was not sampled because the location of the biosolids application is unknown and AOPI BAA FTBN-033O was not sampled because it is an active firing range. SI sampling results from the 17 AOPIs sampled were compared to risk-based screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, and PFBS. PFOS, PFOA, and/or PFBS were detected in soil and/or groundwater at all 17 AOPIs; and 12 of the 17 AOPIs had PFOS, PFOA, and/or PFBS present at concentrations greater than the risk-based screening levels. The Fort Benning PA/SI identified the need for further study in a Comprehensive Environmental Response, Compensation, and Liability Act of 1980 remedial investigation. **Table ES-1** below summarizes the PA/SI sampling results and provides recommendations for further study in a remedial investigation or no action at this time at each AOPI.

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

| AOPI Name | PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NS) | | Recommendation |
|---|---|---|---|
| | GW | SO | |
| FFTA FBSB-88 | Yes | No | Further study in a remedial investigation |
| FFTA FBSB-105 | Yes | No | Further study in a remedial investigation |

| AOPI Name | PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NS) | | Recommendation |
|---|---|---|---|
| | GW | SO | |
| Old Fire Station Building 2452 | Yes | Yes | Further study in a remedial investigation |
| Old Fire Station Building 2445 | Yes | No | Further study in a remedial investigation |
| Hangar 2446 | Yes | No | Further study in a remedial investigation |
| Nozzle Testing Area and Fire Station #4 | Yes | No | Further study in a remedial investigation |
| Wastewater Treatment Plant #1 | Yes | No | Further study in a remedial investigation |
| Wastewater Treatment Plant #3 | Yes | No | Further study in a remedial investigation |
| Fire Station #2 | Yes | No | Further study in a remedial investigation |
| Old Fire Station Building 9 | Yes | Yes | Further study in a remedial investigation |
| BAA: FTBN-033A | No | No | No action at this time |
| BAA: FTBN-033C | Yes | No | Further study in a remedial investigation |
| BAA: FTBN-033E | Yes | No | Further study in a remedial investigation |
| BAA: FTBN-033K | NS | No | No action at this time |
| BAA: FTBN-033L | No | NS | No action at this time |
| BAA: FTBN-033M | No | No | No action at this time |
| BAA: FTBN-033N | No[1] | No[1] | No action at this time |
| BAA: FTBN-033O | No[2] | No[2] | No action at this time |
| BAA: FTBN-033P | NS | No | No action at this time |

**Notes:**
Light gray shading – detection greater than the OSD risk screening level
BAA – biosolids application area
FFTA – former fire training area
GW – groundwater
NS – not sampled
SO – soil

[1] Samples were not collected at the BAA FTBN-033N AOPI because the location where biosolids were spread is unknown. The area is identified only as an approximate location in the vicinity of BAA FTBN-033M. In accordance with the approved Quality Assurance Project Plan Addendum, data from BAA FTBN-033M was used to determine groundwater and soil conditions at BAA FTBN-033N as these AOPIs are comparable sites (e.g., they are both BAA AOPIs and are located in the same general vicinity).

[2] Samples were not collected at the BAA FTBN-033O AOPI because it is an active firing range. Collective data from BAA AOPIs was used to determine groundwater and soil conditions at BAA FTBN-033O as these AOPIs are comparable sites. Two of the seven BAAs had detections of PFOA, PFOS, and/or PFBS that exceeded OSD risk screening levels.

# 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 U.S. Code §§ 9600, et seq. (as amended), and the Defense Environmental Restoration Program, 10 U.S. Code §§ 2701, et seq. The PFAS PA/SI included two distinct efforts. The PA identified locations that are areas of potential interest (AOPIs) at Fort Benning 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 Benning 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 U.S. Environmental Protection Agency (USEPA) established a lifetime health advisory of 70 nanograms per liter (ng/L) in drinking water for PFOS or PFOA and for the sum of PFOS and PFOA when both are present (USEPA 2016). On 15 October 2019, the OSD provided guidance on the investigation of PFOS, PFOA, and PFBS at Department of Defense (DoD) restoration sites (OSD 2019). The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in tap water or soil, calculated using the USEPA's Regional Screening Level (RSL) calculator for residential and industrial/commercial worker receptor scenarios. Following the issuance of the 2019 OSD memo, on 08 April 2021, USEPA published an updated toxicity assessment for PFBS (USEPA 2021). Based on the updated toxicity assessment for PFBS, the OSD issued a memorandum on 15 September 2021 to include updated PFBS risk screening levels (OSD 2021). The September 2021 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the DoD Cleanup Program is provided for reference as **Appendix A**. 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 **Section 6.5**.

## 1.2 PA/SI Objectives

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

### 1.2.1 PA Objectives

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

### 1.2.2 SI Objectives

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

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

## 1.3 PA/SI Process Description

For Fort Benning, PA/SI development followed the process 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 Benning. The PA and SI processes are documented in the PA/SI Quality Control (QC) 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 U.S. Army Environmental Command (USAEC), U.S. Army Corps of Engineers (USACE), Fort Benning, and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred 06 April 2018, 6 weeks before the site visit, to discuss the goals and scope of the PA, project scheduling, installation access, timeline for the site visit, access to installation-specific databases, and to request available records.

Records review was conducted before the site visit to obtain electronically available documents from the installation and external sources for review. The purpose of the records research was to identify any areas on the installation that may have been a location where PFAS-containing materials were used,

stored, and/or disposed, of as well as to gather information on the physical setting and site history at Fort Benning.

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

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

### 1.3.2 Preliminary Assessment Site Visit

The site visit was conducted between 04 and 06 June 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 Benning. The interviews focused on confirming information discussed in historical documents, collecting information that may have not been in historical documents, and corroborating other interviewees' information.

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

An exit briefing was offered to installation personnel at the conclusion of the site visit to raise any items identified during the site visit, discuss any follow-up items, and review the schedule for submitting deliverables. The exit briefing was conducted on 06 June 2018 with the installation 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/scoping teleconference was held between the Army PA team and Fort Benning.

The objectives of the SI kickoff/scoping teleconference were to:

- discuss the AOPIs selected for sampling and the proposed sampling plan for each AOPI
- 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
- provide an updated SI deliverable and field work schedule
- discuss general SI deliverable and field work schedule information and logistics

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

The DQOs, sampling design and rationale, and field methods employed for the SI are summarized from the QAPP Addendum developed for Fort Benning (Arcadis 2020) in **Sections 6.1** through **6.3**.

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

### 1.3.5 Data Analysis, Validation, and Reporting

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

# 2 INSTALLATION OVERVIEW

The following subsections provide general information about Fort Benning, 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 Benning is situated in western Georgia, south of and adjacent to the city of Columbus. The Fort Benning main cantonment area lies approximately 8 miles southwest of the business district of Columbus, Georgia (Army 2016). The southwestern boundary of the installation extends across the Chattahoochee River and into the state of Alabama. The installation occupies an area of approximately 182,500 acres of which approximately 12,500 acres are located within Alabama (**Figures 2-1** and **2-2**). Fort Benning is approximately 20 miles north-south and east-west and is located in three counties: Muscogee and Chattahoochee Counties in Georgia and Russell County in Alabama (**Figure 2-1**).

## 2.2 Mission and Brief Site History

Fort Benning is home to the Infantry School and the Armor School whose missions, along with the Maneuver Center of Excellence, are to “train and develop soldiers and leaders for an Army at war” (Army 2016). Fort Benning was established in 1918 as a temporary facility and was later selected as the site for the new Army Infantry School (Army 2019; Fort Benning 2021).

## 2.3 Current and Projected Land Use

The cantonment area, located in the western portion of the installation, is developed, and consists of the Main Post, Family Housing, Sand Hill, Kelley Hill, and Harmony Church. Almost all the military maintenance and production facilities, supply facilities, operation and training facilities, various community facilities, schools and medical facilities, and family and troop housing are in the cantonment area (Malcolm Pirnie 2007; EDAW et al. 2008). The land surrounding the cantonment area at Fort Benning is made up of predominately forested area except for Lawson Army Airfield to the south and scattered private dwellings, farms, and small communities to the northeast (Malcolm Pirnie 2007; EDAW et al. 2008).

## 2.4 Climate

Fort Benning is located in western Georgia with a portion of the installation in Alabama. The installation is located approximately 170 miles north of the Gulf of Mexico and approximately 225 miles west of the Atlantic Ocean, with a climate that is classified as humid temperate. The seasons are well defined, with hot, humid summers and mild winters. The coldest month is usually January, and the warmest month is usually July. Most summer days have high temperatures over 90 degrees Fahrenheit (ºF), with an average high temperature of 85ºF. The average low temperature from November through February is 38ºF (Army 1982; Malcolm Pirnie 2007; WeatherSpark 2021).

Annual precipitation averages about 51 inches and is generally well distributed throughout the year. Rainfall amounts are typically highest in March, July, and December and the lightest in September, October, and November. Snow occurs occasionally, but usually quickly melts (Army 1982; Malcolm Pirnie 2007, WeatherSpark 2021).

Wind speeds have mild seasonal variation are relatively low throughout the year, averaging 4.6 miles per hour (mph). Average wind speeds are generally highest in March, with an average wind velocity of 6.9 mph. Winds are generally lightest from June to September, with an average wind speed of 3.5 mph. Wind direction is generally from the south to the north in the spring and shifts to the south or southwest in the fall (Army 1982; Malcolm Pirnie 2007; WeatherSpark 2021).

## 2.5 Topography

Fort Benning straddles two distinct geological regions that define the topography of the installation. In this area, crystalline and sedimentary deposits may be exposed in relatively close proximity due to overall thickness of the unconsolidated Upper Coastal Plain sediments and the crystalline rocks combined with incision by streams and rivers. This varied geology results in a topography that ranges from steep upland slopes to gently sloping hills. Remaining areas consist of relatively flat uplands or terraces adjacent to or near the Chattahoochee River. The predominately rolling terrain is highest in the east, rising approximately 740 feet (ft) above sea level, and lowest in the southwest along the Chattahoochee River, about 190 ft above sea level (**Figure 2-3**; Directorate of Public Works [DPW] 2001; Malcolm Pirnie 2007).

## 2.6 Geology

Most of Fort Benning overlies the Upper Coastal Plain physiographic province and a small portion lies north of the Fall Line within the Piedmont physiographic province. Units within the Upper Coastal Plain in this region of Georgia form a thick wedge of unconsolidated and poorly consolidated clastic sediments that dip gently to the south-southeast (seaward). These units were deposited by the cyclical advance and retreat of Upper Cretaceous seas over Paleozoic to Mesozoic age basement rocks. These Coastal Plain sediments were deposited under marine, marginal marine, and non-marine conditions, resulting in changes in lithology, texture, bedding character, and therefore, hydraulic conductivities and porosity (Malcolm Pirnie 2007).

From Fort Benning south to the Florida coast, the width of the entire Coastal Plain sequence of sediments varies from a thickness of zero or a few feet to the north to over 6,000 ft in thickness to the south and continuing to thicken offshore (U.S. Geological Survey [USGS] 1989; Malcolm Pirnie 2007). Thicknesses of this sequence on the installation are reported to vary from 0 ft in the northern portion of the installation to approximately 560 ft within the southwest corner of the installation (Army 1994; Malcolm Pirnie 2007).

Geologic units on Fort Benning from oldest to youngest include the Tuscaloosa Formation, the Eutaw formation, the Blufftown Formation, the Cusseta Sand, and the Ripley Formation. The oldest unit, the Tuscaloosa Formation, primarily outcrops in the northern portion of the installation and the youngest unit, the Ripley Formation, outcrops primarily in the southeast portion of the installation. Each unit's outcrop location trends southeast to northwest. The locations where various units outcrop are influenced by the drainage pattern at Fort Benning. Streams and rivers that have deeply incised the highly erodible soils and underlying unconsolidated sediments at the installation have removed younger units that were

previously present and are still present at higher elevations to the north. Additionally, these streams and rivers have continually eroded and redeposited sediment throughout these valleys, resulting in the presence of aerially significant accumulations of Quaternary Age alluvial deposits overlying the Cretaceous age sediments. These alluvial deposits are especially prevalent in the valleys of Upatoi Creek and its main tributaries (Randall and Ochillee creeks), Oswichee Creek, and the Chattahoochee River floodplain (Reinhardt, Schindler, and Gibson 1994; Malcolm Pirnie 2007).

## 2.7 Hydrogeology

Fort Benning overlies a small portion of the extensive Southeastern Coastal Plain Aquifer System. This aquifer system extends from Mississippi to South Carolina and covers all or most of the states of Mississippi and Florida and most of the southern portions of Alabama, Georgia, and South Carolina. This large regional aquifer system is split into numerous smaller aquifer systems, which may or may not be divided by laterally continuous confining units (USGS 1989; Malcolm Pirnie 2007). Fort Benning specifically overlies a portion of two of these smaller aquifers: the Black Warrior River aquifer and the Chattahoochee River aquifer. (USGS 1996; Malcolm Pirnie 2007). In Georgia, since these two units are made up of Cretaceous and/or Tertiary age sediments and are not separated by a confining unit, they are sometimes together referred to as the Cretaceous-Tertiary aquifer system (Malcolm Pirnie 2007). However, in the Fort Benning area, the Cretaceous-Tertiary aquifer, as shown in the Georgia Department of Natural Resources Geological Survey (GDNRGS), consists exclusively of Cretaceous age units (Malcolm Pirnie 2007).

The Black Warrior River aquifer at the installation is made up of the Tuscaloosa Formation (oldest) and overlain by the basal portion of the Eutaw Formation (younger). The Chattahoochee River aquifer at the installation is made up of the upper portion of the Eutaw Formation (oldest) overlain by the Blufftown Formation, the Cusseta Sand, and locally the Ripley Formation (youngest) (USGS 1989; Malcolm Pirnie 2007). These units consist primarily of fine to coarse sand with interspersed lenses of less permeable clayey beds. Based on the high sand content of the soils at the installation, they are generally relatively permeable with most of the installation considered a recharge area for the Black Warrior River and Chattahoochee River aquifers (GDNRGS n.d.; Malcolm Pirnie 2007). The Army Center for Health Promotion and Preventive Medicine Facility Assessment report describes the uppermost portion of the aquifers at the installation as composed of alternating lenses of varying thicknesses of clay, silt, sand, and gravel (Army 1994). Hydraulic conductivities in these units vary from $10^{-2}$ to $10^{-4}$ centimetres per second (Malcolm Pirnie 2007).

Depth to water within the upper portion of the aquifers from across Fort Benning vary from artesian conditions (a few feet above ground surface in low areas along rivers and/or streams) to approximately 70 ft below ground surface (bgs) in topographically high areas. Groundwater within the shallowest portion of the aquifer mirrors the ground surface topography, with shallow groundwater flowing from areas underlying hilltops or ridges to low-lying areas or streams and similar other coastal plain settings (Army 1982; Malcolm Pirnie 2007). Depths to shallow groundwater, local directions of flow, and discharge of groundwater to streams were verified by reviewing a selection of reports for investigations conducted at solid waste management unit sites throughout the installation for purposes of the PA/SI.

## 2.8 Surface Water Hydrology

The streams at Fort Benning are referred to as either Piedmont or Coastal Plain in origin. Piedmont streams originate in the Piedmont and generally flow in a southerly direction on Fort Benning. Major Piedmont streams include Baker, Cox, Dozier, Kendall, Randall, Uchee, and Upatoi creeks, as well as the Chattahoochee and Tar rivers. Coastal Plain streams originate in the Coastal Plain and generally flow from east to west on the Georgia side and west to east on the Alabama side. Ochillee, Pine Knot, Little Pine Knot, Sally Branch, and Bonham creeks are the major Coastal Plain streams on Fort Benning (Malcolm Pirnie 2007).

Watersheds at Fort Benning consists of two major and one minor watershed regions. The two major watershed basins are named in this report after the major surface waterways that drain the installation: the Chattahoochee River and Upatoi Creek. The minor watershed region, Bull Creek, is separated from the aforementioned regions due to its direct flow off-installation. The three watersheds and associated streams are described below (Malcolm Pirnie 2007).

**Chattahoochee River**

The Chattahoochee River flows through the southwestern portion of Fort Benning and forms the border between Georgia and Alabama. Several creeks such as Harps, Mill, Red Mill, Shell, and Upatoi Creeks drain directly to the Chattahoochee River. It drains approximately 52,685 acres of the installation (Malcolm Pirnie 2007). Multiple AOPIs are in the vicinity of creeks that drain to the Chattahoochee River, including Old Fire Station Building 2452, Old Fire Station Building 2445, Nozzle Testing Area and Fire Station #4, Former Fire Training Area (FFTA) (FBSB-88), FFTA (FBSB-105), wastewater treatment plant (WWTP) #3, and Biosolids Application Areas (BAAs) FTBN-033A, FTBN-033C, FTBN-033K, FTBN-033M, FTBN-033N, FTBN-033O, and FTBN-033P.

**Upatoi Creek**

The Upatoi Creek is in the northern section of the Fort Benning and drains southwesterly into the Chattahoochee River. Approximately 116,448 acres of the installation drains through the Upatoi Creek watershed (Malcolm Pirnie 2007). The Fort Benning water treatment plant (WTP) intake had been located along the Upatoi Creek approximately 1.5 miles upstream of where the Upatoi Creek drains into the Chattahoochee River. The intake has since been moved to the Chattahoochee River sometime after 2016. Several AOPIs are located in the vicinity of the Upatoi Creek or to tributaries that drain to the Upatoi Creek. The AOPIs include Old Fire Station Building 9, WWTP #1, Fire Station #2, and BAAs FTBN-033E and FTBN-033L.

**Bull Creek**

Bull Creek is a minor watershed located in the northwestern corner of Fort Benning and is separate from the Chattahoochee River and Upatoi Creek major watershed basins. Bull Creek is upgradient of all AOPIs on Fort Benning.

## 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 Benning.

### 2.9.1 Stormwater Management System Description

Stormwater at Fort Benning drains via culverts, ditches, swales, and natural seepage and overland flow. Many of the soils at Fort Benning are characterized as susceptible to erosion, and many of the water quality issues for the streams in and around Fort Benning are related to high levels of sedimentation, particularly after storm events (DPW 2018). Drainage from the oil water separator (OWS) associated with the Nozzle Testing Area and Fire Station #4 and FFTA-FBSB-105 discharge into WWTPs through stormwater inlets.

### 2.9.2 Sewer System Description

There were two WWTPs (WWTP #1 and WWTP #3) located on Fort Benning. The WWTPs were transferred to the Columbus Water Works (CWW) in 2004 and are no longer used to treat wastewater. WWTP #1 and WWTP #3 currently serve as lift stations where wastewater from the installation is routed off-post to CWW for treatment. Historically, WWTP #3 drained its effluent into WWTP #1, which then discharged on the Upatoi Creek. WWTP #2 was decommissioned sometime prior to 2002 (and prior to the privatization of WWTP #1 and WWTP #3) and was located immediately southwest of FFTA FTBN-88. The discharge location was downstream of the former WTP intake. The current WTP intake was moved to the Chattahoochee River, south of where the Upatoi Creek intersects (USACE 2002). Additional details regarding the WTP are provided in **Section 2.10**.

Based on personnel interviews, 16 BAAs (FTBN-033A through FTBN-033P) on Fort Benning were used to dispose of digested sewage sludge generated during the treatment of wastewater at WWTP #1 and #3. The sludge was generally applied with a 1,600-gallon "Big Wheel" rear rotating spreader or a 5,000-gallon tanker truck (discharge valve) (USACE 2013).

The following BAAs (known as Biosolid Application Sites in referenced documents) are known to have operated from the mid-1970s until 1995:

- I (FTBN-033A)
- III (FTBN-033B)
- IV (FTBN-033C)
- XI (FTBN-033D)
- XVI (FTBN-033I)
- FTBN-033L

The following four Biosolid/Sewage Sludge Application Sites were in operation between 1992 to approximately 1994:

- XII (FTBN-033E)
- XIII (FTBN-033F)

- XIV (FTBN-033G)
- XV (FTBN-033H)

The time of operation is unknown for the remaining Biosolid/Sewage Sludge Application Sites and limited documentation was available:

- (FTBN-033J
- FTBN-033K
- FTBN-033M
- FTBN-033N
- FTBN-033O
- FTBN-033P)

BAAs FTBN-033A, FTBN-033C, FTBN-033K, FTBN-033M, FTBN-033N, FTBN-033O, and FTBN-033P are located in the vicinity of creeks that drain to the Chattahoochee River.

## 2.10 Potable Water Supply and Drinking Water Receptors

The potable water supply at Fort Benning was owned and operated by the installation until privatization in 2004 when operations and maintenance were leased to CWW in accordance with the Privatization Agreement. Fort Benning owns both potable wells and non-potable wells that are operated and leased by CWW on site. The non-potable wells that are owned by Fort Benning are used strictly for golf course, irrigation, and other non-potable uses. There are 10 potable water wells at Fort Benning that include the following:

- CATF/Leyte Field well
- Good Hope well (GHMTA GIB)
- McKenna Mount Range #1 well (McKenna MOUT 1)
- Mckenna Mount Range #2 well (McKenna MOUT 2)
- Tricolor Road well (DMPRC Tricolor)
- Malone 17 well
- Carmouchee Range well
- Camp Darby well
- Griswald Range well
- Hastings Range well

The wells operated by CWW are used locally on Fort Benning, near where the wells are located (i.e., they are not large production wells pumped back to other areas). These wells have individual treatment systems which include filters and/or iron treatment, and all are chlorinated.

The WTP located at Fort Benning is operated by CWW and is supplied with water from the Chattahoochee River. The WTP on Fort Benning, located on Marne Road, had withdrawn water from the Upatoi Creek; however, the intake was relocated in 2006 to a different location on the Upatoi Creek and then relocated again within the last 10 years to the Chattahoochee River. There are four connection

points to the CWW system (Sante Fe, Custer Road, St. Marys, and Schatalga) and water can flow in either direction depending on demand. Sometimes water comes from CWW to Fort Benning and sometimes water goes to CWW from Fort Benning (CWW 2018). This system (PWS# 2150000) provides drinking water for approximately 40,000 consumers. The consumer population includes active duty and reserve military personnel, on-post residential housing, civilian employees, visitors, guests, and patients of Martin Army Community Hospital.

Groundwater is also recognized as being used in the areas down-gradient of Fort Benning, however; it was determined these sources would not be impacted due to natural barriers such as the Chattahoochee River. As discussed in **Section 2.7**, the Cretaceous-Tertiary aquifer system is used extensively as a groundwater drinking water source for property owners in the area surrounding the installation (GDNRGS 1980; Malcolm Pirnie 2007). Additionally, several municipalities are listed as utilizing groundwater as at least a portion of their drinking water. However, only the City of Cusseta is located downgradient of groundwater flow and within a 5-mile radius of the installation. The City of Cusseta is permitted to pump a total of 0.31 million gallons per day from its four supply wells located approximately 2 miles south of Ochillee Creek and south of the installation. 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 Benning, 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 also provided in **Appendix E**.

## 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.

The most prominent wildlife habitats associated with Fort Benning are mature forests, grasslands, rivers, and wetlands. The Chattahoochee River backwaters are important with regard to environmental sensitivity. This area encompasses a diverse mixture of islands, peninsulas, sloughs, bays, and wetlands and includes riparian areas adjacent to upland hardwood/pine forests. The area is characteristic of the River Floodplains and Cypress/Tupelo Swamps ecological group (Army 2005; Malcolm Pirnie 2007). Typical fauna of the backwaters area includes waterfowl, wading and water birds, and many varieties of turtles and amphibians. A total of 66 animal and plant species of conservation concern are recognized on Fort Benning which are State and/or Federally Threatened, Endangered, or Species of Concern, including the red-cockaded woodpecker, which a federally endangered species (Army 2020).

## 2.12 Previous PFAS Investigations

In response to the third Unregulated Contaminant Monitoring Rule (UCMR3), the CWW water system that serves the City of Columbus and Fort Benning was tested in 2014. The laboratory which analyzed samples under UCMR3 met the USEPA's UCMR3 Laboratory Approval Program application and Proficiency Testing criteria for USEPA Method 537 Version 1.1. The results of these analyses indicated

that no PFAS compounds (including PFOS, PFOA, and PFBS) were detected in the water supply provided by CWW.

Previous (i.e., pre-PA) PFAS investigations relative to Fort Benning, including both those conducted and not conducted by the Army, are summarized to provide full context of available PFAS data for Fort Benning; however, only data collected by the Army will be used to make recommendations for further investigation.

CWW collects samples from drinking water source wells and prepares annual water quality reports on a rotating basis for these wells. The data are sent to the GDNRGS and to the Fort Benning Health Department. Although wells sampled on an annual basis are not normally tested for PFOS/PFOA, at the request of Fort Benning, a one-time event was conducted in November 2016 by CWW. This sampling event included the 10 potable groundwater wells owned by Fort Benning and operated by CWW and six additional locations (the surface water intake, the WTP finished water location, and four connection points to the CWW system). Although there are several former drinking water wells on site, these wells are no longer considered potable water sources, and many have been plugged and abandoned. Therefore, former drinking water wells not sampled as part of the 2016 event. The water samples were analyzed for PFOS and PFOA under USEPA Method 537. Analysis of these samples indicated that PFOS and PFOA were not detected in the samples collected from the 10 potable wells. However, based on information provided via communication with the installation and CWW, PFOS and PFOA were detected in samples from the six additional locations, at concentrations ranging from 5.0 ng/L to 18.0 ng/L, below the OSD screening levels and results are presented below for the 2016 sampling event.

- FB-Raw (drinking WTP)
  - 5.4 ng/L PFOS and 18.0 ng/L PFOA
- FB-High Service (drinking WTP)
  - 5.2 ng/L PFOS and 13.0 ng/L PFOA
- Sante Fe (connection to CWW system)
  - 5.3 ng/L PFOS and 13.0 ng/L PFOA
- Schatagla (connection to CWW system)
  - 5.0 ng/L PFOS and 9.8 ng/L PFOA
- Custer Road (connection to CWW system)
  - 5.1 ng/L PFOS and 11.0 ng/L PFOA
- St. Marys (connection to CWW system)
  - 5.1 ng/L PFOS and 12.0 ng/L PFOA

In 2020, the Columbus surface water intake and WTP finished water and the Fort Benning surface water intake and WTP finished water were sampled and analyzed for PFOA, PFOS, and PFBS by USEPA Method 537. The WTP sampling location identified as FB-Raw during the 2016 sampling event was identified as the sampling location RAW-PU Ft. Benning during the sampling events conducted in 2020. The FB-High Service sampling location sampled in 2016 was later identified as the HSERV Ft. Benning sampling location in 2020. The PFOS, PFOA, and PFBS results from the sampling conducted Fort Benning are as follows as provided via communication with the installation and CWW:

- RAW-PU Ft. Benning (previously FB-Raw) (drinking WTP)

  - January: 5.3 ng/L PFOS and 7.2 ng/L PFOA
  - June: 4.9 ng/L PFOS and 14.0 ng/L PFOA
- HSERV Ft. Benning (previously FB-High Service) (drinking WTP)
  - January: 3.8 ng/L PFOS and 5.6 ng/L PFOA
  - June: 4.3 ng/L PFOS and 10.0 ng/L PFOA

The detected PFOS, PFOA, and PFBS concentrations are below the OSD screening levels. Historical PFOA, PFOS, and/or PFBS analytical results from the 2016 and 2020 sampling events are provided in **Table 2-1**. Analytical results for the surface water intake and WTP finished water for the Columbus sampling locations are also provided on **Table 2-1**. Refer to **Section 2.10** for additional information regarding the drinking water supply at Fort Benning.

# 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 Benning, data were collected from three principal sources of information:

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

These sources of data, along with their relative application to this PA, are discussed below. The specific findings of records review, personnel interviews, and site reconnaissance relevant to PFAS-containing materials at Fort Benning are described in **Section 4**.

## 3.1 Records Review

The records reviewed for this PA included, but were not limited to, various Installation Restoration Program administrative record documents, compliance documents, Fort Benning fire department documents, Fort Benning 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 Benning is provided in **Appendix F**.

## 3.2 Personnel Interviews

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

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

- Acting Environmental Division Chief
- Environmental Compliance Branch Manager
- Environmental Spill Manager
- Hazardous Waste Manager
- Restoration Program Manager
- Environmental Project Scientist
- Integrated Pest Management Coordinator
- Pollution Prevention, Solid and Hazardous Wastes
- Professional Land Surveyor/Engineer Technician
- Assistant Fire Chief
- Battalion Fire Chief
- Airfield Operations Officer
- Installation Aviation Safety Officer

- Army Logistics Command/QC Head
- Chief of Engineering
- Operations and Maintenance Division – Engineer
- Utilities Chief (TIYA Support Services, LLC)
- Contractor (TIYA Support Services, LLC)
- Contractor (TIYA Support Services, LLC)
- Logistics Readiness Center Shop Manager
- Logistics Readiness Center Tank Mechanic
- HazMat Assistant Manager
- Scientist (CWW)
- WWTP Managers (former)

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

## 3.3 Site Reconnaissance

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

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

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

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

Fort Benning was evaluated for all potential current and historical use, storage, and/or disposal of PFAS-containing materials. There are a variety of PFAS-containing materials used in relation to current and historical Army operations. However, the use, storage, and/or disposal of aqueous film-forming foam (AFFF) is the most prevalent potential source of PFAS chemicals at DoD facilities. As such, this section is organized to summarize the AFFF-related uses first, and all remaining potential PFAS-containing materials in the subsequent section.

## 4.1 AFFF Use, Storage, and Disposal Areas

AFFF was developed in the mid-1960s in response to a need for firefighting foams better suited to extinguish Class B, fuel-based fires. AFFF formulations consist of water, an organic solvent, up to 5 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.

The New Fire Training Area is used for a variety of firefighting and rescue training. There is no evidence that PFAS containing material has been used, stored, and/or disposed of at this location.

At Fire Station #4 (former Hangar 2492), AFFF has historically been, and is currently stored in, three Fort Benning Fire Department vehicles and inside the station on large shelving units in 5-gallons buckets and 55-gallon drums. “Chemguard” AFFF (3% concentrate), “National Foam Aer-o-water 3EM” and “Buckeye” Milspec AFFF (3% concentrate) are listed as the brands of AFFF currently stored at the station. AFFF at Fire Station #4 has never been deployed for any vehicle or structure fires. Additionally, fluoroprotein foam was used before AFFF for flight line fires and onsite "crash" trucks at Fire Station #4. A concrete pad located just outside of Fire Station #4 was used as a nozzle testing area for the fire trucks which use AFFF. Testing was conducted annually between 2014 to 2016 and used approximately 50 gallons per test event. The AFFF is contained in a concrete area and washed down a drain to the WWTP. Stormwater from the concrete pad where nozzle testing occurred drained to WWTP #1 and WWTP #3.

Two FFTAs (FFTA FBSB-88 and FFTA FBSB-105) are on Fort Benning that may have used AFFF, however, historical records were not available to confirm the type of AFFF FFTA FBSB-88 was previously used for fire training activities that may have used AFFF. AFFF was confirmed to have been used at FFTA FBSB-105. The stormwater and training water from FFTA FBSB-105 drains from the burn pit through an OWS and into the sanitary sewer. The lining in the pit at FFTA FBSB-105 appeared to be compromised. When the FFTA was active, the sanitary sewer drained to WWTP #1 and WWTP #3.

AFFF is suspected to have been historically stored in Old Fire Station Building 2452 and Old Fire Station Building 2445, reportedly built in 1943 and 1945, respectively. Old Fire Station Building 2452 has been demolished, and interviewees mentioned the possibility of historic foam storage inside the station or in crash vehicles; however, there are no records of this available. Old Fire Station Building 2445 is located on the flight line and interviewees indicated that same possibility of AFFF storage, with no records available to confirm the presence or absence of AFFF storage or use here as well. Old Fire Station Building 2445 is no longer in use, but the building has not been demolished. Crash trucks stored at Old Fire Station Building 2445 may have contained AFFF in their tanks, but there are data gaps concerning additional historical AFFF usage at Old Fire Station Building 2445.

Old Fire Station Building 9 and Fire Station #2 were constructed sometime prior to 1993. According to the current fire chief's knowledge, no PFAS-containing materials were stored or used at Old Fire Station Building 9 and Fire Station #2. The current fire chief's knowledge extends back only to 2005, and Fire Station #2 remains an active fire station.

Fire Station #1 (Building 4206) and Fire Station #3 (Building 2600) are currently operating fire stations at Fort Benning. Neither Fire Station #1 or Fire Station #3 have known history of PFAS-containing AFFF use, testing, or storage. Only Class A foams have reportedly been used or stored at Fire Station #1 and Fire Station #3.

There are several aircraft hangars that have fire suppression systems at Fort Benning, including hangars 2446, 2491, and 2459. However, Hangar 2446 has the only fire suppression system that contained AFFF. The foam fire suppression system in Hangar 2446 consisted of an overhead sprinkler system with two 1000-gallon "Chemgaurd 3% AFFF C-301MS" (3% concentrate) AFFF foam tanks on each side of the hangar. Currently, the tank on the side closer to the runway contains approximately 883 gallons of AFFF and the tank on the side closest to the street contains approximately 774 gallons of AFFF. The fire suppression system was installed in 2013 and was tested when installed using a non-PFAS testing agent, which is the only release event. There have been no releases or spills since installation. Stormwater from the inside the hangar where testing occurred drained to an OWS which then drains to WWTP #1 and WWTP #3 as part of the CWW sanitary sewer system. In the event of an incident, Hangar 2491 would utilize a non-PFAS containing foam fire suppression system, and Hangar 2459 is equipped with a water suppression system.

Of the remaining hangars at Fort Benning, Hangar 2492 was transitioned to Fire Station #4 and Hangar 2486 had access to AFFF from Fire Station #4 in the event of an incident. Hangars 301 and 302 have not historically had AFFF access/fire suppression systems; therefore, AFFF use is not suspected.

There have been no known spills or releases of AFFF in hangars and no known aviation accidents at Fort Benning that utilized AFFF for fire suppression. Testing of the hangar fire suppression system at Hangar 2446 is conducted with an alternate environmentally friendly agent, and not AFFF. Additionally, AFFF has never been stored at the hangars, other than the AFFF within the foam suppression tanks at Hangar 2446.

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

Following document research, personnel interviews, and site reconnaissance at Fort Benning, WWTPs and BAAs were also identified as preliminary locations for use, storage, and/or disposal of PFAS-

containing materials. A summary of information gathered during 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**.

WWTP #1 and WWTP #3 received runoff from several AOPIs around the installation. The biosolids from WWTP #1 and WWTP #3 had been discharged to 16BAAs located throughout Fort Benning using a spray truck. BAAs include: FTBN-033A, FTBN-033B, FTBN-033C, FTBN-033D, FTBN-033I, FTBN-033L, FTBN-033E, FTBN-033F, FTBN-033G, FTBN-033H, FTBN-033J, FTBN-033K, FTBN-033M, FTBN-033N, FTBN-033O, FTBN-033P and 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**.

Based on document research and personnel interviews, it is confirmed there are no metal plating operations, currently or historically, that use PFAS as part of the metal plating process.

During a telephonic interview with 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 and/or stored at Army installations and did not identify Fort Benning as an installation having used or stored PFAS-containing pesticides/insecticides. Additionally, the PA team reviewed available pesticide use inventory documentation provided by the installation and did not identify PFAS-containing pesticides use, storage, or disposal.

## 4.3 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 Benning) is not part of the PA/SI. However, potential off-post PFAS sources within a 5-mile radius of the installation that were identified during the records search and site visit are described below.

Nearby community fire departments, such as the Chattahoochee County Fire Department, Columbus Fire Department, and the Ladonia Fire Department, may potentially be off-post PFAS sources proximal to Fort Benning if they use or have used PFAS-containing firefighting foams. Otherwise, there were no potential off-post PFAS sources identified within a 5-mile radius of the installation.

# 5 SUMMARY AND DISCUSSION OF PA RESULTS

The preliminary locations evaluated for potential use, storage, and/or disposal of PFAS-containing materials at Fort Benning 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, 19 areas have been identified as AOPIs. The process used for refining these areas is presented on **Figure 5-1**, below.

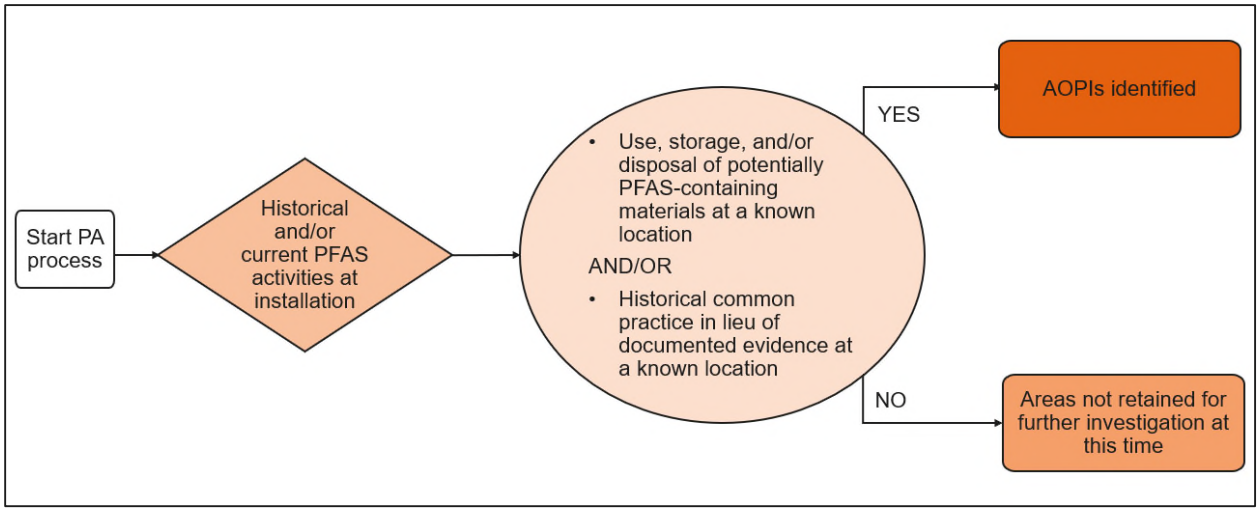


**Figure 5-1: AOPI Decision Flowchart**

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

Data limitations for this PA/SI at Fort Benning are presented in **Section 8**.

## 5.1 Areas Not Retained for Further Investigation

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

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

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

| Area Description | Dates of Operation | Relevant Site History | Rationale |
|---|---|---|---|
| **New Fire Training Area** | 2013 - Present | Used for a variety of firefighting and rescue training. Fire Chief confirmed AFFF has never been used at this site | No evidence of PFAS containing material used, stored, and/or disposed at this location. |

| Area Description | Dates of Operation | Relevant Site History | Rationale |
|---|---|---|---|
| **Hangar 2491** | 2017 – Present | In 2017, a Hi-Ex fire suppression system was installed and was the first fire suppression system installed in this hangar. Hi-Ex foams do not contain PFAS, according to interviewees. | No evidence of PFAS containing material used, stored, and/or disposed at this location. |
| **Hangar 2459** | 2017 – Present | Hangar is equipped with a water fire suppression system only. | No evidence of PFAS containing material used, stored, and/or disposed at this location. |
| **Hangar 301** | Unknown | Hangar 301 has not historically had AFFF access/a fire suppression system; therefore, AFFF use is not suspected. | No evidence of PFAS containing material used, stored, and/or disposed at this location |
| **Hangar 302** | Unknown | Hangar 302 has not historically had AFFF access/a fire suppression system; therefore, AFFF use is not suspected. | No evidence of PFAS containing material used, stored, and/or disposed at this location |
| **Hangar 2486** | Unknown | Hangar had access to AFFF from Fire Station #4 in the event of an incident. The hangars do not have fire suppression systems or known storage of AFFF. | No evidence of PFAS containing material used, stored, and/or disposed at this location. |
| **Fire Station #1 (Building 4206)** | 2010 - Present | The installation indicated on the site visit that only Class A fire-fighting foam was stored at this fire station. | No evidence of PFAS containing material used, stored, and/or disposed at this location. |
| **Fire Station #3 (Building 2600)** | 2005 - Present | The installation indicated on the site visit that only Class A fire-fighting foam was stored at this fire station. | No evidence of PFAS containing material used, stored, and/or disposed at this location. |
| **FTBN-033B BAA** | Mid-1970s until 1995 | The installation formerly disposed of digested sewage sludge generated during the treatment of wastewater at WWTP #1 and #3 at this location. | Unconfirmed locations, extents, frequency, and duration of biosolid application areas. |
| **FTBN-033D BAA** | Mid-1970s until 1995 | The installation formerly disposed of digested sewage sludge generated during the treatment of wastewater at WWTP #1 and #3 at this location. | Unconfirmed locations, extents, frequency, and duration of biosolid application areas. |
| **FTBN-033I BAA** | Mid-1970s until 1995 | The installation formerly disposed of digested sewage sludge generated during the treatment of wastewater at WWTP #1 and #3 at this location. | Unconfirmed locations, extents, frequency, and duration of biosolid application areas. |
| **FTBN-033F BAA** | Mid-1992 to 1994 | The installation formerly disposed of digested sewage sludge generated during the treatment of wastewater at WWTP #1 and #3 at this location. | Unconfirmed locations, extents, frequency, and duration of biosolid application areas. |

| Area Description | Dates of Operation | Relevant Site History | Rationale |
|---|---|---|---|
| **FTBN-033G BAA** | Mid-1992 to 1994 | The installation formerly disposed of digested sewage sludge generated during the treatment of wastewater at WWTP #1 and #3 at this location. | Unconfirmed locations, extents, frequency, and duration of biosolid application areas. |
| **FTBN-033H BAA** | Mid-1992 to 1994 | The installation formerly disposed of digested sewage sludge generated during the treatment of wastewater at WWTP #1 and #3 at this location. | Unconfirmed locations, extents, frequency, and duration of biosolid application areas. |
| **FTBN-033J BAA** | Unknown | The installation formerly disposed of digested sewage sludge generated during the treatment of wastewater at WWTP #1 and #3 at this location. | Unconfirmed locations, extents, frequency, and duration of biosolid application areas. |

## 5.2 AOPIs

Overviews for each AOPI identified during the PA process are presented in this section.

The AOPI locations are shown on **Figure 5-2**. Aerial photographs of each AOPI that also show the approximate extent of AFFF use (if applicable) are presented on **Figures 5-3** through **5-19** and include active monitoring wells in the vicinity of each AOPI.

### 5.2.1 Former Fire Training Area FBSB-88

FFTA FBSB-88 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to its designation as an FFTA. FFTA FBSB-88 was previously used for fire training activities that may have used AFFF. There are data gaps concerning historical training practices and use of AFFF at FFTA FBSB-88. FFTA FBSB-88 is shown on **Figure 5-3**.

### 5.2.2 Former Fire Training Area FBSB-105

FFTA FBSB-105 was identified as an AOPI following document research, personnel interviews, and site reconnaissance trips due to its designation as an FFTA. It is a concrete lined pit, filled with gravel that had been used for training activities until approximately the late 1900s to the early 2000s. The FFTA is located in the Harmony Church section of Fort Benning and was closed in 2008. Fire Department personnel confirmed AFFF use associated with firefighting training. Liquid waste material remaining in the pit after training events discharged into an OWS and then to a WWTP via the sanitary sewer, however the concrete liner is in poor condition and therefore may have resulted in discharges to Harps Creek. FFTA FBSB-105 is shown on **Figure 5-4**.

### 5.2.3 Old Fire Station Building 2452

Old Fire Station Building 2452 was identified as an AOPI following document research, personnel interviews, and site reconnaissance trips due to its use as a fire station. The fire station was built in 1943

and was demolished at a time that is unknown. An unknown type of fire-fighting foam was identified as having been stored and used at the old fire station and crash trucks containing PFAS-containing materials may have been housed here and the historical use and storage of PFAS-containing materials is unknown. Also, instances of nozzle testing are unknown. Old Fire Station Building 2452 is shown on **Figure 5-5**.

### 5.2.4 Old Fire Station Building 2445

Old Fire Station Building 2445 was identified as an AOPI following document research, personnel interviews, and site reconnaissance trips. The Old Fire Station Building 2445 was constructed in 1945 and demolished at an unknown time. AFFF was stored in the building at one point in time and crash trucks stored at this site may have contained AFFF in their tanks. Additional information regarding historical practices and/or instances of releases of PFAS-containing materials during nozzle testing are unknown. Old Fire Station Building 2445 is shown on **Figure 5-5**.

### 5.2.5 Hangar 2446

Hangar 2446 was identified as an AOPI following document research, personnel interviews, and site reconnaissance trips due to the presence of a fire suppression system containing AFFF. Hangar 2446 contains two connected hangars with two aboveground storage tanks containing AFFF (Chemguard). One tank contains approximately 883 gallons of AFFF, and the second tank contained approximately 774 gallons of AFFF at the time of the site reconnaissance visit. During installation in 2013, the system was tested using a non-PFAS testing agent, and there have been no known releases of AFFF since installation. Hangar 2446 is shown on **Figure 5-5**.

### 5.2.6 Nozzle Testing Area and Fire Station #4

The Nozzle Testing Area and Fire Station #4 was identified as an AOPI following document research, personnel interviews, and site reconnaissance trips due to its designation as an area with documented AFFF use, storage, and release. The fire station is still active and is also the former Hangar 2492 which was converted to a fire station. AFFF has historically been, and is currently, stored at this location. AFFF storage currently occurs in three Fort Benning Fire Department vehicles and inside the station in 5-gallons buckets and 55-gallon drums. A concrete pad located just outside of Fire Station #4 was used to test the nozzles on the fire trucks which use AFFF. The last occurrence of AFFF usage was reportedly in 2016. Nozzle testing usage with AFFF was conducted on an annual basis for two years (2014 to 2016), with an estimated 50 gallons of AFFF concentrate used per event. The Nozzle Testing Area and Fire Station #4 are shown on **Figure 5-6**.

### 5.2.7 Wastewater Treatment Plant #1 and #3

WWTP #1 and WWTP #3 were identified as AOPIs following document research, personnel interviews, and site reconnaissance trips due to discharge of AFFF to the sanitary sewer. When the FBSB-105 fire training area was active (confirmed AFFF use), liquids from the training pit discharged into an OWS and then to WWTP #3, via the sanitary sewer. WWTP #3 drained its effluent into WWTP #1 and the outfall discharges to the Chattahoochee River. WWTP #1 is shown on **Figure 5-7** and WWTP #3 is shown on **Figure 5-8**.

### 5.2.8 Fire Station #2

Fire Station #2 was identified as an AOPI following document research, personnel interviews, and site reconnaissance trips due to its use as a fire station. The fire station was reported to only use and store Class A foam, however, knowledge only went back to 2005. There were data gaps for AFFF storage and usage prior to 2005. The construction date of the fire station is unknown; however, it was constructed prior to 1993. Fire Station #2 is shown on **Figure 5-9**.

### 5.2.9 Old Fire Station Building 9

Old Fire Station Building 9 was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to its use as a fire station. The fire station was an original fire station at Fort Benning and was demolished in 2006. A temporary building was located next to the fire station to store fire trucks and was also demolished. Class A foam was carried on the trucks. There are data gaps for AFFF storage and usage prior to 2005. The Old Fire Station Building 9 is shown on **Figure 5-10**.

### 5.2.10 Biosolids Application Areas (FTBN-033A, FTBN-033C, FTBN-033E, FTBN-033K, FTBN-033L, FTBN-033M, FTBN-033N, FTBN-033O, and FTBN-033P)

The following nine BAAs were identified as AOPIs after document research, personnel interviews, and site reconnaissance due to use as areas for disposal of digested sewage sludge generated during the treatment of wastewater at WWTP #1 and #3 which received wastewater potentially containing PFAS-containing materials AFFF:

- FTBN-033A
- FTBN-033C
- FTBN-033E
- FTBN-033K
- FTBN-033L
- FTBN-033M
- FTBN-033N
- FTBN-033O
- FTBN-033P

These BAAs were identified as AOPIs after the PA site visit, because there were limited documents for review and no further information was available (Army 1994; USACE 2013). The spreading of biosolids at locations around Fort Benning occurred from the mid-1970s to approximately 1995 (Army 1994). These BAAs were identified to have received biosolids during the time period which corresponds with when PFAS-containing AFFF was used at Fort Benning and may have been present in wastewater discharged to the on-post WWTPs. AFFF may have entered sanitary sewer drains (e.g., at FFTA FSBS-105) and processed through the WWTPs. PFAS compounds are not readily removed through traditional water treatment processes, thus residual impacts might be present in the resultant biosolid waste. Sixteen BAAs were identified as preliminary locations at Fort Benning where these biosolids were reportedly spread/applied; however, only the nine listed above were identified as AOPIs because the locations of

where the biosolids were applied is unknown. The spreading of biosolids at locations around Fort Benning occurred from the mid-1970s to approximately 1995 (Army 1994). The figures associated with the BAAs are **Figures 5-11** through **5-19**.

# 6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at Fort Benning, an SI for PFOS, PFOA, and PFBS was conducted in accordance with CERCLA. SI sampling was completed at Fort Benning at 17 of the 19 AOPIs to evaluate presence or absence of PFOS, PFOA, and PFBS in comparison with the OSD risk screening levels. Two BAA AOPIs were not sampled during the SI. AOPI BAA FTBN-033N was not sampled because of the location of the biosolids application is unknown. AOPI BAA FTBN-033O was not sampled because it is an active firing range. As such, an installation-specific QAPP Addendum (Arcadis 2020) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A preliminary CSM was prepared for each of the installation's AOPIs in accordance with the USACE Engineer Manual on CSMs, Engineer Manual 200-1-12 (USACE 2012). The preliminary CSMs identified potential human receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSMs identified soil, groundwater, surface water, and sediment pathways as potentially complete, which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on each AOPI's preliminary CSM. The SI scope of work was completed in August 2020 through the collection of field data and analytical samples.

The SI field work was completed in accordance with the standard operating procedures (SOPs), technical guidance instructions (TGIs), sampling design, and QA/QC requirements as detailed in the QAPP Addendum (Arcadis 2020) and PQAPP (Arcadis 2019). The subsections below summarize the DQOs, sampling design and rationale, sampling activities and methods, and data analyses procedures for the SI phase at Fort Benning. Non-conformances to the prescribed procedures in the PQAPP and QAPP Addendum are described in **Section 6.3.4**. Analytical results obtained through August 2020 SI field activities are summarized in **Section 7**.

## 6.1 Data Quality Objectives

As identified during the DQO process and outlined in the site-specific QAPP Addendum (Arcadis 2020), the objective of the SI is to identify whether there has been a release to the environment at the AOPIs identified in the PA and to determine if further investigation is warranted. This SI evaluated groundwater and soil for PFOS, PFOA 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.

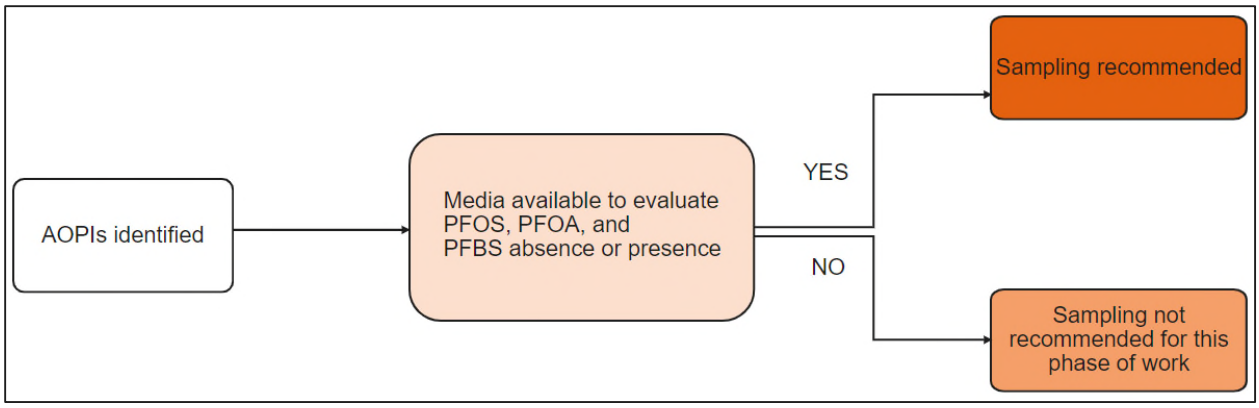


**Figure 6-1: AOPI Sampling Decision Tree**

The sampling design for SI sampling activities at Fort Benning is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2020). The areas of focus were selected based on a review of historical documents, data, and information obtained by conducting personal interviews during the PA and were based on the identified or potential use, storage, disposal, and/or release of PFAS-containing materials.

Groundwater sampling was performed at 15 of the 17 AOPIs sampled during the SI., and concentrations. A groundwater sample was not collected at the BAA FTBN-033K and BAA FTBN-033P.

Soil samples were collected at 16 of the 17 AOPIs sampled during the SI to evaluate PFOS, PFOA, and PFBS presence or absence at potential release areas, and to update the individual AOPI CSMs. Soil samples were analyzed for select PFAS, TOC, pH, and grain size; soil lithological descriptions were continuously logged and were documented on field forms. Soil samples were collected from 42 discrete points at each of the following AOPIs: FFTA FBSB-88, FFTA FBSB-105, Old Fire Station Building 2452, Nozzle Testing Area and Fire Station #4, Old Fire Station Building 2445, Old Fire Station Building 9, Fire Station #2, WWTP #1, WWTP #3, and BAA-FTBN-033A, BAA-FTBN-033C, BAA-FTBN-033E, BAA-FTBN-033K, BAA-FTBN-033M, BAA-FTBN-033P, and Hangar 2446. Soil samples were not collected at the BAA FTBN-033L AOPI. Select soil samples were also analyzed total organic carbon (TOC), pH, and grain size.

Surface water and sediment sampling was not conducted any AOPIs due to the lack of presence of either media at each AOPI.

The sampling depths at existing monitoring wells were at approximately the center of the saturated screened interval. Approximate sampling depths, and constituents analyzed for each sampling location and medium are included in **Table 6-1**. Sampling depths noted for existing monitoring wells represent approximately the center of the saturated screened interval.

## 6.3 Sampling Methods and Procedures

Environmental data were collected and analyzed in accordance with the PQAPP (Arcadis 2019), the SOPs and TGIs included as Appendix A to the PQAPP, the QA/QC requirements identified in Worksheet #20 of the PQAPP, the approved scope and sampling methods outlined in the site-specific QAPP Addendum (Arcadis 2020), and the safety procedures specified in the Accident Prevention Plan (Arcadis

2018) and SSHP (Arcadis 2020). The sampling methods described in the SOPs and TGIs establish equipment requirements, procedures for preparing equipment and containers before sampling, sampling procedures under various conditions, and procedures for storing samples to ensure that sample contamination does not occur during collection and transport. In general, sampling techniques used in the SI were consistent with conventional sampling techniques used in the environmental industry, but special considerations were made regarding PFAS-containing materials and equipment and cross-contamination potential.

The sampling methods employed during the SI are detailed in the PQAPP (Arcadis 2019) and QAPP Addendum (Arcadis 2020). The subsections below provide a summary of the field methods and procedures utilized to complete the SI scope of work. Field notes and field forms (i.e., soil boring logs, groundwater purging logs, equipment calibration forms, tailgate health and safety forms, and sample collection logs) documenting the SI sampling activities are included in **Appendices I** and **J**, respectively.

### 6.3.1 Field Methods

Groundwater field parameters (temperature, pH, specific conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential) were measured during purging and allowed to stabilize in accordance with the TGI for PFAS Sampling Procedures and Low-Flow Groundwater Purging for Monitoring Wells (P-11 in Appendix A to the PQAPP; Arcadis 2019), or were purged for a maximum of 20 minutes, whichever was sooner, before groundwater sampling to ensure a representative sample was collected and, potentially, to inform the interpretation of analytical data. Temporary well boreholes were abandoned in accordance with USEPA Region IV Science and Ecosystem Support Division Guidance (SESDGUID-101-R1). Coordinates for each borehole and groundwater sampling location were recorded using a handheld global positioning system. At existing wells monitoring wells, groundwater samples were collected from approximately the center of the saturated screened interval. Groundwater was collected via low-flow sampling using peristaltic pumps.

Direct-push technology (DPT) boring and sampling was completed using a dual-tube, top-down method. Soil lithological descriptions were continuously logged and were documented on field forms. At each sampling point at each AOPI, soil samples were collected from the top 2 ft of native soil using a stainless-steel hand auger. Decontamination procedures for non-dedicated equipment used during sampling are described in **Section 6.3.5**.

### 6.3.2 Quality Assurance / Quality Control

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

QA/QC samples were collected at the frequencies specified in the QAPP Addendum (Arcadis 2020), typically at a rate of one per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicate samples were collected for media sampled for PFOS, PFOA, PFBS, and TOC only. EBs were collected for media sampled for PFOS, PFOA, and PFBS at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2020). The decontaminated reusable

equipment from which EBs were collected include soil sleeves, tubing, hand augers, drilling shoes, mixing bowls, and water level meters as applicable to the sampled media. Source blanks were collected from the water used to pressure-wash drill tooling. Analytical results for blank samples are discussed in **Section 7.21**.

### 6.3.3 Field Change Reports

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

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

- FCR-FTBN-01: The following six planned boring locations were adjusted based on field conditions:
  - FTBN-FTA105-1: The proposed sample location was located on top of an approximately 6 ft tall gravel berm. The sample location was moved approximately 15 ft to the southwest to the bottom of the berm.
  - FTBN-BAA033A-2: Construction of an ammunition storage building conflicted with the proposed boring location. The location was moved northeast to the edge of the AOPI boundary.
  - FTBN-BAA033A-3: Construction of an ammunition storage building conflicted with the proposed boring location. The location was moved northeast to the edge of the AOPI boundary.
  - FTBN-BAA033E-3: The proposed sample location was located in the center of the parade grounds. The sample location was moved south of the parade grounds within the AOPI.
  - FTBN-BAA033L-1: The proposed sample location was located on a steep slope that was inaccessible to the drill rig. The sample location was moved to a more accessible location to the northwest within the AOPI.
  - FTBN-BAA033M-1: The proposed sample location was impeded by a barbed wire fence. The sample location was moved slightly to the northeast within the target sampling area.
- FCR-FTBN-02:
  - Groundwater sampling location FTBN-FTA105-1-GW was not completed as proposed. The boring was not advanced beyond the shallow soil sampling depth to collect a groundwater sample. An existing 1.5-inch groundwater monitoring well was identified approximately 30 ft to 40 ft from the proposed sampling location. This well was gauged prior to starting work at FTBN-FTA105-1 and the depth to groundwater was approximately 78 ft bgs. Therefore, a shallow soil sample was only collected from FTBN-FTA105-1; a groundwater sample was collected from the existing monitoring well and identified as FTBN-FTA105-MW.

Non-conformances to the approved sampling scope and/or procedures occurred during the sampling events. Non-conformances were reviewed and approved in accordance with the following chain of communication: 1) minor modifications or clarifications were communicated within the field team; and 2) major modifications were communicated to USACE in the daily/periodic field status email updates

submitted by the SI project manager during the sampling event. Non-conformances to the approved sampling plan which affect the DQOs are documented in Non-Conformance Reports included as **Appendix L** and are summarized below:

- NCR-FTBN-01: A groundwater sample was not collected from sampling location FTBN-BSA033K-1. A grab groundwater sample was proposed to be collected from the first encountered saturated zone. Saturated drill cuttings were not encountered during drilling at borehole FTBN-BSA033K-1. The field conditions were discussed with the project team and the borehole was abandoned. FTBN-BSA033K-1 was advanced to a depth of 40 ft bgs.
- NCR-FTBN-02: A groundwater sample was not collected from sampling location FTBN-BSA033P-1. A grab groundwater sample was proposed to be collected from the first encountered saturated zone. Saturated drill cuttings were not encountered during drilling at borehole FTBN-BSA033P-1. The field conditions were discussed with the project team and the borehole was abandoned. FTBN-BSA033P-1 was advanced to a depth of 40 ft bgs.

### 6.3.4 Decontamination

Non-dedicated reusable sampling equipment (e.g., stainless-steel trowels, 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 (Arcadis 2019, **Appendix A**).

### 6.3.5 Investigation-Derived Waste

IDW, including soil cuttings, groundwater, and decontamination fluids, were collected and placed on the ground surface at the point of collection. Disposable equipment IDW was collected in bags and disposed in municipal waste receptacles. Equipment IDW includes personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, Lexan tubes, and high-density polyethylene and silicon tubing) that may come in contact with sampling media.

## 6.4 Data Analysis

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

### 6.4.1 Laboratory Analytical Methods

Analytical samples collected during the SI were submitted to Pace South Carolina (formerly Shealy Environmental Services, Inc.), an ELAP-accredited laboratory for PFAS analysis, including PFOS, PFOA, and PFBS, by liquid chromatography with tandem mass spectrometry. Laboratory analyses associated with the SI were completed in accordance with Worksheets #12.1 through #12.5 in the PQAPP (Arcadis 2019). Eighteen PFAS-related compounds, including PFOS, PFOA, and PFBS were analyzed for in

groundwater and soil samples using an analytical method that is ELAP-accredited and compliant with QSM 5.3 (DoD and Department of Energy 2019), Table B 15.

Additionally, the following general chemistry and physical characteristic analyses were completed for select soil and sediment samples in accordance with Worksheet #18 of the QAPP Addendum (Arcadis 2020) by the analytical method noted:

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

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

The laboratory limit of detection (LOD) is defined as “the lowest concentration for reliable reporting of a non-detect of a specific analyte in a specific matrix with a specific method at 99 percent confidence” (DoD 2017). The lowest concentration of a substance that produces a quantitative result within specified limits of precision and bias is known as the limit of quantitation (LOQ; DoD 2017). Concentrations detected between the LOD and LOQ, therefore, are considered estimates and are qualified as such on laboratory analytical reports. Instrument-specific detection limits (e.g., the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99 percent confidence; DoD 2017), as provided for each analyte by the laboratory, are reported along with the LODs and LOQs in the laboratory analytical reports included in the Data Usability Summary Report (DUSR; **Appendix M**).

### 6.4.2 Data Validation

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

### 6.4.3 Data Usability Assessment and Summary

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

Based on the final data usability assessment, the environmental data collected at Fort Benning 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 M**), and as indicated in the full analytical tables (**Appendix N**) provided for the SI results. These data are of sufficient quality to meet the objectives

and requirements of the PQAPP (Arcadis 2019) and Fort Benning QAPP Addendum (Arcadis 2020). Data qualifiers applied to laboratory analytical results for samples collected during the SI at Fort Benning are provided in the data tables, data validation reports, and the Data Usability Summary Table located at the end of DUSR. Qualifiers for data shown on figures are defined in the notes of figures.

## 6.5 Office of the Secretary of Defense Risk Screening Levels

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

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

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

**Notes:**
1. Risk screening levels for tap water and soil provided by the OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the DoD Cleanup Program. September 15 (**Appendix A**).
2. All soil data will be screened against both the Residential Scenario and Industrial/Commercial risk screening levels (if collected from less than 2 ft bgs), regardless of the current and projected land use of the AOPI.
mg/kg = milligram per kilogram
ppm = part per million
ppt = part 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 Benning are industrial/commercial, both residential and industrial/commercial soil risk screening levels for PFOS, PFOA, and PFBS will be used to evaluate detected soil concentrations. The data from the SI sampling event are compared to the OSD risk screening levels in **Section 7**. If concentrations of PFOS, PFOA, or PFBS are detected greater than the applicable OSD risk screening levels, further study in a remedial investigation is recommended (**Section 8**).

# 7 SUMMARY AND DISCUSSION OF SITE INSPECTION RESULTS

This section summarizes the analytical results obtained from samples collected during the SI at Fort Benning (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 2020) and as noted in **Table 6-1**. The sample results discussion below focuses on the PFOS, PFOA, and PFBS analytical results because they have OSD risk screening levels. The Army will make subsequent investigation decisions based on these constituents' concentrations relative to the OSD risk screening levels.

**Tables 7-1** and **7-2** provide a summary of the groundwater and soil analytical results for PFOS, PFOA, and PFBS. **Table 7-3** summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix N** includes the full suite of analytical results for these media, as well as for the QA/QC samples. An overview of AOPIs at Fort Benning with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2** through **7-16** show the PFOS, PFOA, and PFBS analytical results in groundwater and soil for each AOPI. Non-detected results are reported as less than the LOQ. Detections of PFOS, PFOA, and/or PFBS greater than the applicable OSD risk screening levels are highlighted in summary tables and on figures. Final qualifiers applied to the data by the laboratory and the project chemist (as defined in **Section 6.4.3**) are presented on the analytical tables. Groundwater data collected during the SI are reported in ng/L, or parts per trillion, and soil data are reported in mg/kg, or parts per million.

Field parameters measured for groundwater during low-flow purging and sample and soil descriptions are provided on the field forms in **Appendix J**. The results of the SI are grouped by AOPI and discussed for each medium as applicable. Groundwater was generally first encountered at varying depths across the installation. In some locations, groundwater was encountered as shallow as 5 ft bgs and in other locations was not encountered after drilling to 40 ft bgs in accordance with the approved QAPP Addendum. Depth to groundwater in the western portion of the installation (in the vicinity of Lawson Army Airfield) ranged from 5 to 38 ft bgs. Depth to groundwater in the northwestern portion of the installation (in the vicinity of Upatoi Creek) ranged from 11 to 39 ft bgs. Depth to groundwater in the northeastern portion of the installation ranged from 1 ft bgs at WWTP #3 to 78 ft bgs at FFTA FBSB-105, depending on proximity to a creek. FTBN-033N and FTBN-033O were not sampled, so the depth to groundwater in these AOPIs is unknown.

**Table 7-3 AOPIs and OSD Risk Screening Level Exceedances**

| AOPI Name | OSD Exceedances (Yes/No) |
|---|---|
| FFTA FBSB-88 | Yes |
| FFTA FBSB-105 | Yes |
| Old Fire Station Building 2452 | Yes |
| Old Fire Station Building 2445 | Yes |
| Hangar 2446 | Yes |
| Nozzle Testing Area and Fire Station #4 | Yes |
| WWTP #1 | Yes |
| WWTP #3 | Yes |
| Fire Station #2 | Yes |
| Old Fire Station Building 9 | Yes |
| BAA: FTBN-033A | No |
| BAA: FTBN-033C | Yes |
| BAA: FTBN-033E | Yes |
| BAA: FTBN-033K | No |
| BAA: FTBN-033L | No |
| BAA: FTBN-033M | No |
| BAA: FTBN-033N | No[1] |
| BAA: FTBN-033O | No[2] |
| BAA: FTBN-033P | No |

**Notes:**

[1] Samples were not collected at the BAA FTBN-033N AOPI because the location where biosolids were spread is unknown. The area is identified only as an approximate location in the vicinity of BAA FTBN-033M. In accordance with the approved QAPP Addendum, data from BAA FTBN-033M was used to determine groundwater and soil conditions at BAA FTBN-033N as these AOPIs are comparable sites (e.g., they are both BAA AOPIs and are located in the same general vicinity).

[2] Samples were not collected at the BAA FTBN-033O AOPI because it is an active firing range. Collective data from BAA AOPIs was used to determine groundwater and soil conditions at BAA FTBN-033O as these AOPIs are comparable sites. Two of the seven BAAs had detections of PFOA, PFOS, and/or PFBS that exceeded OSD risk screening levels.

## 7.1 FFTA FBSB-88

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with FFTA FBSB-88 shown on **Figure 7-2** and **Tables 7-1** and **7-2**.

### 7.1.1 Groundwater

Groundwater samples were collected from three borings via DPT at the FFTA FBSB-88 AOPI. Grab groundwater samples were collected at first-encountered groundwater (21 to 25 ft bgs). PFOS was

detected at concentrations greater than the OSD tap water risk screening level of 40 ng/L in groundwater at two of the three borings: FTBN-FTA88-2-GW (85 ng/L) and FTBN-FTA88-3-GW (330 ng/L). PFOA was detected at concentrations greater than the OSD tap water risk screening level of 40 ng/L in groundwater at one of the three borings: FTBN-FTA88-3-GW (48 ng/L PFOS). PFBS was not detected in groundwater at concentrations that exceeded OSD tap water risk screening levels in any of the samples. FFTA FBSB-88 is shown on **Figure 7-2** and groundwater analytical results are presented on **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.1.2 Soil

Soil samples were collected from three borings at the FFTA FBSB-88 AOPI co-located with the groundwater samples. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOA and PFBS were not detected in any samples. PFOS was detected in two of the three soil samples at concentrations ranging from 0.0025 mg/kg in FTBN-FTA88-2-SO to 0.013 mg/kg in FTBN-FTA88-3-SO. The PFOS concentrations detected in the soil did not exceed the OSD residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. FFTA FBSB-88 is shown on **Figure 7-2** and soil analytical results are presented on **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.2 FFTA FBSB-105

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with FFTA FBSB-105.

### 7.2.1 Groundwater

A groundwater sample was collected from one existing monitoring well at the FFTA FBSB-105 AOPI. Depth to groundwater was measured at 78 ft bgs therefore the samples was collected in the middle of the screen at 83 ft bgs. PFOS was detected at a concentration greater than the OSD tap water risk screening level of 40 ng/L in the groundwater sample: FTBN-FTA105-MW (98 ng/L). PFOA were detected at a concentration greater than the OSD tap water risk screening level of 40 ng/L in the groundwater sample: FTBN-FTA105-MW (160 ng/L). PFBS was detected in the groundwater sample at 200 ng/L, which did not exceed the OSD tap water risk screening level of 600 ng/L. FFTA FBSB-105 is shown on **Figure 7-3** and groundwater analytical results are presented on **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.2.2 Soil

Soil samples were collected from two boring locations at the FFTA FBSB-105 AOPI with hand auger. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS was detected in both soil samples at concentrations ranging from 0.025 mg/kg in FTBN-FTA105-2-SO to 0.12 mg/kg in FTBN-FTA105-1-SO. PFOA was detected in one of the soil samples at a concentration of 0.0063 mg/kg in FTBN-FTA105-1-SO. The PFOS and PFOA concentrations detected in the soil did not exceed the OSD residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFBS was not

detected in either sample. FFTA FBSB-105 is shown on **Figure 7-3** and soil analytical results are presented on **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.3 Old Fire Station Building 2452

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Old Fire Station Building 2452.

### 7.3.1 Groundwater

Groundwater samples were collected from two borings via DPT at the Old Fire Station Building 2452 AOPI. Grab groundwater samples were collected at first-encountered groundwater (16 to 20 ft bgs). PFOS was detected at concentrations greater than the OSD tap water risk screening level of 40 ng/L in both groundwater samples: FTBN-FS2452-1-GW (13,000 ng/L) and FTBN-FS2452-2-GW (6,300 ng/L). PFOA was detected at concentrations greater than the OSD tap water risk screening level of 40 ng/L in both groundwater samples: FTBN-FS2452-1-GW (1,200 ng/L) and FTBN-FS2452-2-GW (210 ng/L). PFBS was detected in both groundwater samples at concentrations which did not exceed the OSD tap water risk screening level of 600 ng/L. Old Fire Station Building 2452 is shown on **Figure 7-4** and groundwater analytical results are presented on **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.3.2 Soil

Soil samples were collected from two borings at the Old Fire Station Building 2452 AOPI co-located with the groundwater samples. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS was detected at concentrations greater the OSD residential risk screening level of 0.13 mg/kg in one of the two soil samples but did not exceed the industrial/commercial screening level: FTBN-FS2452-2-SO (1.2 mg/kg and a duplicate sample of 1.3 mg/kg). PFOA and PFBS were also detected in the soil at concentrations that did not exceed the OSD residential (and therefore did not exceed industrial/commercial) screening levels of 0.13 mg/kg and 1.9 mg/kg, respectively. Old Fire Station 2452 is shown on **Figure 7-4** and soil analytical results are presented on **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.4 Old Fire Station Building 2445

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Old Fire Station Building 2445.

### 7.4.1 Groundwater

Groundwater samples were collected from three borings via DPT at the Old Fire Station Building 2445 AOPI. Grab groundwater samples were collected at first-encountered groundwater (16 to 20 ft bgs). PFOS was detected at concentrations greater than the OSD tap water risk screening level of 40 ng/L in all three groundwater samples: FTBN-FS2445-1-GW (3,800 ng/L), FTBN-FS2445-2-GW (13,000 ng/L) and FTBN-FS2445-3-GW (1,600 ng/L). PFOA was detected at concentrations greater than the OSD tap

water risk screening level of 40 ng/L in all three groundwater samples: FTBN-FS2445-1-GW (200 ng/L), FTBN-FS2445-2-GW (570 ng/L) and FTBN-FS2445-3-GW (130 ng/L). PFBS was detected in all three groundwater samples at concentrations which did not exceed the OSD residential risk screening level of 600 ng/L. Old Fire Station Building 2445 is shown on **Figure 7-4** and groundwater analytical results are presented on **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.4.2 Soil

Soil samples were collected from three borings at the Old Fire Station 2445 AOPI co-located with the groundwater samples. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS and PFOA were detected in all three soil samples at concentrations which did not exceed the OSD residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFBS was not detected in any of the samples. Old Fire Station 2445 is shown on **Figure 7-4** and soil analytical results are presented on **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.5 Hangar 2446

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Hangar 2446.

### 7.5.1 Groundwater

Groundwater samples were collected from two borings via DPT at the Hangar 2446 AOPI. Grab groundwater samples were collected at first-encountered groundwater (6 to 10 ft bgs). PFOS was detected at concentrations greater than the OSD residential risk screening level of 40 ng/L in both groundwater samples: FTBN-H2446-1-GW (510 ng/L) and FTBN-H2446-2-GW (51 ng/L). PFOA was detected above the OSD residential risk screening level of 40 ng/L in one of the groundwater samples: FTBN-H2446-1-GW (44 ng/L). PFBS was detected in both groundwater samples at concentrations which did not exceed the residential risk screening level of 600 ng/L. Hangar 2446 is shown on **Figure 7-4** and groundwater analytical results are presented on **Table 7-1**. The full suite of analytical results is and **Appendix M**.

### 7.5.2 Soil

Soil samples were collected from two borings at the Hangar 2446 AOPI co-located with the groundwater samples. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS was detected in both soil samples at concentrations which did not exceed residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFOA and PFBS were not detected in either of the samples. Hangar 2446 is shown on **Figure 7-4** and soil analytical results are presented on **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.6 Nozzle Testing Area and Fire Station #4

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

### 7.6.1 Groundwater

Groundwater samples were collected from three borings via DPT at the Nozzle Testing Area and Fire Station #4 AOPI. Grab groundwater samples were collected at first-encountered groundwater (16 to 20 ft bgs). PFOS was detected at concentrations greater than the OSD tap water risk screening level of 40 ng/L in two of the three groundwater samples: FTBN-FS4-1-GW (190 ng/L) and FTBN-FS4-3-GW (81 ng/L). PFOA was detected at concentrations greater than the OSD tap water risk screening level of 40 ng/L in two of the three groundwater samples: FTBN-FS4-1-GW (71 ng/L) and FTBN-FS4-3-GW (46 ng/L). PFBS was detected in all three groundwater samples at concentrations which did not exceed the OSD tap water risk screening level of 600 ng/L. Nozzle Testing Area and Fire Station #4 is shown on **Figure 7-5** and groundwater analytical results are presented on **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.6.2 Soil

Soil samples were collected from three borings at the Nozzle Testing Area and Fire Station #4 AOPI co-located with the groundwater samples. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS was detected in soil samples FTBN-FS4-1-SO and FTBN-FS4-2-SO at concentrations which did not exceed residential risk screening level of 0.13 mg/kg. PFOA was detected in soil sample FTBN-FS4-3-SO at a concentration which did not exceed residential risk screening level of 0.13 mg/kg. PFBS was not detected in any of the soil samples. Nozzle Testing Area and Fire Station #4 is shown on **Figure 7-5** and soil analytical results are presented on **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.7 Wastewater Treatment Plant #1

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with WWTP #1.

### 7.7.1 Groundwater

One groundwater sample was collected from one boring via DPT at the WWTP #1 AOPI. The grab groundwater sample was collected at first-encountered groundwater (21 to 25 ft bgs). PFOS was detected at a concentration greater than the OSD tap water risk screening level of 40 ng/L in the groundwater sample: FTBN-WWTP-1-GW (97 ng/L). PFOA was detected at a concentration greater than the OSD tap water risk screening level of 40 ng/L in the groundwater sample: FTBN-WWTP-1-GW (57 ng/L). PFBS was detected in the groundwater sample at a concentration which did not exceed the OSD tap water risk screening level of 600 ng/L. WWTP #1 is shown in **Figure 7-6** and groundwater analytical data is presented in **Table 7-1**. The full suite of analytical results is included in **Table 7-1** and **Appendix M**.

### 7.7.2 Soil

A soil sample was collected at the WWTP #1 AOPI co-located with the groundwater sample. PFOS and PFOA were detected in the soil sample at concentrations which did not exceed the residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFBS was not

detected in the soil sample. WWTP #1 is shown in **Figure 7-6** and soil analytical data is presented in **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.8 Wastewater Treatment Plant #3

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

### 7.8.1 Groundwater

One groundwater sample was collected from one boring via DPT at the WWTP #3 AOPI and was collected at first-encountered groundwater (21 to 25 ft bgs). PFOS was detected at a concentration greater than the OSD tap water risk screening level of 40 ng/L in the groundwater sample: FTBN-WWTP-3-GW (46 ng/L). PFOA was detected at a concentration greater than the OSD tap water risk screening level of 40 ng/L in the groundwater sample: FTBN-WWTP-3-GW (710 ng/L). PFBS was detected in the groundwater sample at a concentration which did not exceed the residential risk screening level of 600 ng/L. WWTP #3 is shown in **Figure 7-7** and groundwater analytical data is presented in **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.8.2 Soil

A soil sample was collected at the WWTP #3 AOPI co-located with the groundwater sample. PFOS was not detected in the soil sample. PFOA was detected in the soil sample at concentrations which did not exceed the residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFBS was not detected in the soil sample. WWTP #3 is shown in **Figure 7-7** and soil analytical data is presented in **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.9 Fire Station #2

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Fire Station #2.

### 7.9.1 Groundwater

Groundwater samples were collected from two borings via DPT at the Fire Station #2 AOPI. Grab groundwater samples were collected at first-encountered groundwater (26 to 30 ft bgs). PFOS was detected at concentrations greater than the OSD tap water risk screening level of 40 ng/L in both groundwater samples: FTBN-FS2-1-GW (84 ng/L) and FTBN-FS2-2-GW (920 ng/L). PFOA was detected above the OSD tap water risk screening level of 40 ng/L in one of the groundwater samples: FTBN-FS2-2-GW (370 ng/L). PFBS was detected above the OSD tap water risk screening level of 600 ng/L in one of the groundwater samples: FTBN-FS2-2-GW (1,500 ng/L). Fire Station #2 is shown in **Figure 7-8** and groundwater analytical data is presented in **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.9.2 Soil

Soil samples were collected from three borings at the Fire Station #2 AOPI, two co-located with the groundwater samples and one additional location. Each boring included one shallow soil sample (0 to 2 ft bgs). PFBS and PFOA were not detected in any of the soil samples. PFOS was detected in all three soil samples at concentrations which did not exceed the residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. Fire Station #2 is shown in **Figure 7-8** and soil analytical data is presented in **Table 7-2.** The full suite of analytical results is included in **Appendix M**.

## 7.10 Old Fire Station Building 9

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with Old Fire Station Building 9.

### 7.10.1 Groundwater

A groundwater sample was collected from one boring via DPT at the Old Fire Station Building 9 AOPI. The grab groundwater sample was collected at first-encountered groundwater (41 to 45 ft bgs). PFOS was detected at a concentration greater than the OSD tap water risk screening level of 40 ng/L in the groundwater sample: FTBN-FS9-1-GW (350 ng/L). PFOA and PFBS were detected in the groundwater sample at a concentration which did not exceed the residential risk screening level of 40 ng/L and 600 ng/L, respectively. Old Fire Station Building 9 is shown in **Figure 7-9** and groundwater analytical data is presented in **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.10.2 Soil

Soil samples were collected from three borings at the Old Fire Station Building 9 AOPI, one co-located with the groundwater sample and two hand auger locations. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS was detected at a concentration greater than the OSD residential risk screening level but below the industrial/commercial risk screening level in one of the three soil samples: FTBN-FS9-2-SO (0.16 mg/kg). PFOA was also detected in the soil at concentrations that did not exceed the OSD residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFBS was not detected in the soil samples at this AOPI. Old Fire Station Building 9 is shown in **Figure 7-9** and soil analytical data is presented in **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.11 Biosolid Application Area: FTBN-033A

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with BAA FTBN-033A.

### 7.11.1 Groundwater

Groundwater samples were collected from two existing monitoring wells at the BAA FTBN-033A AOPI. A groundwater sample was collected at first-encountered groundwater (approximately 10 ft bgs for MW3 and approximately 37 ft bgs for MW8). PFOS, PFBS, and PFOA were detected at concentrations below

OSD tap water risk screening levels in both groundwater samples. BAA FTBN-033A is shown in **Figure 7-10** and groundwater analytical data is presented in **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.11.2 Soil

Soil samples were collected from three boring locations at the BAA FTBN-033A AOPI with hand auger. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS and PFOA were detected in the soil samples at concentrations which did not exceed the OSD residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFBS was not detected in any of the soil samples. BAA FTBN-033A is shown in **Figure 7-10** and soil analytical data is presented in **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.12 Biosolid Application Area: FTBN-033C

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with BAA FTBN-033C.

### 7.12.1 Groundwater

A groundwater sample was collected from one boring via DPT at the BAA FTBN-033C AOPI. The grab groundwater samples was collected at first-encountered groundwater (11 to 15 ft bgs). PFOS was detected at a concentration greater than the OSD tap water risk screening level of 40 ng/L in the groundwater sample: FTBN-BAA033C-1-GW (110 ng/L). PFOA and PFBS were detected in the groundwater sample (FTBN-BAA033C-1-GW) at concentrations which did not exceed their respective OSD tap water risk screening levels. BAA FTBN-033C is shown in **Figure 7-11** and groundwater analytical data is presented in **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.12.2 Soil

Soil samples were collected from four borings at the BAA FTBN-033C AOPI, one co-located with the groundwater sample and three hand auger locations. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS was detected in all four soil samples at concentrations that did not exceed the OSD residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFBS and PFOA were not detected in the soil samples from this AOPI. BAA FTBN-033C is shown in **Figure 7-11** and soil analytical data is presented in **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.13 Biosolid Application Area: FTBN-033E

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with BAA FTBN-033E.

### 7.13.1 Groundwater

A groundwater sample was collected from one boring via DPT at the BAA FTBN-033E AOPI. The grab groundwater sample was collected at first-encountered groundwater (26 to 30 ft bgs). PFOA was detected at a concentration greater than the OSD tap water risk screening level of 40 ng/L in the groundwater sample: FTBN-BAA033C-1-GW (54 ng/L). PFOS and PFBS were detected in the groundwater sample (FTBN-BAA033C-1-GW) at concentrations that did not exceed the OSD tap water risk screening levels. BAA FTBN-033E is shown in **Figure 7-12** and groundwater analytical data is presented in **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.13.2 Soil

Soil samples were collected from three borings at the BAA FTBN-033E AOPI, one co-located with the groundwater sample and two hand auger locations. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS was detected in two of the soil samples and PFOA was detected in one of the soil samples at concentrations that did not exceed the residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFBS was not detected in the soil samples from this AOPI. BAA FTBN-033E is shown in **Figure 7-12** and soil analytical data is presented in **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.14 Biosolid Application Area: FTBN-033K

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with BAA FTBN-033K. A groundwater sample was not collected because saturated soils were not encountered during drilling at borehole FTBN-BSA033K-1 to a depth of 40 feet bgs. Additional details are provided in **Section 6.3.3**.

### 7.14.1 Soil

Soil samples were collected from three boring locations at the BAA FTBN-033K AOPI with hand auger. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS and PFOA were detected in two of the soil samples at concentrations that did not exceed the OSD residential (and therefore did not exceed industrial/commercial) risk screening level of 0.13 mg/kg. PFBS was not detected in the soil samples from this AOPI. BAA FTBN-033K is shown in **Figure 7-13** and soil analytical data is presented in **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.15 Biosolid Application Area: FTBN-033L

The subsections below summarize the groundwater PFOS, PFOA, and PFBS analytical results associated with BAA FTBN-033L. Soil was not collected at this AOPI in accordance with the approved QAPP Addendum (Arcadis 2020). The area has been redeveloped and native soil was not present, therefore, the soil was not representative of the soils that were present at the time of biosolid application activities.

### 7.15.1 Groundwater

A groundwater sample was collected via DPT at the BAA FTBN-033L AOPI. Grab groundwater samples were collected at first-encountered groundwater (16 to 20 ft bgs). PFOS, PFOA, and PFBS were not detected in the groundwater sample. BAA FTBN-033L is shown in **Figure 7-14** and groundwater analytical data is presented in **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

## 7.16 Biosolid Application Area: FTBN-033M

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with BAA FTBN-033P.

### 7.16.1 Groundwater

A groundwater sample was collected via DPT at the BAA FTBN-033M AOPI. The grab groundwater sample was collected at first-encountered groundwater (approximately 16 ft bgs). PFOS, PFOA, and PFBS were not detected in the groundwater sample. BAA FTBN-033M is shown in **Figure 7-15** and groundwater analytical data is presented in **Table 7-1**. The full suite of analytical results is included in **Appendix M**.

### 7.16.2 Soil

Soil samples were collected from three borings at the BAA FTBN-033M AOPI, one co-located with the groundwater sample and two hand auger locations. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS, PFOA, and PFBS were not detected in the soil samples from this AOPI. BAA FTBN-033M is shown in **Figure 7-15** and soil analytical data is presented in **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.17 Biosolid Application Area: FTBN-033N

Groundwater and soil samples were not collected at the BAA FTBN-033N AOPI because the location where the biosolids were spread was unknown. The area identified was only an approximate location, in the vicinity of BAA FTBN-033M. In accordance with the approved QAPP Addendum (Arcadis 2020), data from BAA FTBN-033M was used to determine groundwater and soil conditions at BAA FTBN-033N, as these AOPIs are comparable sites (e.g., they are both BAA AOPIs and are located in the same general vicinity).

As discussed in **Section 7.16**, PFOS, PFOA, and PFBS were not detected in the groundwater or soil samples collected at BAA FTBN-033M. Therefore, similar results are expected for BAA FTBN-033N.

## 7.18 Biosolid Application Area: FTBN-033O

Groundwater and soil, samples were not collected at the BAA FTBN-033O AOPI because the AOPI is an active firing range. While FTBN-033A and FTBN-033C both have OSD exceedances, comparable data from all BAA AOPIs sampled was used to determine groundwater and soil conditions in accordance with the approved QAPP Addendum (Arcadis 2020). Detections of PFOA, PFOS, and/or PFBA were not

detected at concentrations that exceeded respective OSD risk levels in five out of the seven BAA AOPIs sampled.

## 7.19 Biosolid Application Area: FTBN-033P

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with BAA FTBN-033P. A groundwater sample was not collected because saturated soils were not encountered during drilling at borehole FTBN-BSA033P-1 to a depth of 40 feet bgs. Additional details are provided in **Section 6.3.3**.

### 7.19.1 Soil

Soil samples were collected from three boring locations at the BAA FTBN-033P AOPI with hand auger. Each boring included one shallow soil sample (0 to 2 ft bgs). PFOS was detected in one soil sample 9FTBN-BSA-033P-2-SO) at a concentration that did not exceed the OSD residential (and therefore did not exceed industrial/commercial) risk screening level of 0.00062 mg/kg. PFOA, and PFBS were not detected in the soil samples from this AOPI. BAA FTBN-033M is shown in **Figure 7-16** and soil analytical data is presented in **Table 7-2**. The full suite of analytical results is included in **Appendix M**.

## 7.20 TOC, pH, and Grain Size

In addition to sampling soil for PFOS, PFOA, and PFBS, one soil sample per AOPI was analyzed for TOC, pH, moisture content, and grain size data as they may be useful in future fate and transport studies. The TOC in the soil samples ranged from 595 to 6,690 mg/kg.

The TOC at this installation was lower than typically observed in topsoil: 5,000 to 30,000 mg/kg. The combined percentage of fines (i.e., silt and clay) in soils at Fort Benning ranged from 3.9% to 72.1% with an average of 22.7%. In general, PFAS constituents tend to be more mobile in soils with less than 20% fines (silt and clay) and lower TOC. The percent moisture varied at Fort Benning between 1.8% to 26.1%. The percent moisture of the soil varied across the installation. Average percent moisture in the western portion of the installation (in the vicinity of Lawson Army Airfield) is approximately 9.97%. The average percent moisture in the northwestern portion of the installation (in the vicinity of Upatoi Creek) is approximately 9.07%. The average percent moisture in the northeastern portion of the installation is approximately 12.0%. The percent moisture of the soil is indicative of sandy soil (0% to 10%) and/or loam (0% to 12%) in the western portion of the installation (in the vicinity of Lawson Army Airfield) and in the northwestern portion of the installation (in the vicinity of Upatoi Creek). The percent moisture of the soil is indicative of loam (0% to 12%), and/or clay (0% to 20%) soil in the northeastern portion of the installation. Soil was not sampled at FTBN-033L, FTBN-033N, or FTBN-033O. The average pH of the soil was slightly acidic (4 to 6). While PFAS constituents are relatively less mobile in soils with high percentages of fines, depleted TOC may allow for enhanced mobility of the constituents in soil.

## 7.21 Blank Samples

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

## 7.22 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2020) were re-evaluated and updated, based on the SI sampling results. The CSMs presented on **Figures 7-17** through **7-24** and in this section therefore represent the current understanding of the potential for human exposure. For some AOPIs, the CSM is the same and thus shown on the same figure.

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

Based on the use, storage, and/or disposal of PFAS-containing materials at the AOPIs, affected media are likely to consist of soil, groundwater, surface water, and sediment.

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

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

CSMs were developed for each individual AOPI and were combined where source media, potential migration pathways and exposure media, and human exposure pathway determinations are congruent. Exposure pathway descriptions for each CSM are listed below by figure.

**Figure 7-17** shows the CSM for the FFTA FBSB-88, FFTA FBSB-105, Old Fire Station (Building 2445), Old Fire Station (Building 2452), Hangar 2446, Fire Station #2, Old Fire Station (Building 9), and BAAs FTBN-033A, 033C and 033K AOPIs. These AOPIs have historical releases due to use, storage, or

disposal of AFFF, or at the BAAs, from surface application of biosolids potentially containing PFOS, PFOA, and/or PFBS.

- 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. The AOPIs are not residential or recreational sites and are wholly located within the installation boundaries. Therefore, the soil exposure pathways for on-installation residents and recreational users and for off-installation receptors are incomplete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at these AOPIs, except for at BAA FTBN-033K where groundwater samples were not collected. The AOPIs are downgradient or outside the vicinity of and not likely to affect existing drinking water wells at Fort Benning. 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. Recreational users are not likely to contact groundwater during outdoor recreational activities. Therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.
- Groundwater originating at these AOPIs flows off-post through the installation's southwestern boundary. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.
- The Chattahoochee River on-post is used for drinking water. The AOPIs addressed by **Figure 7-17**, except for potentially FFTA FBSB-105 and Fire Station #2, are downgradient of the existing surface water intake on the Chattahoochee River. However, the Chattahoochee River downstream of the AOPIs is likely large enough to support potential future drinking water intakes. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete. On-installation site workers and residents are not likely to contact sediment in on-post surface water bodies; therefore, these exposure pathways are incomplete.
- Recreational users could contact constituents in the Chattahoochee River or Upatoi Creek through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for on-installation recreational users are potentially complete.
- Surface water bodies flow off-post through the Chattahoochee River. The Chattahoochee River downstream of the AOPIs is likely large enough to support potential future drinking water intakes. Therefore, the surface water exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete. Additionally, recreational users off-post could contact constituents in the Chattahoochee River through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

**Figure 7-18** shows the CSM for the Nozzle Testing Area and Fire Station #4 AOPI, where AFFF was historically released to soil and paved surfaces during AFFF storage or nozzle testing. Nozzle testing usage with AFFF was conducted on an annual basis for two years between 2014 and 2016, with an estimated 50 gallons of AFFF concentrate used per event.

- PFOS, PFOA, and/or PFBS were not detected in soil samples collected from three borings at this AOPI. However, PFOS, PFOA, and/or PFBS were detected in the co-located groundwater samples at this AOPI, and due to the frequency of documented use of AFFF, it is possible that PFOS, PFOA, and/or PFBS are present in the soil. 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 remains potentially complete. The AOPIs are not residential or recreational sites and are wholly located within the installation boundaries. Therefore, the soil exposure pathways for on-installation residents and recreational users and for off-installation receptors are incomplete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at this AOPI. The AOPI is downgradient of and not likely to affect existing drinking water wells at Fort Benning. 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. Recreational users are not likely to contact groundwater during outdoor recreational activities. Therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.
- Groundwater originating at this AOPI flows off-post through the installation's southwestern boundary. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.
- The AOPI is downgradient of the existing surface water intake on the Chattahoochee River. However, the surface water 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 surface water as a source of drinking water. On-installation site workers and residents are not likely to contact sediment in on-post surface water bodies; therefore, these exposure pathways are incomplete.
- Recreational users could contact constituents in the Chattahoochee River through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for on-installation recreational users are potentially complete.
- Surface water bodies flow off-post through the Chattahoochee River and are not used for drinking water within 25 miles downstream of the installation. However, the Chattahoochee River downstream of the AOPI is likely large enough to support potential future drinking water intakes. Therefore, the surface water exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete. Additionally, recreational users off-post could contact constituents in the Chattahoochee River through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

**Figure 7-19** shows the CSM for AOPIs WWTP #1 and WWTP #3. Stormwater that contained PFAS-containing materials was historically routed from nozzle testing areas and Fire Stations to WWTP #1 and WWTP #3. It is possible that biosolids from the wastewater treatment process were land applied at the treatment facilities. Additional releases could have occurred at the outfalls and during overflows at the treatment facilities during large storm events. PFOS, PFOA, and/or PFBS were detected in soil and groundwater samples collected at these AOPIs. Although the potential sources of PFOS, PFOA, and/or PFBS and release/transport mechanisms shown on the CSM figures differ, the human receptors and

exposure pathways are the same as described above for **Figure 7-17** presented above, and therefore will not be restated here.

**Figure 7-20** shows the CSM for the BAA FTBN-033E AOPI, where surface application of biosolids potentially containing PFOS, PFOA, and/or PFBS occurred.

- PFOS, PFOA, and/or PFBS were detected in soil at BAA FTBN-033E. The AOPI is used as a park and graduation arena. Site workers and recreational users could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathways for on-installation site workers and recreational users are complete. The AOPI is not a residential site and is wholly located within the installation boundaries. Therefore, the soil exposure pathways for on-installation residents and off-installation receptors are incomplete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at this AOPI. The AOPI is downgradient of and not likely to affect existing drinking water wells at Fort Benning. 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. Recreational users are not likely to contact groundwater during outdoor recreational activities. Therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.
- Groundwater originating at this AOPI flows off-post through the installation's western boundary. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.
- This AOPI is potentially upgradient of the surface water intake on the Chattahoochee River. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete. On-installation site workers and residents are not likely to contact sediment in the on-post surface water bodies through incidental ingestion and dermal contact, therefore, the sediment exposure pathways for these receptors are incomplete.
- Recreational users could contact constituents in the Chattahoochee River through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for on-installation recreational users are potentially complete.
- Surface water bodies flow off-post through the Chattahoochee River and are not used for drinking water within 25 miles downstream of the installation. However, the Chattahoochee River downstream of the AOPI is likely large enough to support potential future drinking water intakes. Therefore, the surface water exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete. Additionally, recreational users off-post could contact constituents in the Chattahoochee River through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

**Figure 7-21** shows the CSM for the BAA FTBN-033L AOPI, where surface application of biosolids potentially containing PFOS, PFOA, and/or PFBS occurred.

- PFOS, PFOA, and/or PFBS were not sampled in soil at BAA FTBN-033L. If PFOS, PFOA, and/or PFBS are present in soil, site workers could contact constituents via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is

potentially complete. The AOPI is not a residential or recreational site and is wholly located within the installation boundaries. Therefore, the soil exposure pathways for on-installation residents and recreational users and for off-installation receptors are incomplete.

- PFOS, PFOA, and/or PFBS were not detected in groundwater. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation and off-installation receptors are incomplete.
- Given the non-detect results for PFOS, PFOA, and/or PFBS in groundwater, it is unlikely that there is a source of PFOS, PFOA, and/or PFBS to downgradient surface water and sediment. Therefore, the surface water and sediment exposure pathways for all receptors are incomplete.

**Figure 7-22** shows the CSM for the BAA FTBN-033M and BAA FTBN-033N AOPIs, where surface application of biosolids potentially containing PFOS, PFOA, and/or PFBS occurred. SI samples were not collected at BAA FTBN-033N because the location where biosolids were spread is unknown. In accordance with the approved QAPP Addendum, analytical results from BAA FTBN-033M were used to infer conditions at BAA FTBN-033N as these AOPIs are comparable sites (e.g., they are both BAA AOPIs and are in the same general vicinity).

- PFOS, PFOA, and/or PFBS were not detected in soil at BAA FTBN-033M. Therefore, the soil exposure pathways for all receptors at both AOPIs are incomplete.
- PFOS, PFOA, and/or PFBS were not detected in groundwater. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation and off-installation receptors are incomplete.
- Given the non-detect results for PFOS, PFOA, and/or PFBS in soil and groundwater, it is unlikely that there is a source of PFOS, PFOA, and/or PFBS to downgradient surface water and sediment. Therefore, the surface water and sediment exposure pathways for all receptors are incomplete.

**Figure 7-23** shows the CSM for the BAA FTBN-033O AOPI, where surface application of biosolids potentially containing PFOS, PFOA, and/or PFBS occurred. SI samples were not collected at BAA FTBN-033O because it is an active firing range. Results from all the other BAAs at Fort Benning were used to infer potential conditions at BAA FTBN-033O AOPI.

- If PFOS, PFOA, and/or PFBS are present in soil at BAA FTBN-033O AOPI, site workers (i.e., installation personnel) could contact constituents via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is potentially complete. The AOPI is not a residential or recreational site and is wholly located within the installation boundaries. Therefore, the soil exposure pathways for on-installation residents and recreational users and for off-installation receptors are incomplete.
- PFOS, PFOA, and/or PFBS were not sampled in groundwater at BAA FTBN-033O AOPI. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents and for off-installation receptors are potentially complete. Recreational users are not likely to contact groundwater during outdoor recreational activities. Therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.
- The AOPI is potentially upgradient of the surface water intake on the Chattahoochee River. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for

on-installation site workers and residents are potentially complete. On-installation site workers and residents are not likely to contact sediment in the on-post surface water bodies through incidental ingestion and dermal contact, therefore, the sediment exposure pathways for these receptors are incomplete.

- Recreational users could contact constituents in on-post 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.
- Surface water bodies flow off-post through the Chattahoochee River and are not used for drinking water within 25 miles downstream of the installation. However, the Chattahoochee River downstream of the AOPIs is likely large enough to support potential future drinking water intakes. Therefore, the surface water exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete. Additionally, recreational users off-post could contact constituents in the Chattahoochee River through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

**Figure 7-24** shows the CSM for the BAA FTBN-033P AOPI, where surface application of biosolids potentially containing PFOS, PFOA, and/or PFBS occurred.

- PFOS, PFOA, and/or PFBS were not detected in soil at BAA FTBN-033P, therefore the soil exposure pathways for all receptors are incomplete.
- Groundwater was not sampled at BSA FTBN-033K. The AOPI is downgradient of and not likely to affect existing drinking water wells at Fort Benning. 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. Recreational users are not likely to contact groundwater during outdoor recreational activities. Therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.
- Groundwater originating at this AOPI flows off-post through the installation's southern boundary. Due to the absence of land use controls preventing potable use of groundwater in this area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.
- FTBN-033P is downgradient of the existing surface water intake on the Chattahoochee River. However, the surface water 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 surface water as a source of drinking water. On-installation site workers and residents are not likely to contact sediment in on-post surface water bodies; therefore, these exposure pathways are incomplete.
- Recreational users could contact constituents in Harps Creek, Mill Creek, or the Chattahoochee River through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for on-installation recreational users are potentially complete.
- Surface water bodies flow off-post through the Chattahoochee River and are not used for drinking water within 25 miles downstream of the installation. However, the Chattahoochee River downstream of the AOPIs is likely large enough to support potential future drinking water intakes. Therefore, the surface water exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete. Additionally, recreational users off-post could contact constituents in

the Chattahoochee River through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Following the SI sampling, 17 of the 19 AOPIs were considered to have complete or potentially complete exposure pathways. Although the CSMs indicate complete or potentially complete exposure pathways may exist, the recommendation for remedial investigation is based on the comparison of analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2**).

# 8 CONCLUSIONS AND RECOMMENDATIONS

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

OSD provided residential risk screening levels based on the USEPA oral reference dose for PFOS, PFOA, and PFBS in soil and groundwater (tap water) and industrial/commercial risk screening levels for PFOS, PFOA, and PFBS in soil (**Appendix A**). A combination of document review, internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFOS, PFOA, and PFBS use, storage, and/or disposal at Fort Benning. Following the evaluation, 19 AOPIs were identified.

There are 10 potable water wells at Fort Benning which are operated by CWW and are used locally on Fort Benning, near where the wells are located (i.e., they are not large production wells pumped back to other areas). These wells have individual treatment systems which include filters and/or iron treatment, and all are chlorinated. The WTP located on Marne Road at Fort Benning is operated by CWW and supplied with water from the Chattahoochee River. In the past, the WTP used to draw water from the Upatoi Creek; however, the intake was relocated in 2006 to the Chattahoochee River. This system (PWS# 2150000) provides drinking water for approximately 40,000 consumers. The consumer population includes active duty and Reserve military personnel, their family members, civilian employees, visitors, guests, and patients of Martin Army Community Hospital. Multiple AOPIs are located in the vicinity of creeks that drain to the Chattahoochee River, including Old Fire Station Building 2452, Old Fire Station Building 2445, Nozzle Testing Area and Fire Station #4, FFTA FBSB-88, FFTA FBSB-105, WWTP #3, and BAAs FTBN-033A, FTBN-033C, FTBN-033K, FTBN-033M, FTBN-033N, FTBN-033O, FTBN-033P.

Seventeen of the 19 AOPIs were sampled during the SI at Fort Benning to identify presence or absence of PFOS, PFOA, and PFBS at each AOPI. The BAA FTBN-033N AOPI was not sampled because the location of the biosolids application is unknown and the BAA FTBN-033O AOPI was not sampled because it is an active firing range. The SI scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the Fort Benning QAPP Addendum (Arcadis 2020).

Fifteen AOPIs had detections of PFOS, PFOA, and PFBS in groundwater and/or soil and 12 AOPIs exceeded OSD risk screening levels. PFOS, PFOA, and PFBS in groundwater were detected at concentrations greater than the OSD risk screening levels at 12 of the 17 AOPIs sampled.

- PFOS was detected above the 40 ng/L OSD risk screening level for tapwater in 24 groundwater samples. The highest concentration of PFOS was 13,000 ng/L at two locations, one at Old Fire Station Building 2452 and one Old Fire Station Building 2445.
- PFOA was detected above the 40 ng/L OSD risk screening level for tapwater in 16 groundwater samples. The highest concentration of PFOA was 1,200 ng/L at Old Fire Station Building 2452.
- PFBS was detected above the 600 ng/L OSD risk screening level for tapwater in one groundwater sample. The highest concentration of PFBS was 1,500 ng/L at Fire Station #2.

PFOS in soil was detected at concentrations above the OSD risk screening levels at two of the AOPIs sampled. The highest concentration of PFOS was 1.3 mg/kg (1.2 mg/kg) at Old Fire Station Building 2452. PFOA was not detected above the 0.13 mg/kg OSD risk screening level and PFBS was not detected above the 1.9 mg/kg OSD risk screening level at any of the AOPIs sampled.

Following the SI sampling, 17 out of the 19 AOPIs with confirmed PFOS, PFOA, and/or PFBS presence were considered to have complete or potentially complete exposure pathways. Complete and potentially complete exposure pathways are summarized below:

- Soil exposure pathways for on-installation site workers were considered to be complete at 13 AOPIs with confirmed PFOS, PFOA, and PFBS presence in soil, and potentially complete at an additional three AOPIs.
- At 16 AOPIs, the groundwater exposure pathways for on-post receptors are potentially complete to account for potential future use of the downgradient on-post groundwater. Due to a lack of land use controls off-installation and downgradient of Fort Benning, the groundwater exposure pathways for off-installation drinking water receptors were also considered to be potentially complete for 16 AOPIs.
- The Chattahoochee River on-post is used for drinking water. Five of the AOPIs (FFTA FBSB-105, Fire Station #2, BAAs FTBN-033E and FTBN-033O, and WWTP #1) with the potential for surface water impacts are located potentially upgradient of the existing surface water intake. However, the Chattahoochee River downstream of the AOPIs is likely large enough to support potential future drinking water intakes. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation and off-installation drinking water receptors are potentially complete for 16 AOPIs.
- Surface water is also used for recreation; therefore, the surface water and sediment exposure pathways for on-installation and off-installation recreational users were considered to be potentially complete for 16 AOPIs.

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

**Table 8-1 Summary of AOPIs Identified during the PA, PFOS, PFOA, and PFBS Sampling at Fort Benning, and Recommendations**

| AOPI Name | PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NS) | | Recommendation |
|---|---|---|---|
| | GW | SO | |
| FFTA FBSB-88 | Yes | No | Further study in a remedial investigation |

| AOPI Name | PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NS) | | Recommendation |
|---|---|---|---|
| | GW | SO | |
| FFTA FBSB-105 | Yes | No | Further study in a remedial investigation |
| Old Fire Station Building 2452 | Yes | Yes | Further study in a remedial investigation |
| Old Fire Station Building 2445 | Yes | No | Further study in a remedial investigation |
| Hangar 2446 | Yes | No | Further study in a remedial investigation |
| Nozzle Testing Area and Fire Station #4 | Yes | No | Further study in a remedial investigation |
| Wastewater Treatment Plant #1 | Yes | No | Further study in a remedial investigation |
| Wastewater Treatment Plant #3 | Yes | No | Further study in a remedial investigation |
| Fire Station #2 | Yes | No | Further study in a remedial investigation |
| Old Fire Station Building 9 | Yes | Yes | Further study in a remedial investigation |
| BAA: FTBN-033A | No | No | No action at this time |
| BAA: FTBN-033C | Yes | No | Further study in a remedial investigation |
| BAA: FTBN-033E | Yes | No | Further study in a remedial investigation |
| BAA: FTBN-033K | NS | No | No action at this time |
| BAA: FTBN-033L | No | NS | No action at this time |
| BAA: FTBN-033M | No | No | No action at this time |
| BAA: FTBN-033N | No[1] | No[1] | No action at this time |
| BAA: FTBN-033O | No[2] | No[2] | No action at this time |
| BAA: FTBN-033P | NS | No | No action at this time |

**Notes:**
Light gray shading – detection greater than the OSD risk screening level
FFTA – former fire training area
BAA – biosolids application area
NS – not sampled

[1] Samples were not collected at the BAA FTBN-033N AOPI because the location where biosolids were spread is unknown. The area is identified only as an approximate location in the vicinity of BAA FTBN-033M. In accordance with the approved QAPP Addendum, data from BAA FTBN-033M was used to determine groundwater and soil conditions at BAA FTBN-033N as these AOPIs are comparable sites (e.g., they are both BAA AOPIs and are located in the same general vicinity).

[2] Samples were not collected at the BAA FTBN-033O AOPI because it is an active firing range. Collective data from BAA AOPIs was used to determine groundwater and soil conditions at BAA FTBN-033O as these AOPIs are comparable sites. Two of the seven BAAs had detections of PFOA, PFOS, and/or PFBS that exceeded OSD risk screening levels.

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

- One AOPI (BAA FTBN-033N) was not sampled because of the unknown location for biosolids application and the proximity to the Columbus River and the airfield.
- One AOPI (BAA FTBN-033O) was not sampled because it is an active firing range.
- No groundwater was collected at BAA FTBN-033K or BAA FTBN-033P because, after advancing to a total depth of 40 ft bgs in accordance with the approved QAPP Addendum, groundwater was not encountered in borehole FTBN-BSA033K-1 or FTBN-BSA033P-1.

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

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

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

Finally, the available PFOS, PFOA, and PFBS analytical data is limited to results from on-post drinking water well sources. Sampling did not include residential wells or aquifers other than where drinking water wells are screened. Additionally, the available PFOS, PFOA, and PFBS data is limited to the eighteen PFAS-related compounds as listed in **Appendix N.** The limited 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 close proximity of the AOPIs and potable water wells 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 N**, which were analyzed per the selected analytical method.

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

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# ACRONYMS

| | |
|---|---|
| °F | degrees Fahrenheit |
| % | percent |
| AFFF | aqueous film-forming foam |
| AOPI | area of potential interest |
| Arcadis | Arcadis U.S., Inc. |
| Army | United States Army |
| BAA | biosolids application area |
| bgs | below ground surface |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| CSM | conceptual site model |
| CWW | Columbus Water Works |
| 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 |
| FFTA | former fire training area |
| ft | foot or feet |
| GDNRGS | Georgia Department of Natural Resources Geological Survey |
| GIS | geographic information system |
| GW | groundwater |
| IDW | investigation-derived waste |
| installation | United States Army or Reserve installation |
| LOD | limit of detection |
| LOQ | limit of quantitation |
| mg/kg | milligrams per kilogram (parts per million) |

| | |
|---|---|
| mph | miles per hour |
| ng/L | nanogram per liter (part per trillion) |
| NS | not sampled |
| OSD | Office of the Secretary of Defense |
| OWS | oil water separator |
| PA | preliminary assessment |
| PFAS | per- and polyfluoroalkyl substances |
| PFBS | perfluorobutanesulfonic acid |
| PFOA | perfluorooctanoic acid |
| PFOS | perfluorooctane sulfonate |
| POC | point of contact |
| ppm | part per million |
| ppt | part 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 |
| SE | sediment |
| SI | site inspection |
| SO | soil |
| SOP | standard operating procedure |
| SSHP | Site Safety and Health Plan |
| SW | surface water |
| TGI | technical guidance instruction |
| TOC | total organic carbon |
| 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 |
| WTP | water treatment plant |
| WWTP | wastewater treatment plant |

# TABLES

**Table 2-1**
**Historical PFAS Analytical Results**
**PFAS Preliminary Assessment/Site Inspection**
**Fort Benning, Georgia**

| | | | Location | Sante Fe | Good Hope (GHMTA GIB) | CATF/ Leyte Field | McKenna MOUT #1 | McKenna MOUT #2 | Tricolor Road | Malone 17 | Carmouchee Range | Schatalga | FB-High Service (HSERVE Ft. Benning) | FB-Raw (RAW-PU ft.Benning) | Custer Rd | St Marys | Camp Danby | Griswald Range | Hastings Range |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Type | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | Sample ID | 3594139 | 3594164 | 3594165 | 3594166 | 3594167 | 3594168 | 3594169 | 3594170 | 3594171 | 3594172 | 3594173 | 3594174 | 3594175 | 3594454 | 3601169 | 3601170 |
| | | | Sample Date | 11/26/2016 | 11/24/2016 | 11/24/2016 | 11/24/2016 | 11/24/2016 | 11/24/2016 | 11/24/2016 | 11/24/2016 | 11/24/2016 | 11/26/2016 | 11/26/2016 | 11/26/2016 | 11/26/2016 | 11/24/2016 | 12/6/2016 | 12/7/2016 |
| Analyte | OSD Risk Screening Level* | LHA | | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L |
| Perfluorooctanoic acid (PFOA) | 40 | 70 | | 13 | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 9.8 | 13 | 18 | 11 | 12 | 2.0 U | 2.0 U | 2.0 U |
| Perfluorobutane sulfonic acid (PFBS) | 600 | NA | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Perfluorooctane sulfonic acid (PFOS) | 40 | 70 | | 5.3 | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 5.0 | 5.2 | 5.4 | 5.1 | 5.1 | 2.0 U | 2.0 U | 2.0 U |

**Notes and Acronyms:**

1. * risk screening level for tap water. To be conservative, the OSD tap water risk screening levels will be used to compare all groundwater and potable-use surface water for this Army PFAS PA/SI program.

2. For the year 2020, the PFAS analyte group including PFOS, PFOA, PFBS and 15 other PFAS constituents were analysed but only PFOS, PFOA and PFBS results are shown in the above table as these are the only PFAS consituents with applicable OSD risk screening levels.

LHA - United States Environmental Protection Agency lifetime health advisory
NA - not available
ND - not detected
ng/L - nanograms per liter
NS - not sampled
OSD - Office of the Secretary of Defense
U - not detected at or above the corresponding quantitation limit

## Table 2-1
## Historical PFAS Analytical Results
## PFAS Preliminary Assessment/Site Inspection
## Fort Benning, Georgia

| | | Location | RAW-PU Columbus | | | | | HSERV Columbus | | | | | RAW-PU Ft. Benning | | | | | HSERV Ft. Benning | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Type | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW | DW |
| | | Sample ID | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | Sample Date | 2/1/2020 | 3/1/2020 | 4/1/2020 | 5/1/2020 | 6/1/2020 | 1/1/2020 | 3/1/2020 | 4/1/2020 | 5/1/2020 | 6/1/2020 | 1/1/2020 | 2/1/2020 | 4/1/2020 | 5/1/2020 | 6/1/2020 | 1/1/2020 | 2/1/2020 | 4/1/2020 | 5/1/2020 | 6/1/2020 |
| Analyte | OSD Risk Screening Level* | LHA | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L | ng/L |
| Perfluorooctanoic acid (PFOA) | 40 | 70 | 4.5 | NS | NS | NS | ND | 3.9 | 4.3 | NS | NS | ND | 7.2 | NS | NS | NS | 14.0 | 5.6 | NS | NS | NS | 10.0 |
| Perfluorobutane sulfonic acid (PFBS) | 600 | NA | 2.8 | 2.3 | NS | NS | ND | 2.8 | 2.5 | NS | NS | ND | 2.4 | NS | NS | NS | ND | 2 | NS | NS | NS | ND |
| Perfluorooctane sulfonic acid (PFOS) | 40 | 70 | 7.6 | 5 | NS | NS | ND | 5.8 | 6 | NS | NS | 3.9 | 5.3 | NS | NS | NS | 4.9 | 3.8 | NS | NS | NS | 4.3 |

**Notes and Acronyms:**

1. * risk screening level for tap water. To be conservative, the OSD tap water risk screening levels will be used to compare all groundwater and potable-use surface water for this Army PFAS PA/SI program.

2. For the year 2020, the PFAS analyte group including PFOS, PFOA, PFBS and 15 other PFAS constituents were analysed but only PFOS, PFOA and PFBS results are shown in the above table as these are the only PFAS consituents with applicable OSD risk screening levels.

LHA - United States Environmental Protection Agency lifetime health advisory
NA - not available
ND - not detected
ng/L - nanograms per liter
NS - not sampled
OSD - Office of the Secretary of Defense
U - not detected at or above the corresponding quantitation limit

**Table 6-1**
**Monitoring Well Construction Details**
**PFAS Preliminary Assessment/Site Inspection**
**Fort Benning, Georgia**

| AOPI | Matrix | Sample ID | Depth Interval | Sample Method | Analytes |
|---|---|---|---|---|---|
| FFTA FBSB-88 | Soil | FTBN-FTA88-1-SO-081420 | 0-2 ft bgs | DPT | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-FTA88-2-SO-081420 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | | FTBN-FTA88-3-SO-081420 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-FTA88-1-GW-081420 | 21-25 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FTA88-2-GW-081420 | 21-25 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FTA88-3-GW-081420 | 21-25 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| FFTA FBSB-105 | Soil | FTBN-FTA105-SO-081620 | 0-2 ft bgs | Hand Auger | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | Groundwater | FTBN-FTA105-MW-081620 | 83 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Old Fire Station Building 2452 | Soil | FTBN-FS2452-1-SO-081120 | 0-2 ft bgs | DPT | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-FS2452-2-SO-081220 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | | FTBN-FD-1-SO-081220 / FTBN-FS2452-2-SO-081220 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-FS2452-1-GW-081120 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FS2452-2-GW-081220 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FD-1-GW-081220 / FTBN-FS2452-2-GW-081220 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Old Fire Station Building 2445 | Soil | FTBN-FS2445-1-SO-081120 | 0-2 ft bgs | DPT | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-FS2445-2-SO-081120 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | | FTBN-FS2445-3-SO-081120 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-FS2445-1-GW-081120 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FS2445-2-GW-081120 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FS2445-3-GW-081120 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Hangar 2446 | Soil | FTBN-H2446-1-SO-081220 | 0-2 ft bgs | DPT | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-H2446-2-SO-081220 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-H2446-1-GW-081220 | 6-10 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-H2446-2-GW-081220 | 6-10 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Nozzle Testing Area and Fire Station #4 | Soil | FTBN-FS4-1-SO-081320 | 0-2 ft bgs | DPT | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-FS4-2-SO-081320 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | | FTBN-FS4-3-SO-081320 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | | FTBN-FD-2-SO-081320 / FTBN-FS4-3-SO-081320 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-FS4-1-GW-081320 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FS4-2-GW-081320 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FS4-3-GW-081320 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FD-2-GW-081320 / FTBN-FS4-3-GW-081320 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Wastewater Treatment Plant #1 | Soil | FTBN-WWTP-1-SO-081720 | 0-2 ft bgs | DPT | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | Groundwater | FTBN-WWTP-1-GW-081720 | 21-25 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Wastewater Treatment Plant #3 | Soil | FTBN-WWTP3-SO-081620 | 0-2 ft bgs | DPT | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | Groundwater | FTBN-WWTP3-GW-081620 | 1-5 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Fire Station #2 | Soil | FTBN-FS2-1-SO-081720 | 0-2 ft bgs | Grab | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-FS2-2-SO-081720 | 0-2 ft bgs | Grab | PFOA, PFOS, PFBS |
| | | FTBN-FS2-3-SO-081020 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-FS2-1-GW-081720 | 26-30 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-FS2-2-GW-081720 | 26-30 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Old Fire Station Building 9 | Soil | FTBN-FS9-1-SO-081820 | 0-2 ft bgs | Grab | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-FS9-2-SO-081320 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | | FTBN-FS9-3-SO-081320 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-FS9-1-GW-081820 | 41-45 ft bgs | Low Flow | PFOA, PFOS, PFBS |

**Table 6-1**
**Monitoring Well Construction Details**
**PFAS Preliminary Assessment/Site Inspection**
**Fort Benning, Georgia**

| AOPI | Matrix | Sample ID | Depth Interval | Sample Method | Analytes |
|---|---|---|---|---|---|
| Biosolid Application Area: FTBN-033A | Soil | FTBN-BSA033A-1-SO-081120 | 0-2 ft bgs | Hand Auger | PFAS, TOC, pH, grain size |
| | | FTBN-BSA033A-2-SO-081120 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | | FTBN-BSA033A-3-SO-081120 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-BSA033A-MW3-081120 | 10.35 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| | | FTBN-BSA033A-MW8-081120 | 37.35 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Biosolid Application Area: FTBN-033C | Soil | FTBN-BSA033C-SO-081520 | 0-2 ft bgs | DPT | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-FD-2-SO-SO-081520 / FTBN-BSA033C-SO-081520 | 0-2 ft bgs | DPT | PFOA, PFOS, PFBS |
| | | FTBN-BSA033C-2-SO-081720 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | | FTBN-BSA033C-3-SO-081720 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | | FTBN-BSA033C-4-SO-081720 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-BSA033C-1-GW-081520 | 11-15 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Biosolid Application Area: FTBN-033E | Soil | FTBN-BSA033E-1-SO-081520 | 0-2 ft bgs | DPT | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-BSA033E-2-SO-081220 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | | FTBN-BSA033E-3-SO-081220 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-BSA033E-1-GW-081520 | 26-30 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Biosolid Application Area: FTBN-033K | Soil | FTBN-BSA033K-1-SO-081820 | 0-2 ft bgs | Grab | PFAS, TOC, pH, grain size |
| | | FTBN-BSA033K-2-SO-081820 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | | FTBN-BSA033K-3-SO-081820 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| Biosolid Application Area: FTBN-033L | Groundwater | FTBN-BSA033L-1-GW-081520 | 16-20 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Biosolid Application Area: FTBN-033M | Soil | FTBN-BSA033M-1-SO-081020 | 0-2 ft bgs | Hand Auger | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-BSA033M-2-SO-081020 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | | FTBN-BSA033M-3-SO-081020 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | Groundwater | FTBN-BSA033M-1-GW-081020 | 16 ft bgs | Low Flow | PFOA, PFOS, PFBS |
| Biosolid Application Area: FTBN-033P | Soil | FTBN-BSA033P-1-SO-081820 | 0-2 ft bgs | Grab | PFOS, PFOA, PFBS, TOC, pH, grain size |
| | | FTBN-BSA033P-2-SO-081220 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |
| | | FTBN-BSA033P-3-SO-081220 | 0-2 ft bgs | Hand Auger | PFOA, PFOS, PFBS |

**Notes:**

1. Depth units are reported in feet below ground surface (ft bgs) unless otherwise noted. Sampling depth noted for existing monitoring wells indicates the depth at approximately the center of the saturated screened interval.

2. In addition to laboratory analytes, field parameters were measured for groundwater samples and include temperature, pH, conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential. Lithologic descriptions were logged continuously at soil boring locations, and for sediment sampling locations. Field parameters and lithological descriptions are shown on field sampling forms included in **Appendix K**.

3. The PFAS analyte group includes PFOS, PFOA, PFBS and 15 other PFAS constituents.

AOPI = Area of Potential Interest
DPT = Direct Push Technology
GW = groundwater
ID = identification
N/A = not available or not applicable
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil
TOC = total organic carbon

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Analyte | PFOS (ng/L) | | PFOA (ng/L) | | PFBS (ng/L) | |
| | | | | | OSD Risk Screening Level - Tap Water | 40 | | 40 | | 600 | |
| Associated AOPI | Location Type | Location | Sample ID / Parent Sample ID | Sample Date | Sample Type | Result | Qual | Result | Qual | Result | Qual |
| FFTA FBSB-88 | Monitoring Well | FTBN-FTA88-1 | FTBN-FTA88-1-GW-081420 | 08/14/2020 | N | 3.5 | U | 3.5 | U | **18** | |
| FFTA FBSB-88 | Monitoring Well | FTBN-FTA88-2 | FTBN-FTA88-2-GW-081420 | 08/14/2020 | N | **85** | | **24** | | **9.5** | |
| FFTA FBSB-88 | Monitoring Well | FTBN-FTA88-3 | FTBN-FTA88-3-GW-081420 | 08/14/2020 | N | **330** | | **48** | | **15** | |
| FFTA-FBSB-105 | Monitoring Well | FTBN-FTA105-MW | FTBN-FTA105-GW-081620 | 08/16/2020 | N | **98** | | **160** | | **200** | |
| Old Fire Station Building 2452 | Monitoring Well | FTBN-FS2452-1 | FTBN-FS2452-1-GW-081120 | 08/11/2020 | N | **13,000** | J | **1,200** | J | **150** | |
| Old Fire Station Building 2452 | Monitoring Well | FTBN-FS2452-2 | FTBN-FS2452-2-GW-081220 | 08/12/2020 | N | **6,300** | J | **210** | | **560** | |
| | | | FTBN-FD-1-GW-081220 / FTBN-FS2452-2-GW-081220 | 08/12/2020 | FD | **6,200** | J | **230** | | **500** | |
| Old Fire Station Building 2445 | Monitoring Well | FTBN-FS2445-1 | FTBN-FS2445-1-GW-081120 | 08/11/2020 | N | **3,800** | J | **200** | | **63** | |
| Old Fire Station Building 2445 | Monitoring Well | FTBN-FS2445-2 | FTBN-FS2445-2-GW-081120 | 08/11/2020 | N | **13,000** | J | **570** | J | **180** | J |
| Old Fire Station Building 2445 | Monitoring Well | FTBN-FS2445-3 | FTBN-FS2445-3-GW-081120 | 08/11/2020 | N | **1,600** | J | **130** | | **43** | |
| Hangar 2446 | Monitoring Well | FTBN-H2446-1 | FTBN-H2446-1-GW-081220 | 08/12/2020 | N | **510** | J | **44** | | **61** | |
| Hangar 2446 | Monitoring Well | FTBN-H2446-2 | FTBN-H2446-2-GW-081220 | 08/12/2020 | N | **51** | J+ | **26** | | **12** | |
| Nozzle Testing Area and Fire Station #4 | Monitoring Well | FTBN-FS4-1 | FTBN-FS4-1-GW-081320 | 08/13/2020 | N | **190** | | **71** | | **20** | |
| Nozzle Testing Area and Fire Station #4 | Monitoring Well | FTBN-FS4-2 | FTBN-FS4-2-GW-081320 | 08/13/2020 | N | **21** | | **14** | | **2.2** | J |
| Nozzle Testing Area and Fire Station #4 | Monitoring Well | FTBN-FS4-3 | FTBN-FS4-3-GW-081320 | 08/13/2020 | N | **81** | | **46** | | **3.0** | J |
| | | | FTBN-FD-2-GW-081320 / FTBN-FS4-3-GW-081320 | 08/13/2020 | FD | **76** | | **47** | | **2.8** | J |
| Wastewater Treatment Plant #1 | Monitoring Well | FTBN-WWTP-1 | FTBN-WWTP-1-GW-081720 | 08/17/2020 | N | **97** | | **57** | | **6.2** | |
| Wastewater Treatment Plant #3 | Monitoring Well | FTBN-WWTP-3 | FTBN-WWTP3-GW-081620 | 08/16/2020 | N | **46** | J+ | **710** | | **160** | |
| Fire Station #2 | Monitoring Well | FTBN-FS2-1 | FTBN-FS2-1-GW-081720 | 08/17/2020 | N | **84** | | **14** | | **40** | |
| Fire Station #2 | Monitoring Well | FTBN-FS2-2 | FTBN-FS2-2-GW-081720 | 08/17/2020 | N | **920** | J | **370** | | **1,500** | J |
| Old Fire Station Building 9 | Monitoring Well | FTBN-FS9-1 | FTBN-FS9-1-GW-081820 | 08/18/2020 | N | **350** | | **28** | | **13** | |
| Biosolid Application Area: FTBN-033A | Monitoring Well | FTBN-BSA033A-MW3 | FTBN-BSA033A-MW3-081120 | 08/11/2020 | N | **36** | | **13** | | **4.5** | |
| Biosolid Application Area: FTBN-033A | Monitoring Well | FTBN-BSA033A-MW8 | FTBN-BSA033A-MW8-081120 | 08/11/2020 | N | **2.4** | J | **3.7** | | **1.8** | J |
| Biosolid Application Area: FTBN-033C | Monitoring Well | FTBN-BSA033C-1 | FTBN-BSA033C-GW-081520 | 08/15/2020 | N | **110** | | **37** | | **3.2** | J |
| Biosolid Application Area: FTBN-033E | Monitoring Well | FTBN-BSA033E-1 | FTBN-BSA033E-1-GW-081520 | 08/15/2020 | N | **22** | | **54** | | **8.5** | |
| Biosolid Application Area: FTBN-033L | Monitoring Well | FTBN-BSA033L-1 | FTBN-BSA033C-1-GW-081520 | 08/15/2020 | N | 3.6 | U | 3.6 | U | 3.6 | U |
| Biosolid Application Area: FTBN-033M | Monitoring Well | FTBN-BSA033M-1 | FTBN-BSA033M-1-GW-081020 | 08/10/2020 | N | 3.4 | U | 3.4 | U | 3.4 | 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 Office of the Secretary of Defense (OSD) risk screening levels for tap water (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September).

**Acronyms/Abbreviations:**
-- = not applicable
% = percent
AOPI = Area of Potential Interest
FD = field duplicate sample
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier

**Qualifier Definitions:**
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
J+ = The analyte was positively identified; however the % recovery was less than 50% and therefore the concentration is biased high.
U = The analyte was analyzed for but the result was not detected above the limit of quantitation.

**Table 7-2**
**Soil PFOS, PFOA, and PFBS Analytical Results**
**PFAS Preliminary Assessment / Site Inspection**
**Fort Benning, Georgia**

| | | | Analyte | | | PFOS (mg/kg) | | PFOA (mg/kg) | | PFBS (mg/kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | OSD Risk Screening Level - Industrial/Commercial Scenario | | | 1.6 | | 1.6 | | 25 | |
| | | | OSD Risk Screening Level - Residential Scenario | | | 0.13 | | 0.13 | | 1.9 | |
| Associated AOPI | Location Type | Location | Sample ID / Parent Sample ID | Sample Date | Sample Type | Result | Qual | Result | Qual | Result | Qual |
| FFTA FBSB-88 | Soil | FTBN-FTA88-1 | FTBN-FTA88-1-SO-081420 | 08/14/2020 | N | 0.00095 | U | 0.00095 | U | 0.00095 | U |
| FFTA FBSB-88 | Soil | FTBN-FTA88-2 | FTBN-FTA88-2-SO-081420 | 08/14/2020 | N | **0.0025** | | 0.0011 | U | 0.0011 | U |
| FFTA FBSB-88 | Soil | FTBN-FTA88-3 | FTBN-FD-2-SO-SO-081420 / FTBN-FTA88-3-SO-081420 | 08/14/2020 | FD | **0.013** | | 0.001 | U | 0.001 | U |
| | | | FTBN-FTA88-3-SO-081420 | 08/14/2020 | N | **0.013** | | 0.00092 | U | 0.00092 | U |
| FFTA FBSB-105 | Soil | FTBN-FTA105-1 | FTBN-FTA105-1-SO-081620 | 08/16/2020 | N | **0.12** | | **0.0063** | | 0.001 | U |
| FFTA FBSB-105 | Soil | FTBN-FTA105-2 | FTBN-FTA105-2-SO-081620 | 08/16/2020 | N | **0.025** | | 0.0012 | U | 0.0012 | U |
| Old Fire Station Building 2452 | Soil | FTBN-FS2452-1 | FTBN-FS2452-1-SO-081120 | 08/11/2020 | N | **0.019** | | **0.00065** | J | 0.0013 | U |
| Old Fire Station Building 2452 | Soil | FTBN-FS2452-2 | FTBN-FD-1-SO-081220 / FTBN-FS2452-2-SO-081220 | 08/12/2020 | FD | **1.3** | J | **0.0025** | | **0.0045** | |
| | | | FTBN-FS2452-2-SO-081220 | 08/12/2020 | N | **1.2** | J | **0.0023** | | **0.0028** | |
| Old Fire Station Building 2445 | Soil | FTBN-FS2445-1 | FTBN-FS2445-1-SO-081120 | 08/11/2020 | N | **0.0024** | | **0.00078** | J | 0.0011 | U |
| Old Fire Station Building 2445 | Soil | FTBN-FS2445-2 | FTBN-FS2445-2-SO-081120 | 08/11/2020 | N | **0.03** | | **0.0022** | | 0.001 | U |
| Old Fire Station Building 2445 | Soil | FTBN-FS2445-3 | FTBN-FS2445-3-SO-081120 | 08/11/2020 | N | **0.047** | | **0.0012** | | 0.0011 | U |
| Hangar 2446 | Soil | FTBN-H2446-1 | FTBN-H2446-1-SO-081220 | 08/12/2020 | N | **0.0078** | | 0.0011 | U | 0.0011 | U |
| Hangar 2446 | Soil | FTBN-H2446-2 | FTBN-H2446-2-SO-081220 | 08/12/2020 | N | **0.006** | | 0.001 | U | 0.001 | U |
| Nozzle Testing Area and Fire Station #4 | Soil | FTBN-FS4-1 | FTBN-FS4-1-SO-081320 | 08/13/2020 | N | **0.00098** | J | 0.001 | U | 0.001 | U |
| Nozzle Testing Area and Fire Station #4 | Soil | FTBN-FS4-2 | FTBN-FS4-2-SO-081320 | 08/13/2020 | N | **0.00058** | J | 0.00098 | U | 0.00098 | U |
| Nozzle Testing Area and Fire Station #4 | Soil | FTBN-FS4-3 | FTBN-FD-2-SO-081320 / FTBN-FS4-3-SO-081320 | 08/13/2020 | FD | 0.00096 | U | **0.00092** | J | 0.00096 | U |
| | | | FTBN-FS4-3-SO-081320 | 08/13/2020 | N | 0.0011 | U | **0.00081** | J | 0.0011 | U |
| Wastewater Treatment Plant #1 | Soil | FTBN-WWTP-1 | FTBN-WWTP-1-SO-081720 | 08/17/2020 | N | **0.0046** | | **0.0011** | | 0.00099 | U |
| Wastewater Treatment Plant #3 | Soil | FTBN-WWTP-3 | FTBN-WWTP3-SO-081620 | 08/16/2020 | N | 0.0012 | U | **0.0016** | | 0.0012 | U |
| Fire Station #2 | Soil | FTBN-FS2-1 | FTBN-FS2-1-SO-081720 | 08/17/2020 | N | **0.0011** | | 0.0011 | U | 0.0011 | U |
| Fire Station #2 | Soil | FTBN-FS2-2 | FTBN-FS2-2-SO-081720 | 08/17/2020 | N | **0.07** | | 0.00097 | U | 0.00097 | U |
| Fire Station #2 | Soil | FTBN-FS2-3 | FTBN-FS2-3-SO-081020 | 08/10/2020 | N | **0.0046** | | 0.001 | U | 0.001 | U |
| Old Fire Station Building 9 | Soil | FTBN-FS9-1 | FTBN-FS9-1-SO-081820 | 08/18/2020 | N | **0.042** | | 0.00097 | U | 0.00097 | U |
| Old Fire Station Building 9 | Soil | FTBN-FS9-2 | FTBN-FS9-2-SO-081320 | 08/13/2020 | N | **0.16** | | **0.0025** | | 0.001 | U |
| Old Fire Station Building 9 | Soil | FTBN-FS9-3 | FTBN-FS9-3-SO-081320 | 08/13/2020 | N | **0.007** | | 0.00096 | U | 0.00096 | U |
| Biosolid Application Area: FTBN-033A | Soil | FTBN-BSA033A-1 | FTBN-BSA033A-1-SO-081120 | 08/11/2020 | N | **0.0018** | | **0.0047** | | 0.0012 | U |
| Biosolid Application Area: FTBN-033A | Soil | FTBN-BSA033A-2 | FTBN-BSA033A-2-SO-081120 | 08/11/2020 | N | 0.00099 | U | 0.00099 | U | 0.00099 | U |
| Biosolid Application Area: FTBN-033A | Soil | FTBN-BSA033A-3 | FTBN-BSA033A-3-SO-081120 | 08/11/2020 | N | **0.00078** | J | 0.001 | U | 0.001 | U |
| Biosolid Application Area: FTBN-033C | Soil | FTBN-BSA033C-1 | FTBN-BSA033C-SO-081520 | 08/15/2020 | N | **0.0027** | | 0.00098 | U | 0.00098 | U |
| Biosolid Application Area: FTBN-033C | Soil | FTBN-BSA033C-2 | FTBN-BSA033C-2-SO-081720 | 08/17/2020 | N | **0.008** | | 0.0011 | U | 0.0011 | U |
| Biosolid Application Area: FTBN-033C | Soil | FTBN-BSA033C-3 | FTBN-BSA033C-3-SO-081720 | 08/17/2020 | N | **0.0028** | | 0.0009 | U | 0.0009 | U |
| Biosolid Application Area: FTBN-033C | Soil | FTBN-BSA033C-4 | FTBN-BSA033C-4-SO-081720 | 08/17/2020 | N | **0.00088** | J | 0.001 | U | 0.001 | U |
| Biosolid Application Area: FTBN-033E | Soil | FTBN-BSA033E-1 | FTBN-BSA033E-1-SO-081520 | 08/15/2020 | N | **0.00066** | J | 0.00098 | U | 0.00098 | U |
| Biosolid Application Area: FTBN-033E | Soil | FTBN-BSA033E-2 | FTBN-BSA033E-2-SO-081220 | 08/12/2020 | N | 0.0011 | U | 0.0011 | U | 0.0011 | U |
| Biosolid Application Area: FTBN-033E | Soil | FTBN-BSA033E-3 | FTBN-BSA033E-3-SO-081220 | 08/12/2020 | N | **0.011** | | **0.0026** | | 0.0012 | U |
| Biosolid Application Area: FTBN-033K | Soil | FTBN-BSA033K-1 | FTBN-BSA033K-1-SO-081820 | 08/18/2020 | N | **0.0056** | | **0.0048** | | 0.0011 | U |
| Biosolid Application Area: FTBN-033K | Soil | FTBN-BSA033K-2 | FTBN-BSA033K-2-SO-081820 | 08/18/2020 | N | 0.0011 | U | 0.0011 | U | 0.0011 | U |
| Biosolid Application Area: FTBN-033K | Soil | FTBN-BSA033K-3 | FTBN-BSA033K-3-SO-081820 | 08/18/2020 | N | **0.0017** | | **0.00077** | J | 0.0012 | U |

**Table 7-2**
**Soil PFOS, PFOA, and PFBS Analytical Results**
**PFAS Preliminary Assessment / Site Inspection**
**Fort Benning, Georgia**

| | | | Analyte | | PFOS (mg/kg) | | PFOA (mg/kg) | | PFBS (mg/kg) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | OSD Risk Screening Level - Industrial/Commercial Scenario | | 1.6 | | 1.6 | | 25 | |
| | | | OSD Risk Screening Level - Residential Scenario | | 0.13 | | 0.13 | | 1.9 | |
| Associated AOPI | Location Type | Location | Sample ID / Parent Sample ID | Sample Date | Sample Type | Result | Qual | Result | Qual | Result | Qual |
| Biosolid Application Area: FTBN-033M | Soil | FTBN-BSA033M-1 | FTBN-BSA033M-1-SO-081020 | 08/10/2020 | N | 0.0012 | U | 0.0012 | U | 0.0012 | U |
| Biosolid Application Area: FTBN-033M | Soil | FTBN-BSA033M-2 | FTBN-BSA033M-2-SO-081020 | 08/10/2020 | N | 0.00095 | U | 0.00095 | U | 0.00095 | U |
| Biosolid Application Area: FTBN-033M | Soil | FTBN-BSA033M-3 | FTBN-BSA033M-3-SO-081020 | 08/10/2020 | N | 0.001 | U | 0.001 | U | 0.001 | U |
| Biosolid Application Area: FTBN-033P | Soil | FTBN-BSA033P-1 | FTBN-BSA033P-1-SO-081820 | 08/18/2020 | N | 0.00092 | U | 0.00092 | U | 0.00092 | U |
| Biosolid Application Area: FTBN-033P | Soil | FTBN-BSA033P-2 | FTBN-BSA033P-2-SO-081220 | 08/12/2020 | N | **0.00062** | J | 0.00098 | U | 0.00098 | U |
| Biosolid Application Area: FTBN-033P | Soil | FTBN-BSA033P-3 | FTBN-BSA033P-3-SO-081220 | 08/12/2020 | 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. Data are compared to the Office of the Secretary of Defense (OSD) risk screening levels for both the residential as well as the industrial/commercial scenarios (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September).
3. Grey shaded values indicate the result was detected greater than the residential scenario risk screening levels (OSD 2021). There were no exceedances of the industrial/commercial scenario risk screening level.

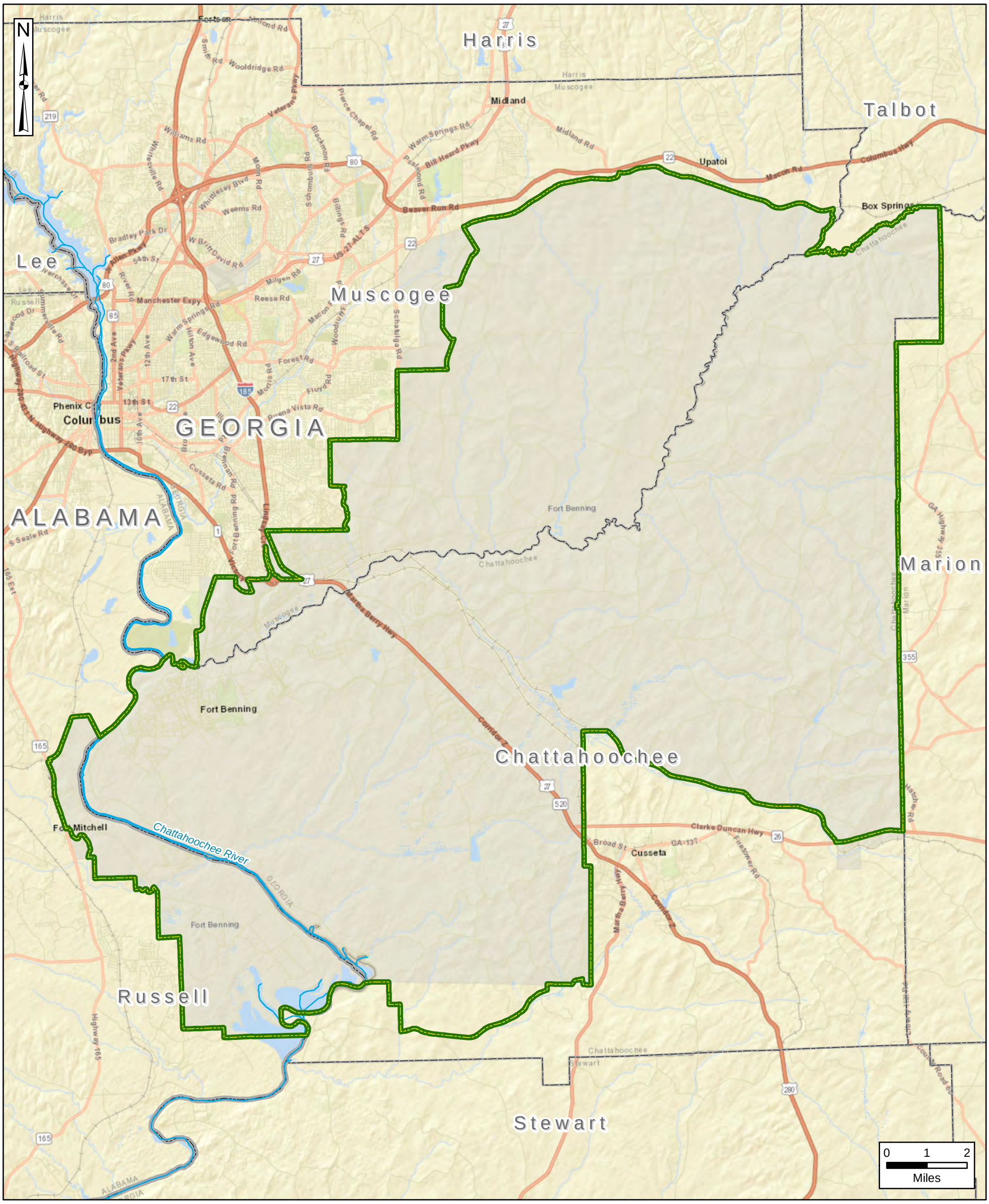
**Acronyms/Abbreviations:**
AOPI = Area of Potential Interest
FD = field duplicate sample
ID = identification
mg/kg = milligrams per kilogram (parts per million)
N = primary sample
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier

**Qualifier Definitions:**
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.

# FIGURES

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 2-1**
**Site Location**

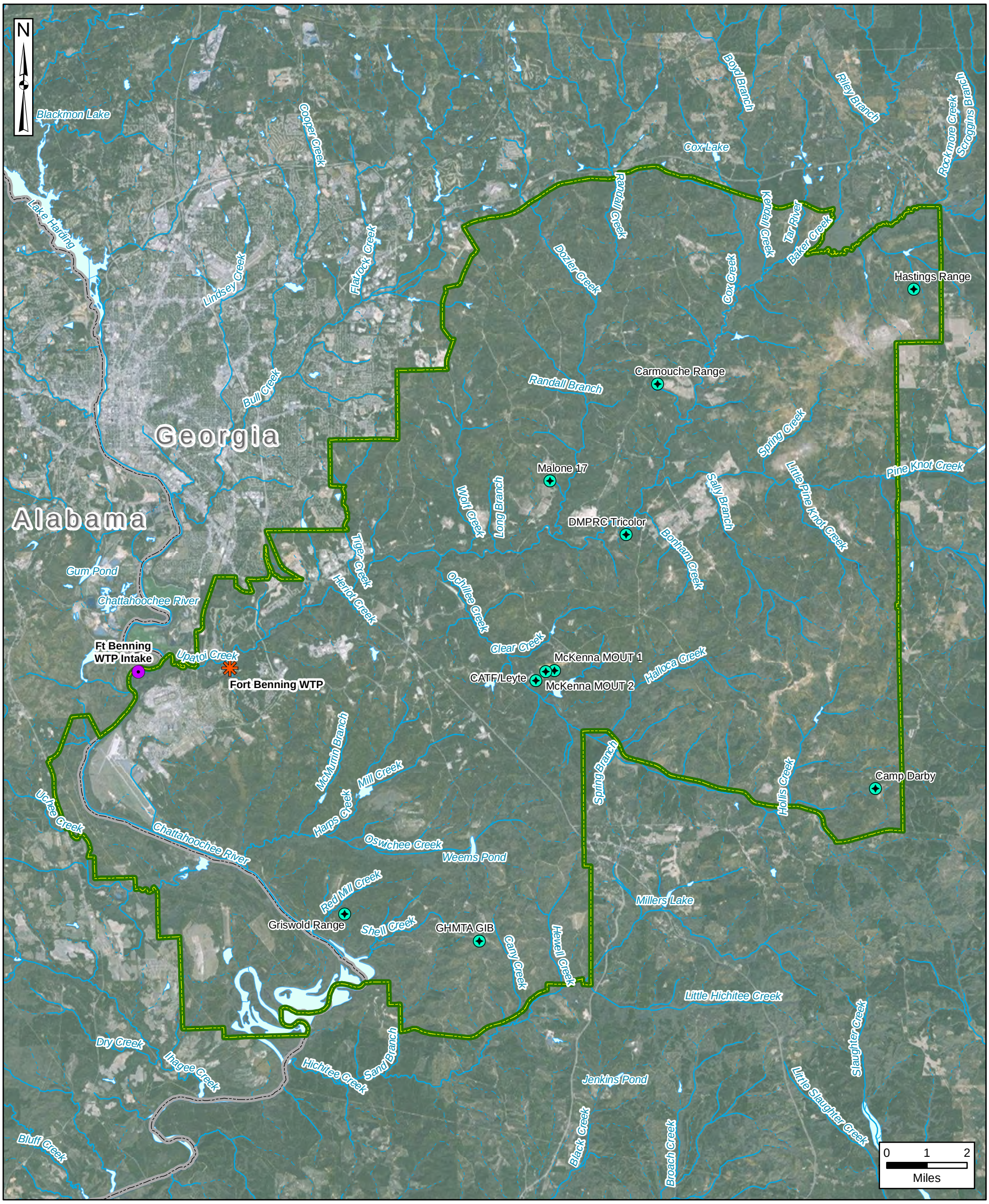

Installation Boundary
State Boundary
County Boundary

Data Sources:
AEC, ARID-GEO Data, 2007
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 2-2**
**Site Layout**




Installation Boundary
State Boundary
River/Stream (Perennial)
Stream (Intermittent)
Water Body

Intake
Fort Benning WTP
Potable Water Well (On-Post)

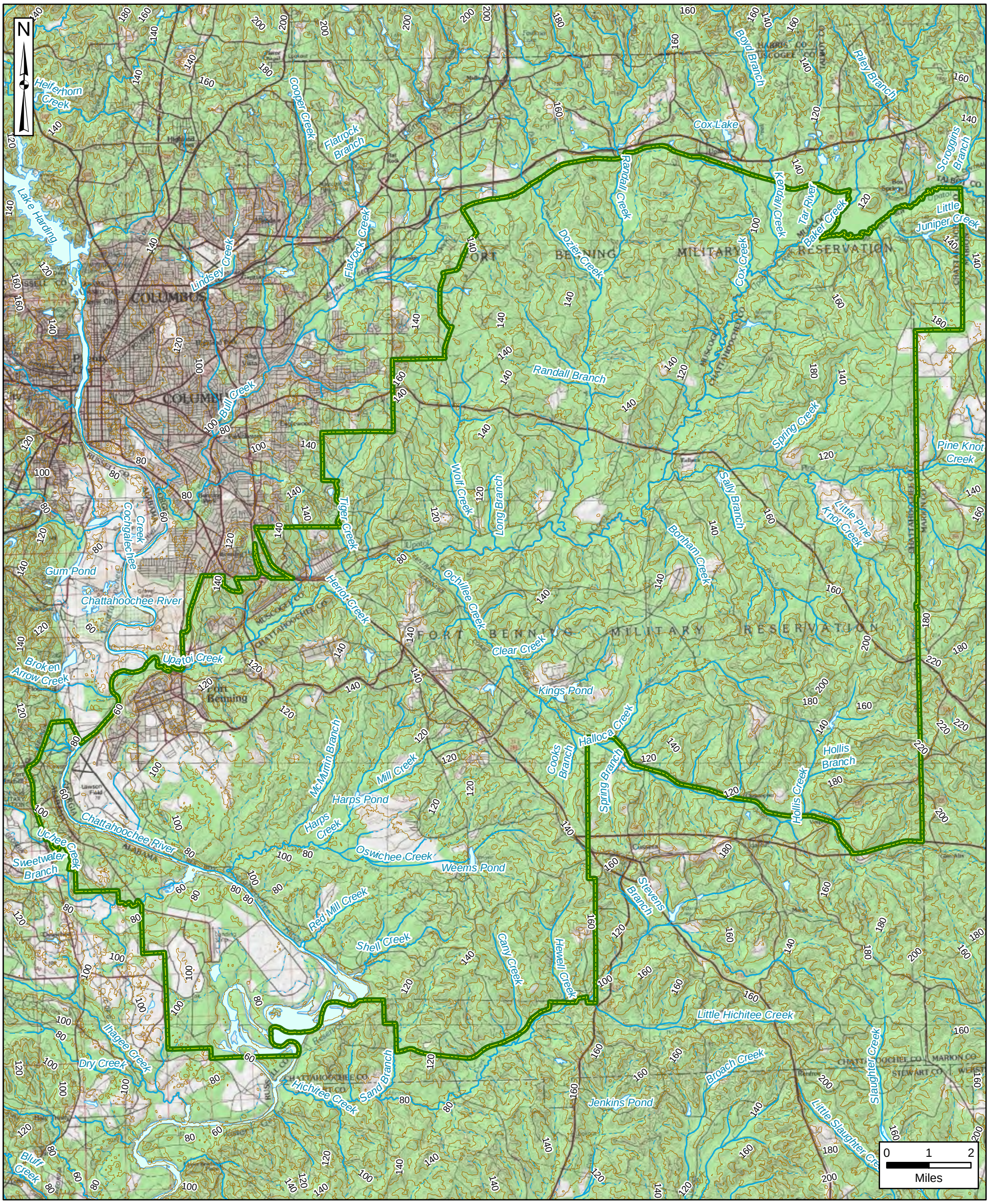
WTP = Water Treatment Plant

Data Sources:
AEC, ARID-GEO Data, 2007
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 2-3
# Topographic Map



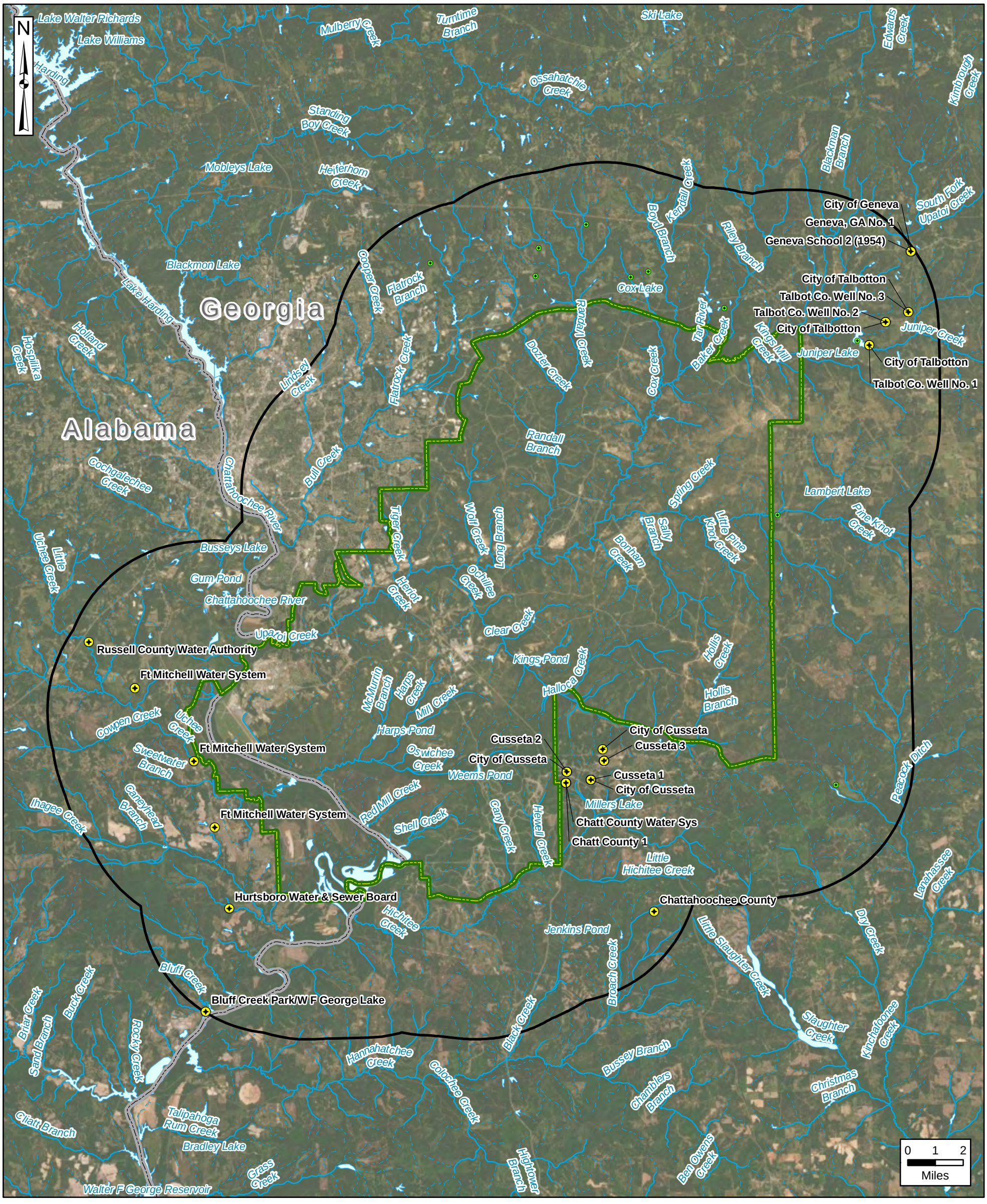

- Installation Boundary
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Elevation Contour (feet)

Data Sources:
AEC, ARID-GEO Data, 2007
ESRI ArcGIS Online, USA Topo Maps

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 2-4
# Off-Post Potable Wells

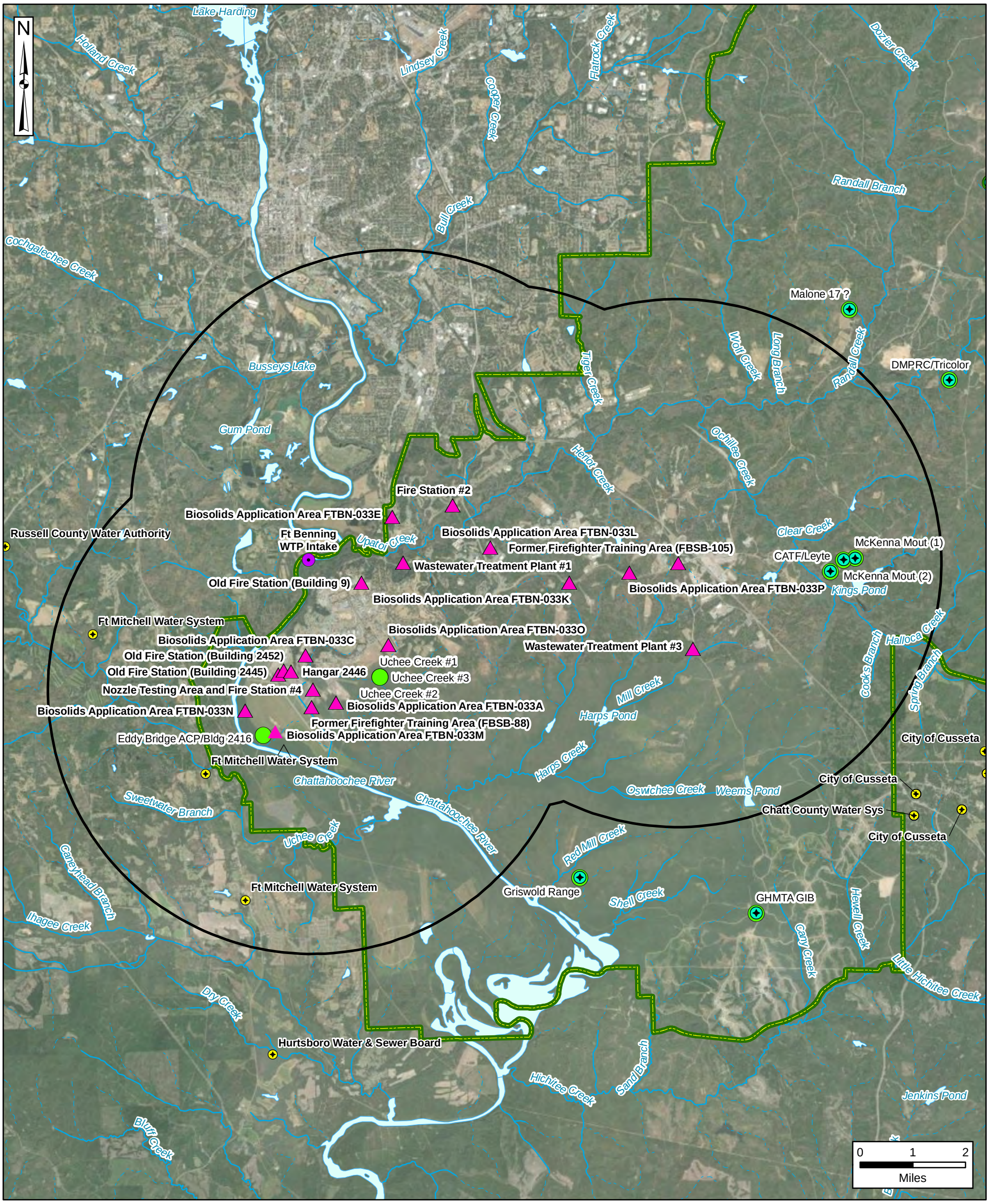



Data Sources:
Fort Benning, GIS Data, 2018
EDR, Well Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessments
Fort Benning, GA

# Figure 5-2
# AOPI Locations



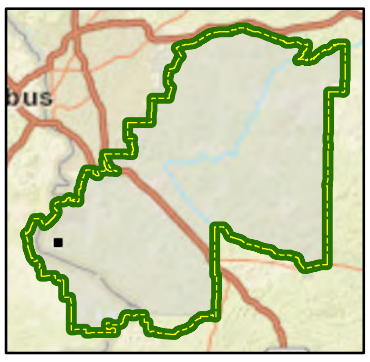

- Installation Boundary
- AOPI Location
- 5-Mile Radius of AOPI
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Intake
- Potable Water Well (On-Post)
- Public Supply Well
- Well Previously Tested for PFAS

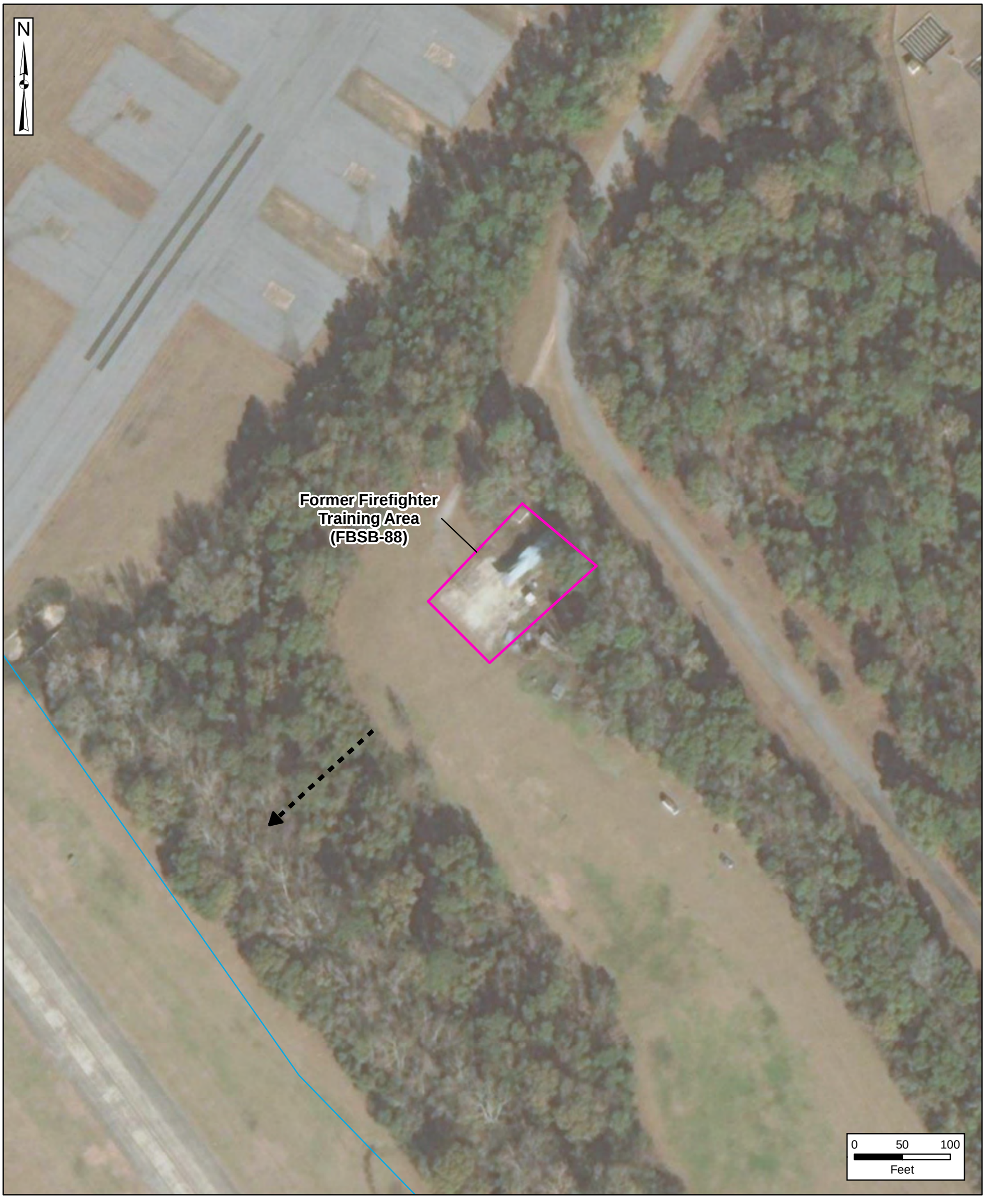
Data Sources:
Fort Benning, GIS Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-3**
**Aerial Photo of**
**AOPI Former Firefighter Training Area (FBSB-88)**





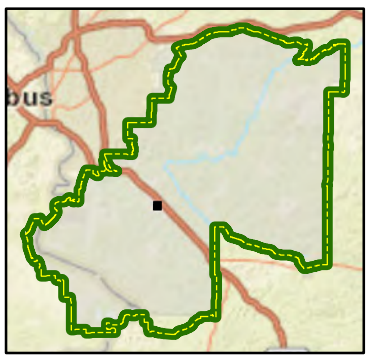

Installation Boundary
Area of Potential Interest (AOPI)
River/Stream (Perennial)
Inferred Groundwater Flow Direction (Unconfined Aquifer)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-4**
**Aerial Photo of**
**AOPI Former Firefighter Training Area (FBSB-105)**





Installation Boundary

Area of Potential Interest (AOPI)

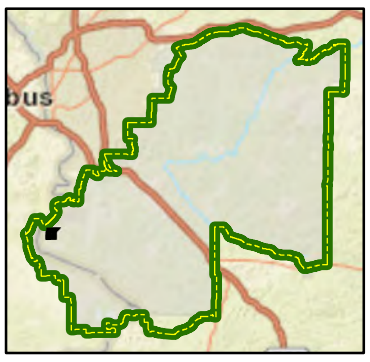
Inferred Groundwater Flow Direction (Unconfined Aquifer)

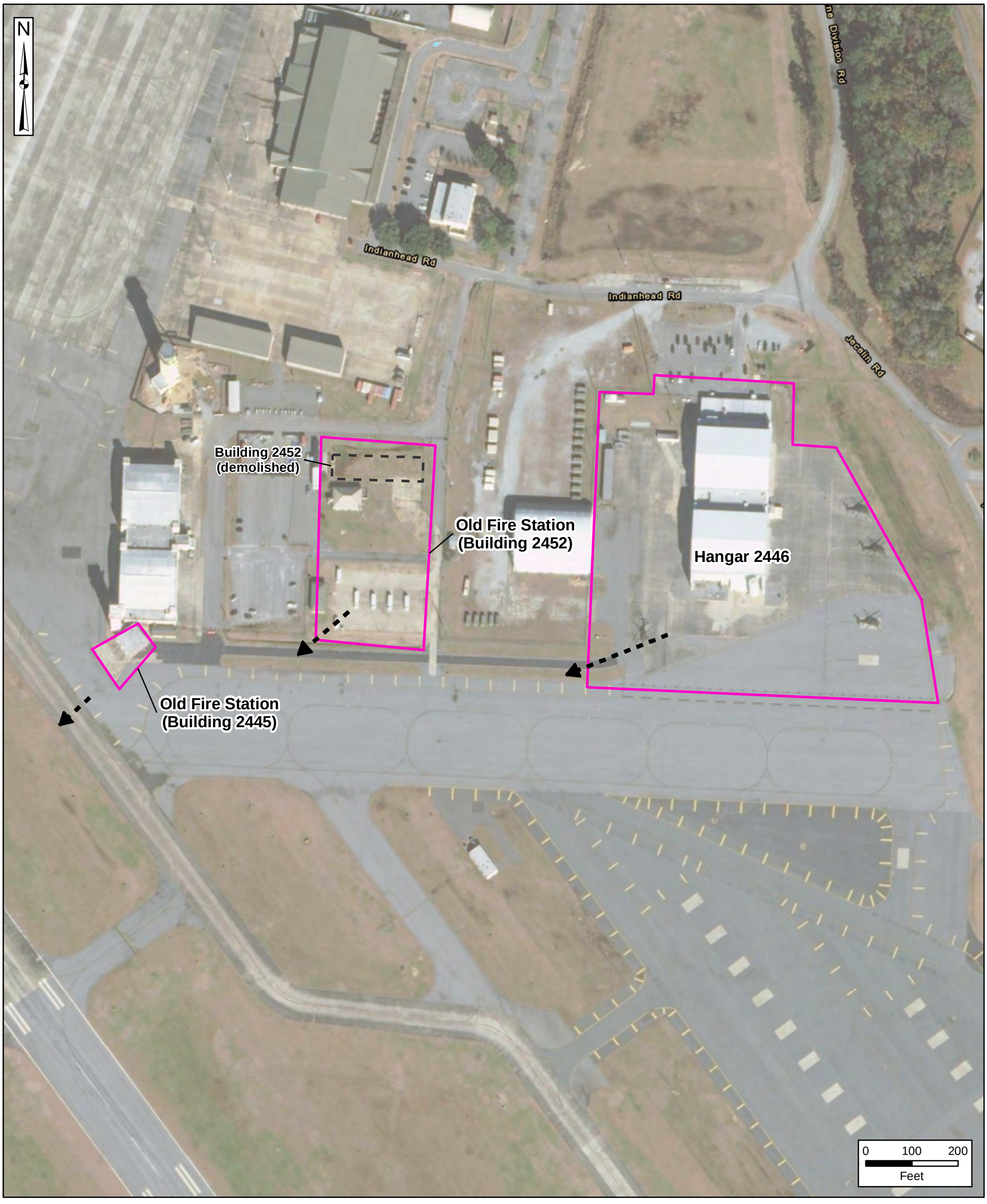
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-5**
**Aerial Photo of**
**Old Fire Station (Building 2452), Old Fire Station (Building 2445), and Hangar 2446 AOPI**





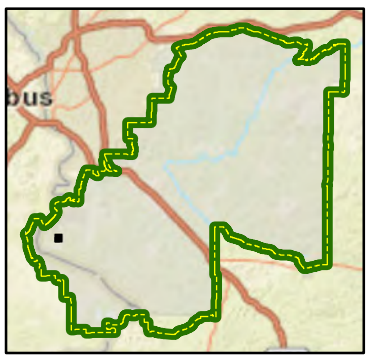

Installation Boundary
Area of Potential Interest (AOPI)
Former Building Footporint
Inferred Groundwater Flow Direction (Unconfined Aquifer)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-6**
**Aerial Photo of**
**AOPI Nozzle Testing Area and Fire Station #4**




Installation Boundary
Area of Potential Interest (AOPI)
Inferred Groundwater Flow Direction (Unconfined Aquifer)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

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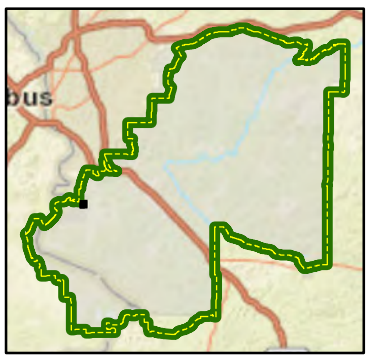
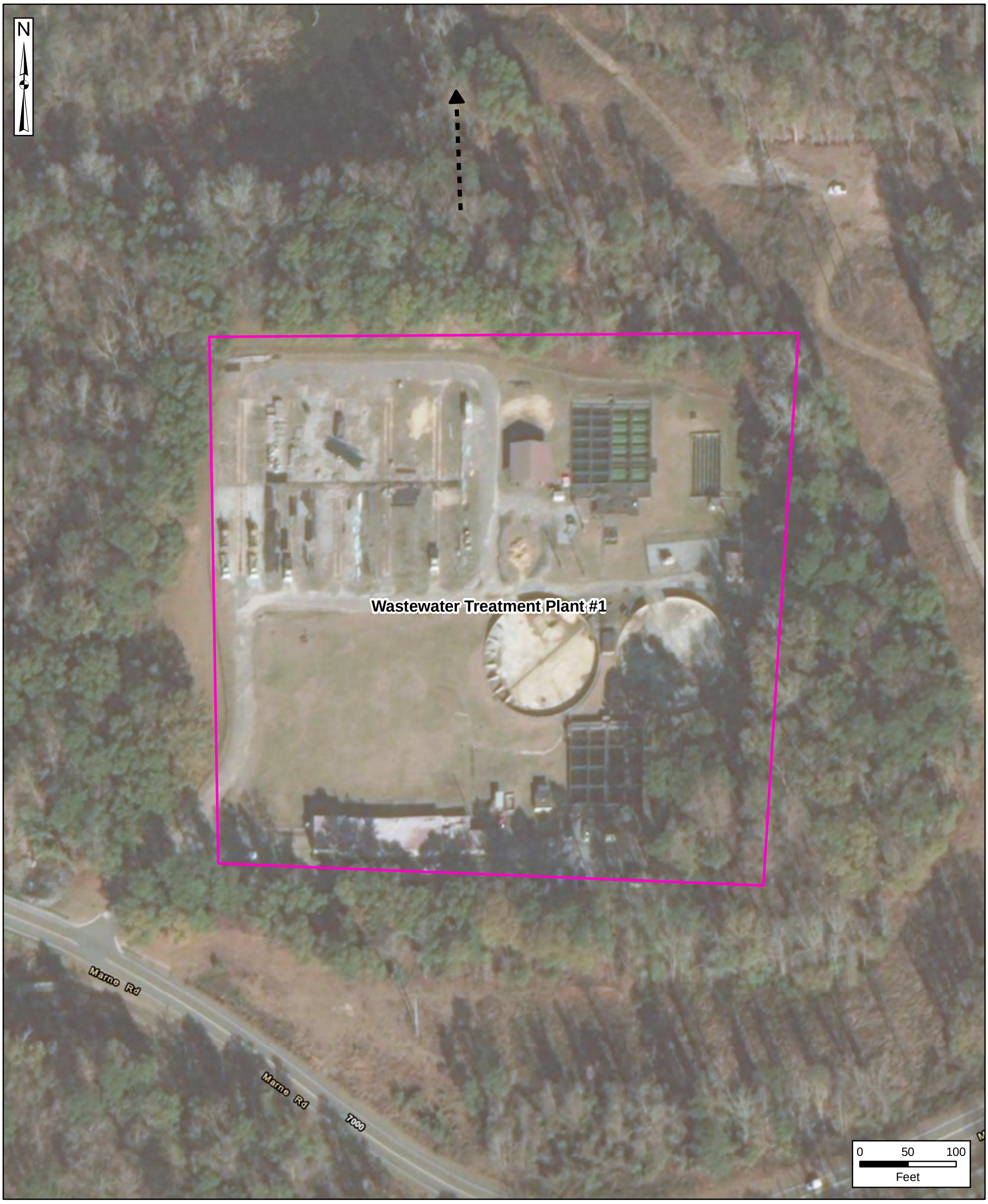
Fort Benning, GA

**Figure 5-7**
**Aerial Photo of**
**AOPI Wastewater Treatment Plant #1**






Installation Boundary

Area of Potential Interest (AOPI)

Inferred Groundwater Flow Direction (Unconfined Aquifer)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

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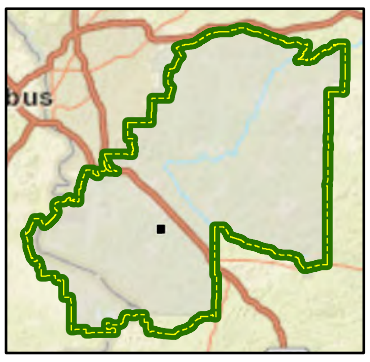
Fort Benning, GA

**Figure 5-8**
**Aerial Photo of**
**AOPI Wastewater Treatment Plant #3**



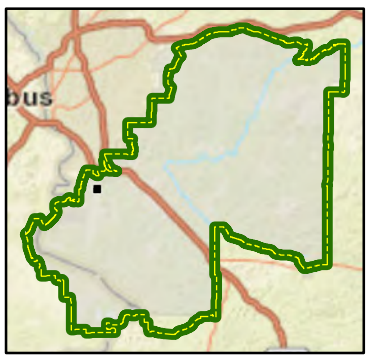

Installation Boundary
Area of Potential Interest (AOPI)
River/Stream (Perennial)
Inferred Groundwater Flow Direction (Unconfined Aquifer)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 5-9
# Aerial Photo of
# AOPI Fire Station #2




Installation Boundary

Area of Potential Interest (AOPI)

Inferred Groundwater Flow Direction (Unconfined Aquifer)

Fort Benning WTP

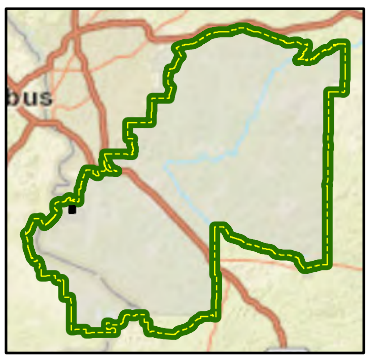
WTP = Water Treatment Plant

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-10**
**Aerial Photo of**
**AOPI Old Fire Station (Building 9)**



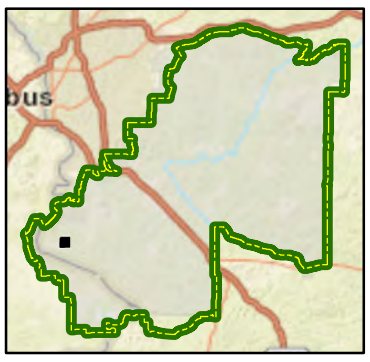

Installation Boundary
Area of Potential Interest (AOPI)
Former Building Footprint
Inferred Groundwater Flow Direction (Unconfined Aquifer)

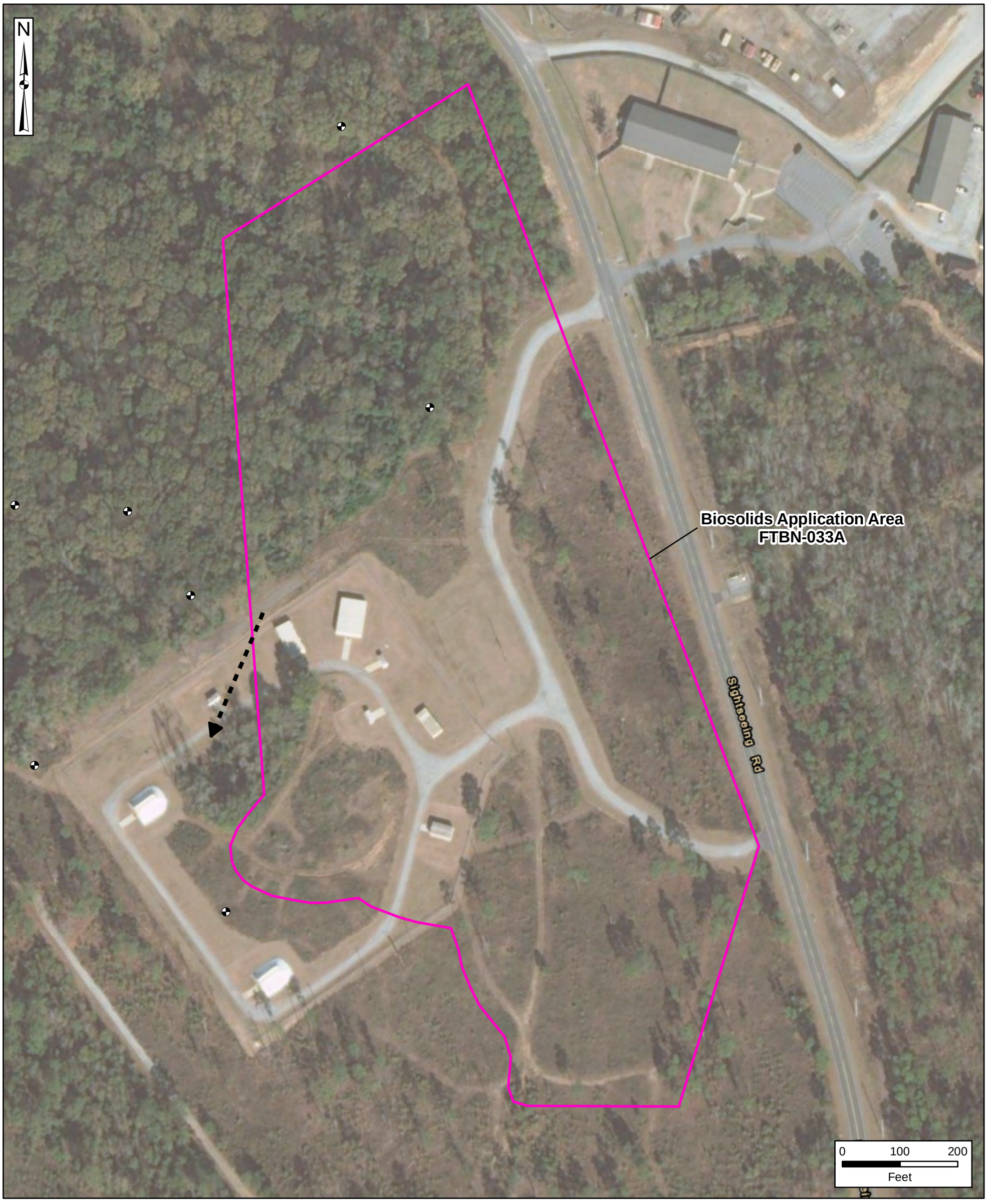
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-11**
**Aerial Photo of**
**AOPI Biosolids Application Area FTBN-033A**



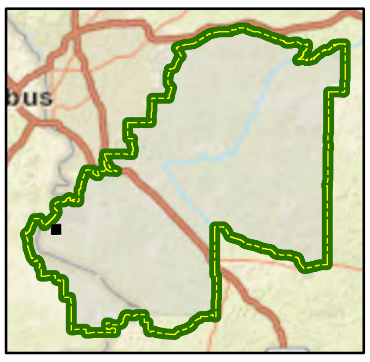

Installation Boundary
Area of Potential Interest (AOPI)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Monitoring Well

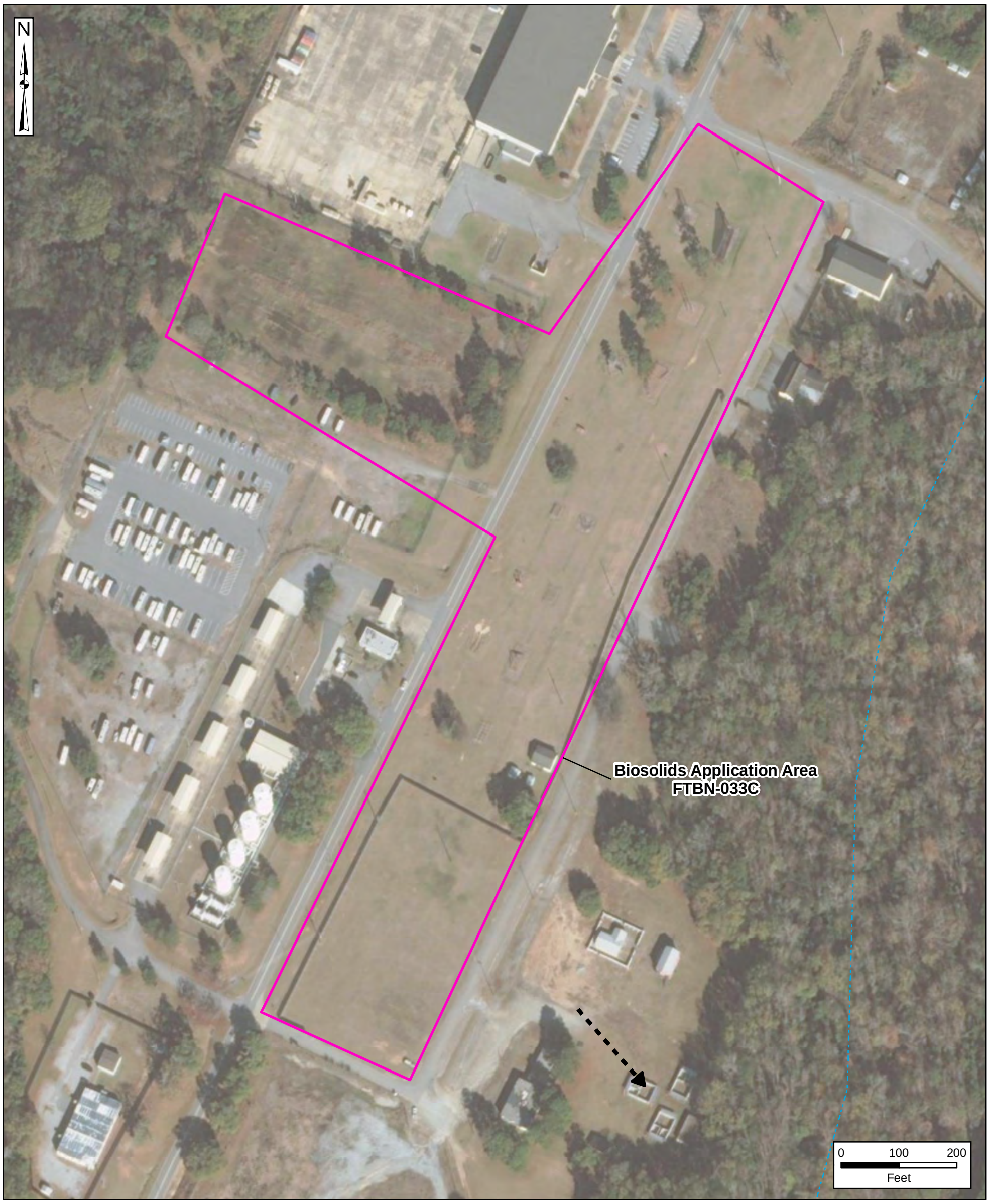
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-12**
**Aerial Photo of**
**AOPI Biosolids Application Area FTBN-033C**






Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

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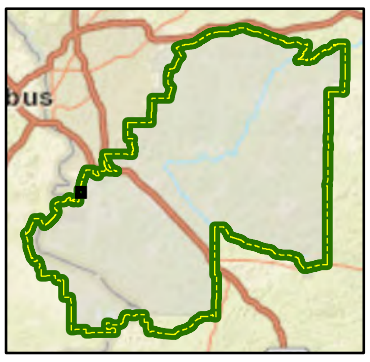
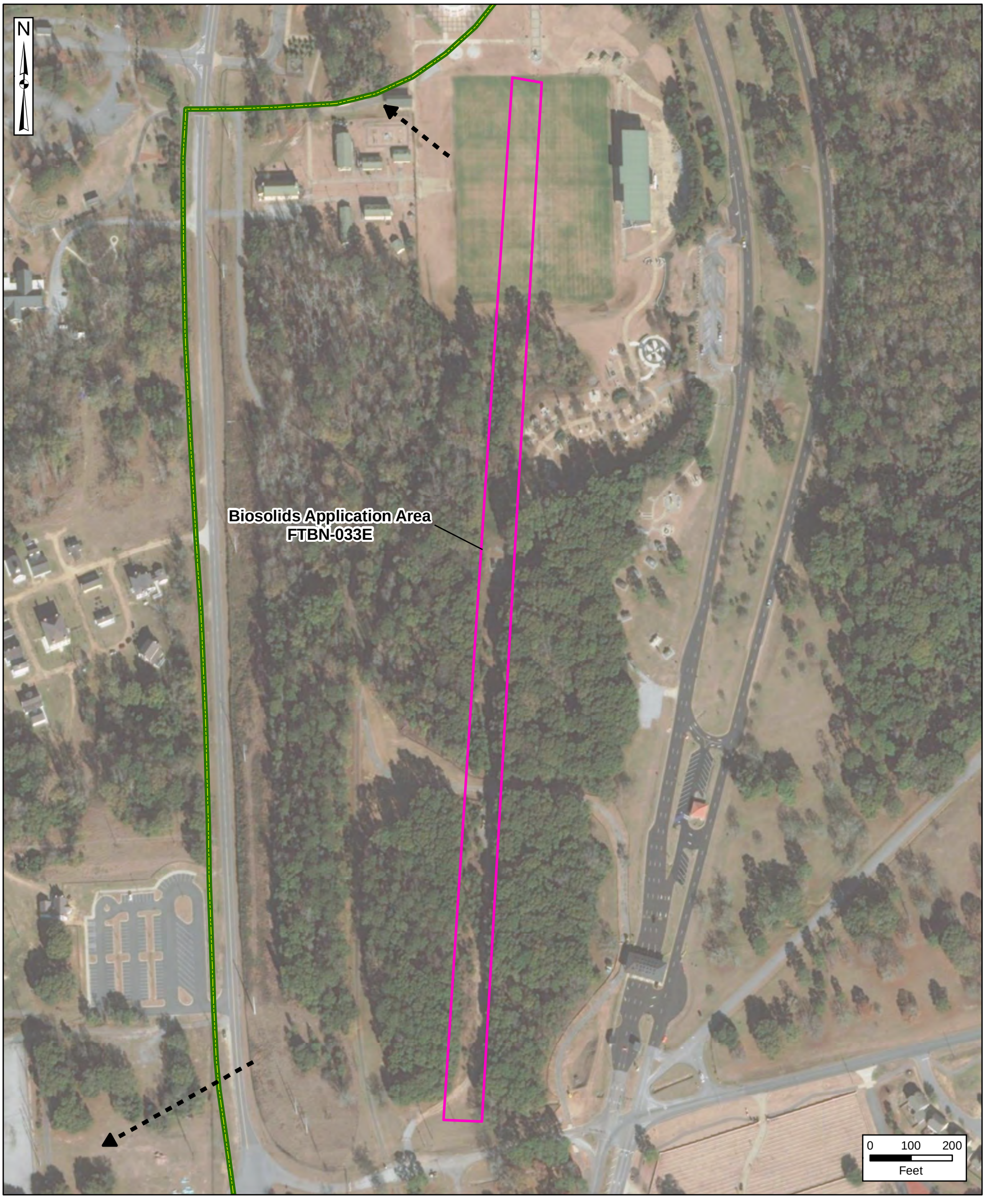
Fort Benning, GA

**Figure 5-13**
**Aerial Photo of**
**AOPI Biosolids Application Area FTBN-033E**






Installation Boundary

Area of Potential Interest (AOPI)

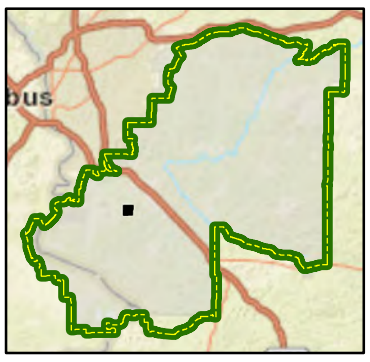
Inferred Groundwater Flow Direction (Unconfined Aquifer)

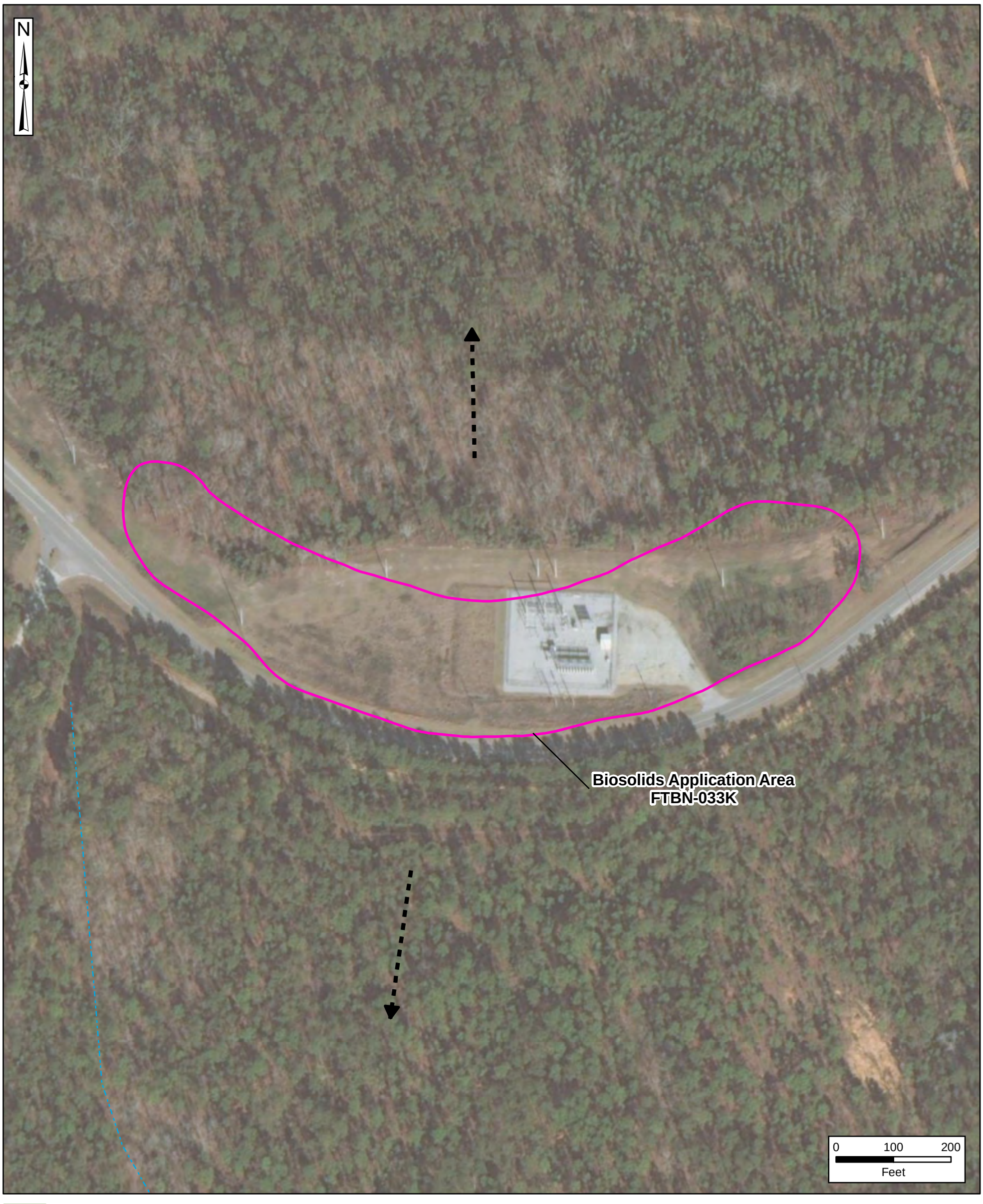
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-14**
**Aerial Photo of**
**AOPI Biosolids Application Area FTBN-033K**





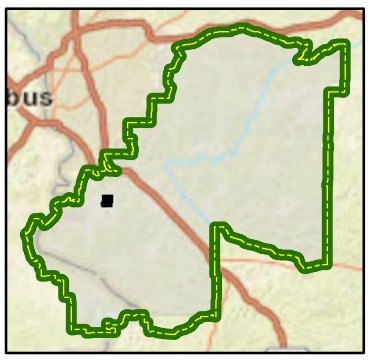

Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)

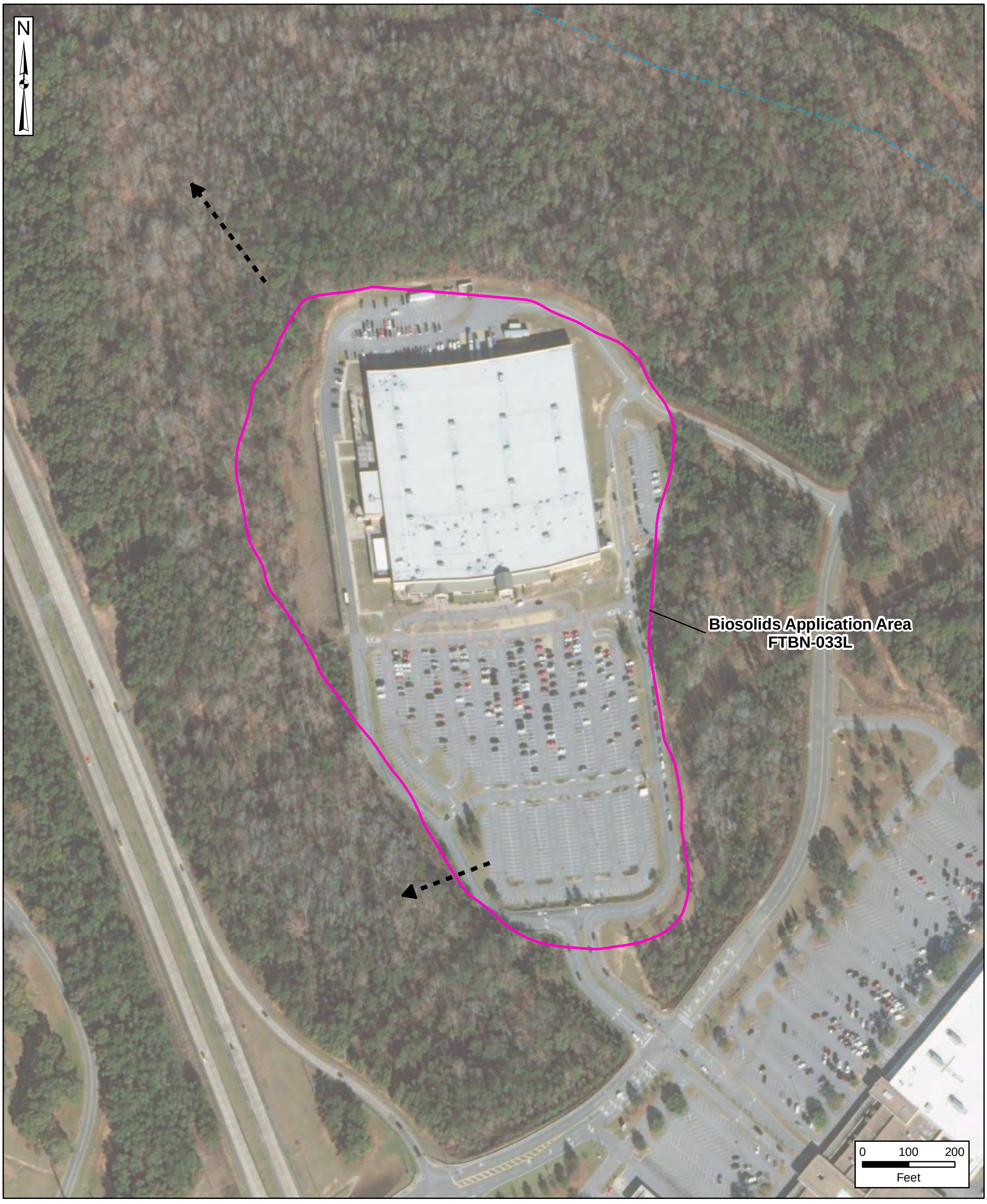
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-15**
**Aerial Photo of**
**AOPI Biosolids Application Area FTBN-033L**





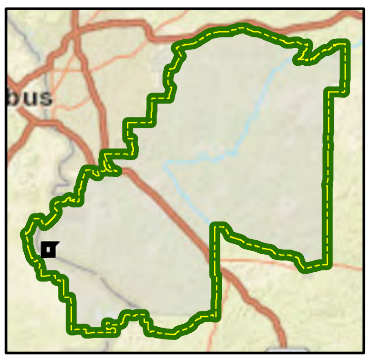

Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)

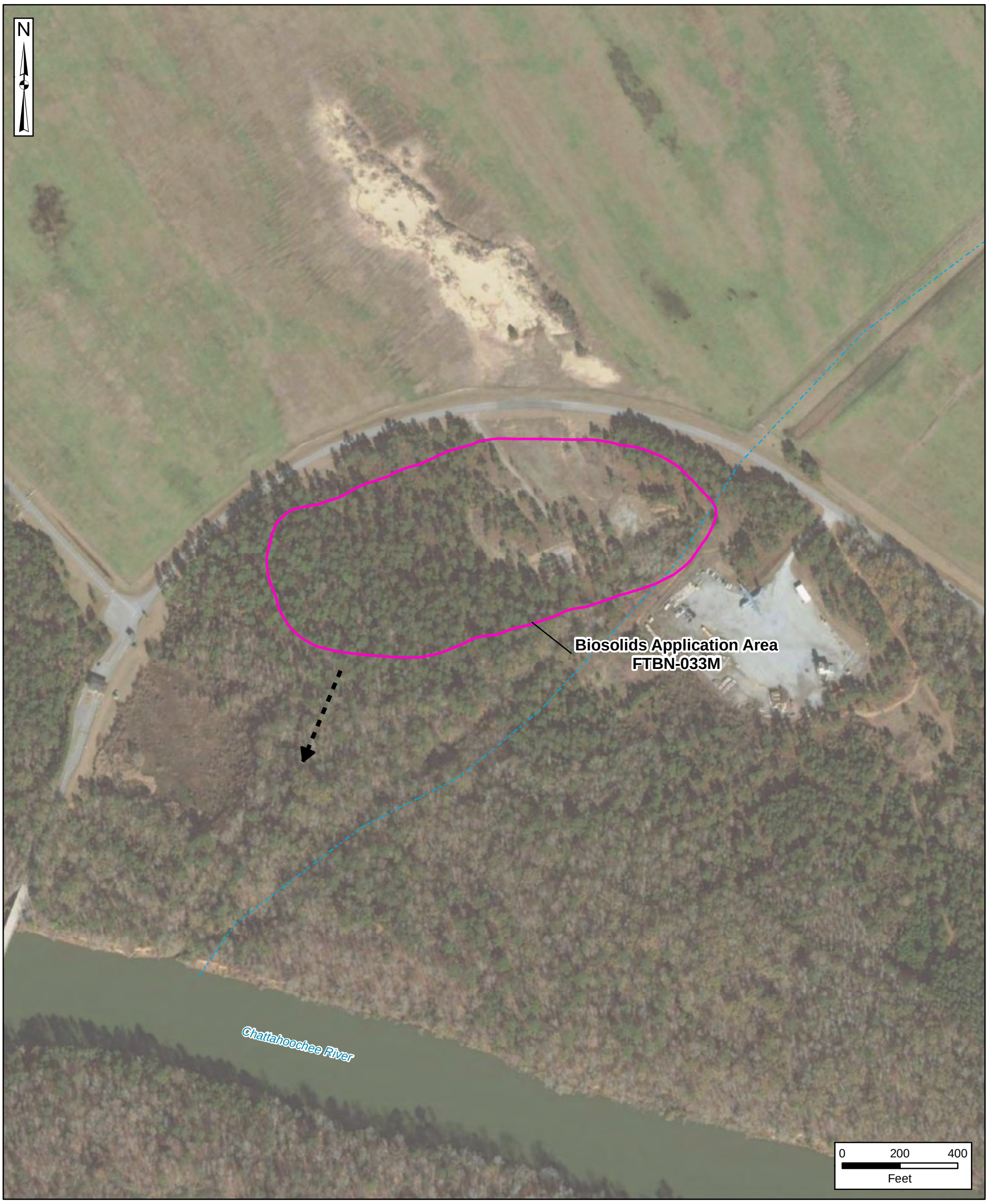
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-16**
**Aerial Photo of**
**AOPI Biosolids Application Area FTBN-033M**





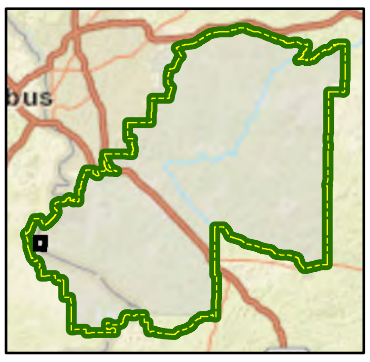

Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)

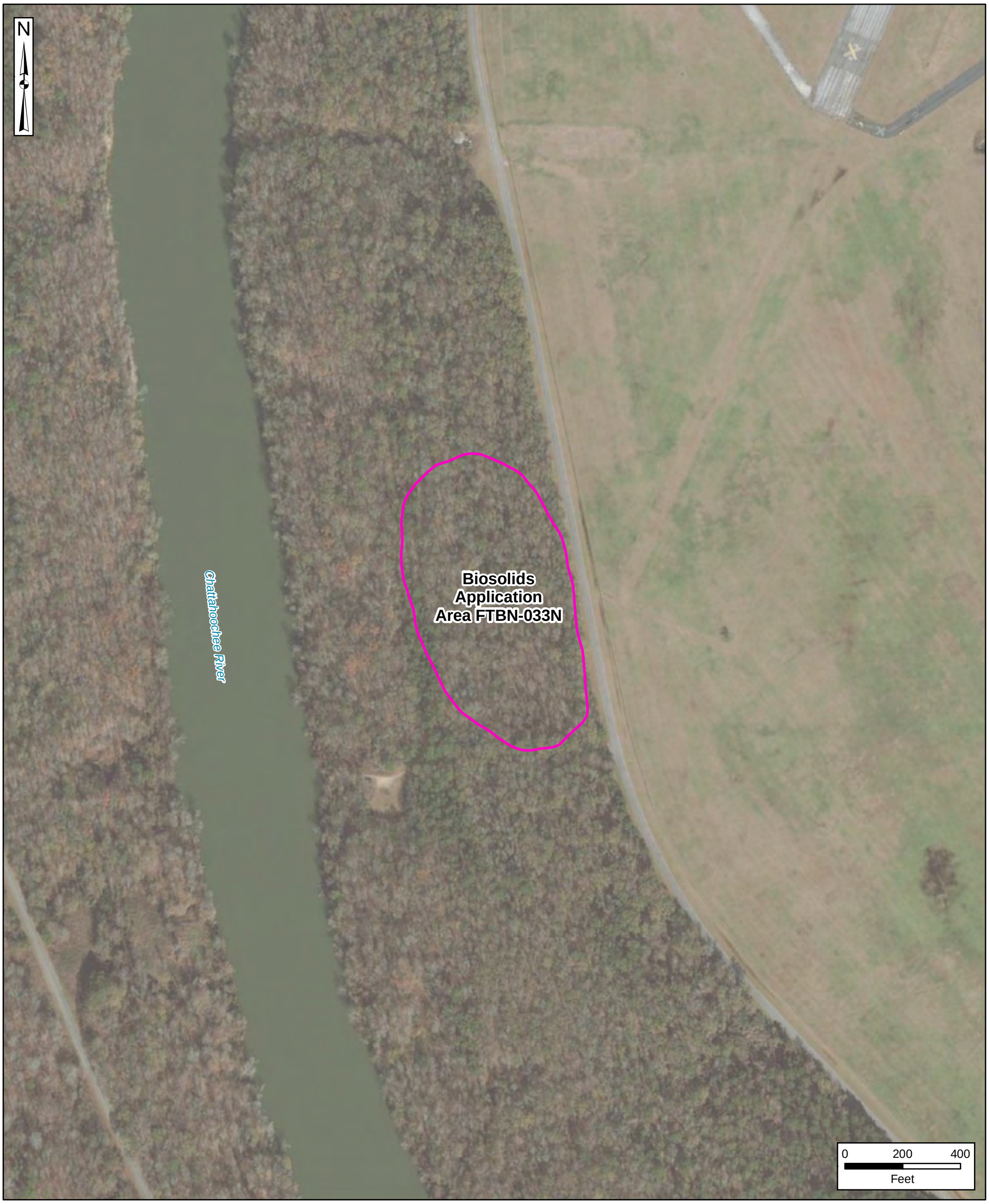
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-17**
**Aerial Photo of**
**AOPI Biosolids Application Area FTBN-033N**




Installation Boundary

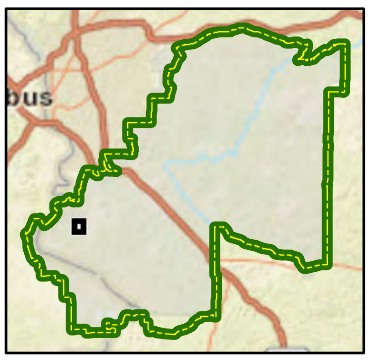
Area of Potential Interest (AOPI)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-18**
**Aerial Photo of**
**AOPI Biosolids Application Area FTBN-033O**



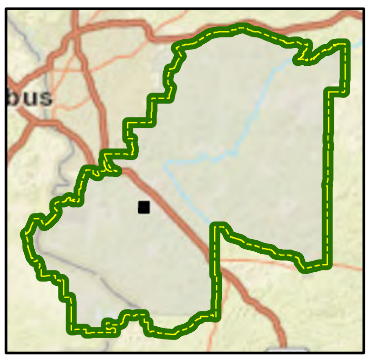

Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)

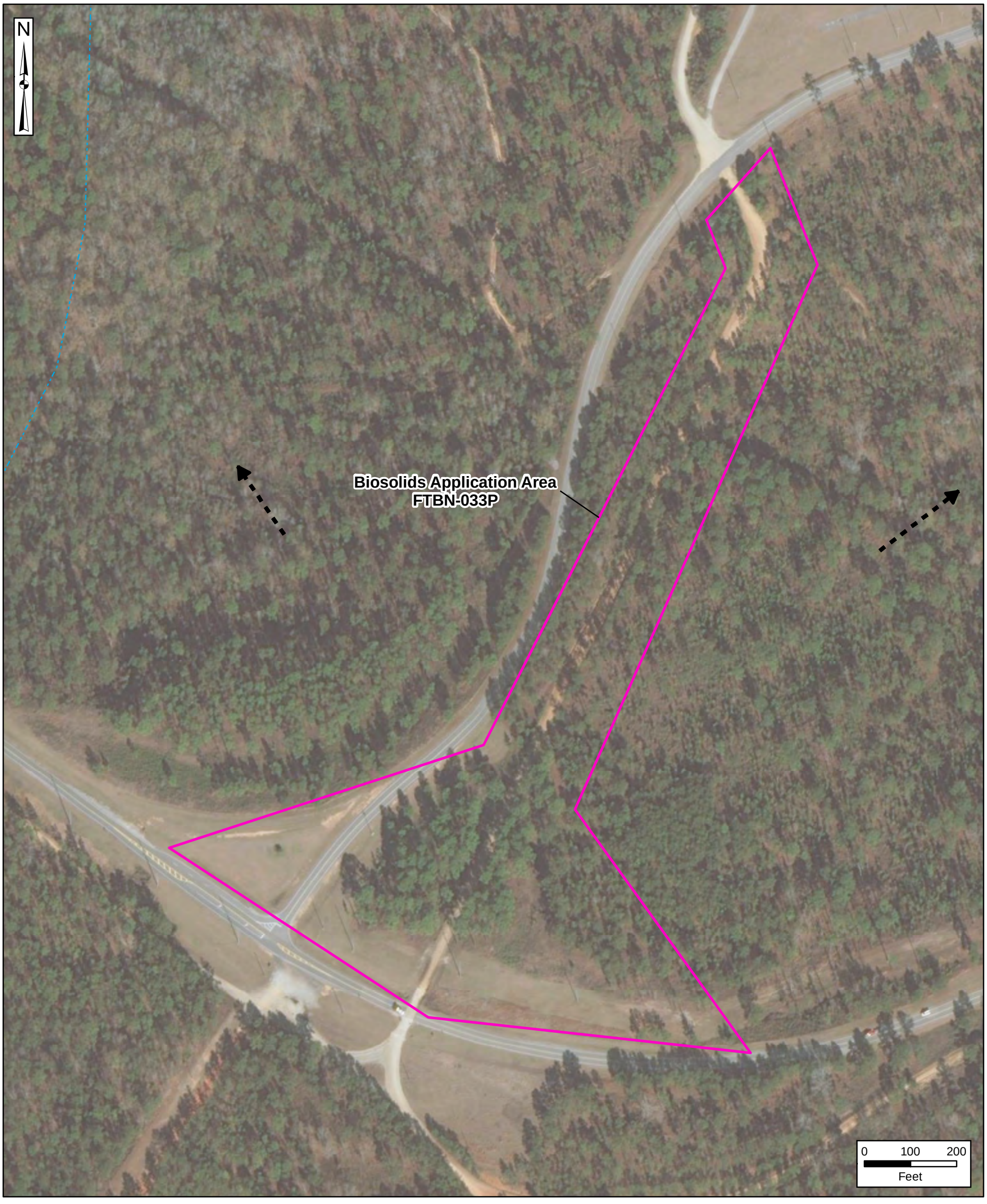
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 5-19**
**Aerial Photo of**
**AOPI Biosolids Application Area FTBN-033P**




Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

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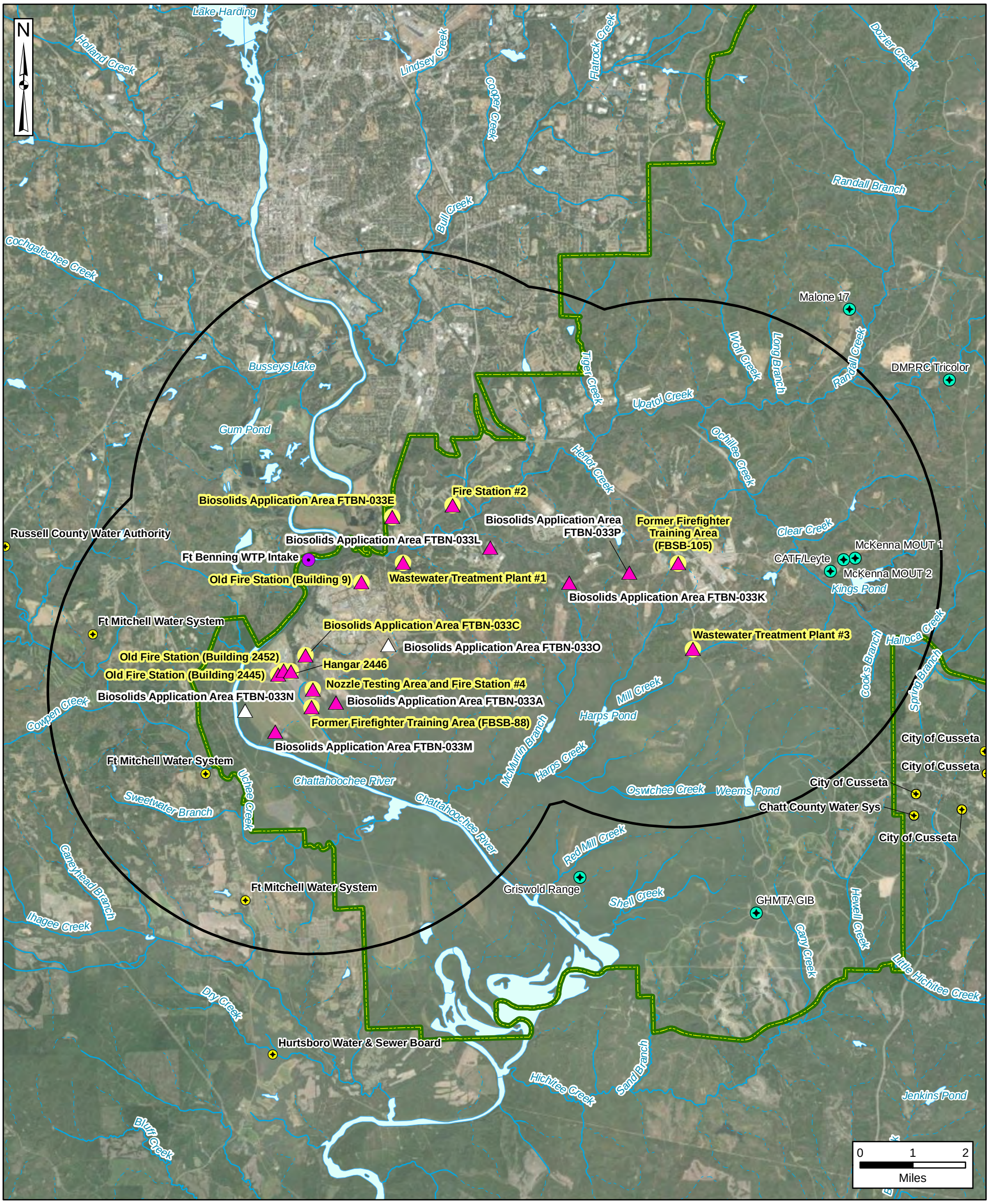
Fort Benning, GA

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




- Installation Boundary
- Sampled AOPI
- AOPI with OSD Risk Screening Level Exceedance
- AOPI not Sampled
- 5-Mile Radius of AOPI
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Intake
- Potable Water Well (On-Post)
- Public Supply Well

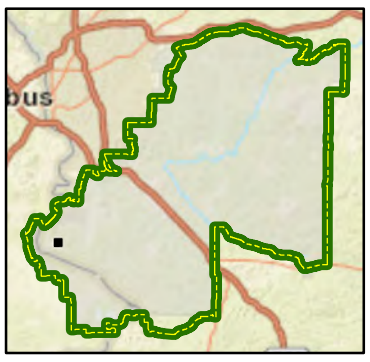
AOPI = area of potential interest
OSD = Office of the Secretary of Defense

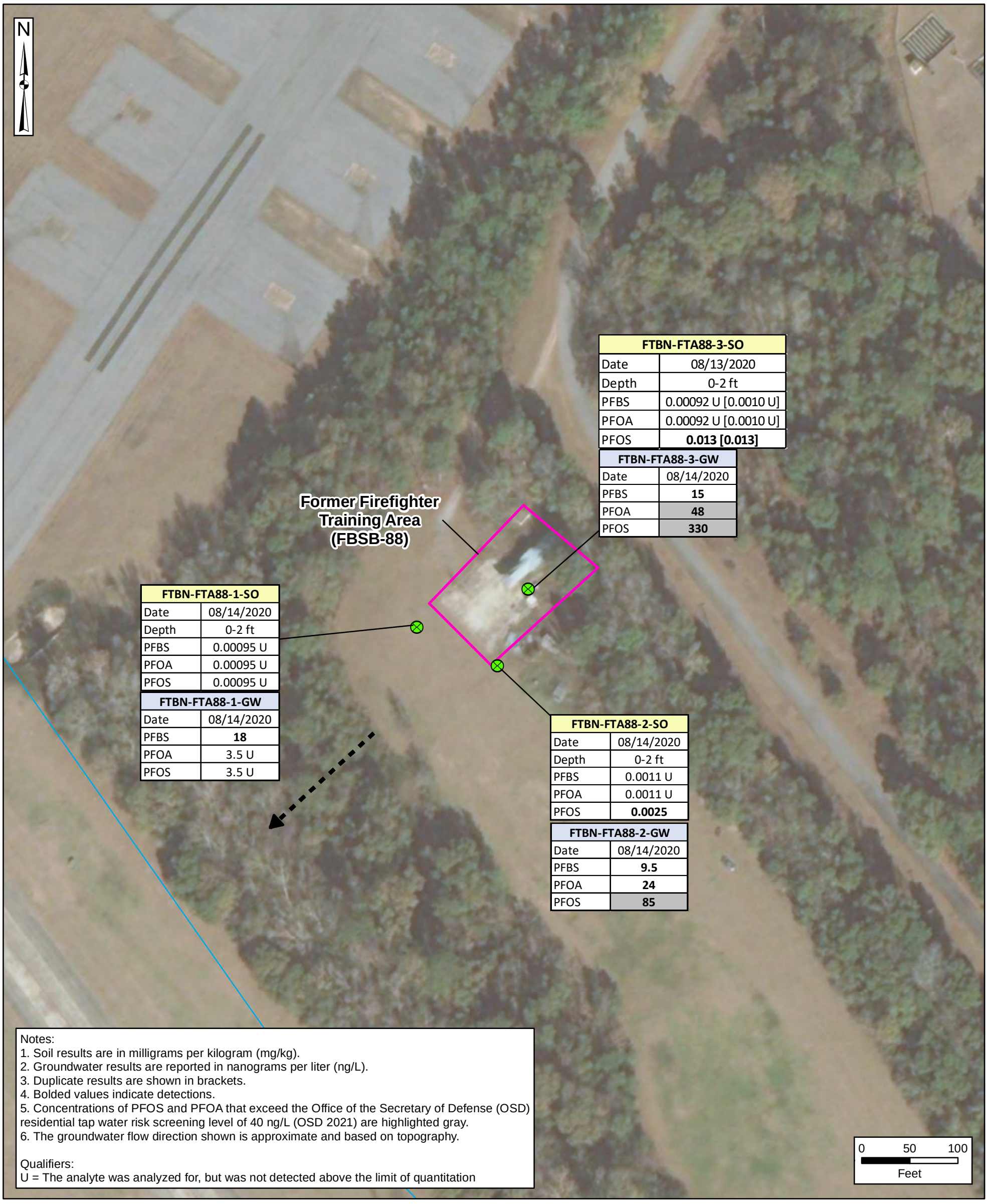
Data Sources:
Fort Benning, GIS Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-2
# AOPI Former Firefighter Training Area (FBSB-88)
# PFOS, PFOA, and PFBS Analytical Results






| FTBN-FTA88-3-SO | |
|---|---|
| Date | 08/13/2020 |
| Depth | 0-2 ft |
| PFBS | 0.00092 U [0.0010 U] |
| PFOA | 0.00092 U [0.0010 U] |
| PFOS | **0.013 [0.013]** |

| FTBN-FTA88-3-GW | |
|---|---|
| Date | 08/14/2020 |
| PFBS | **15** |
| PFOA | **48** |
| PFOS | **330** |

| FTBN-FTA88-1-SO | |
|---|---|
| Date | 08/14/2020 |
| Depth | 0-2 ft |
| PFBS | 0.00095 U |
| PFOA | 0.00095 U |
| PFOS | 0.00095 U |

| FTBN-FTA88-1-GW | |
|---|---|
| Date | 08/14/2020 |
| PFBS | **18** |
| PFOA | 3.5 U |
| PFOS | 3.5 U |

| FTBN-FTA88-2-SO | |
|---|---|
| Date | 08/14/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0011 U |
| PFOA | 0.0011 U |
| PFOS | **0.0025** |

| FTBN-FTA88-2-GW | |
|---|---|
| Date | 08/14/2020 |
| PFBS | **9.5** |
| PFOA | **24** |
| PFOS | **85** |

Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Duplicate 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. The groundwater flow direction shown is approximate and based on topography.

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

Installation Boundary
Area of Potential Interest (AOPI)
River/Stream (Perennial)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil and Groundwater Sampling Location

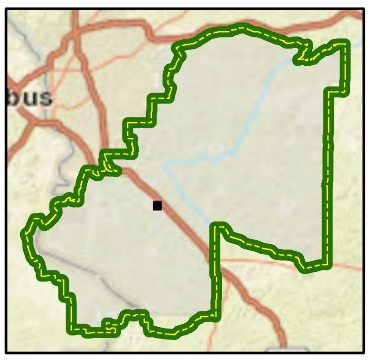
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

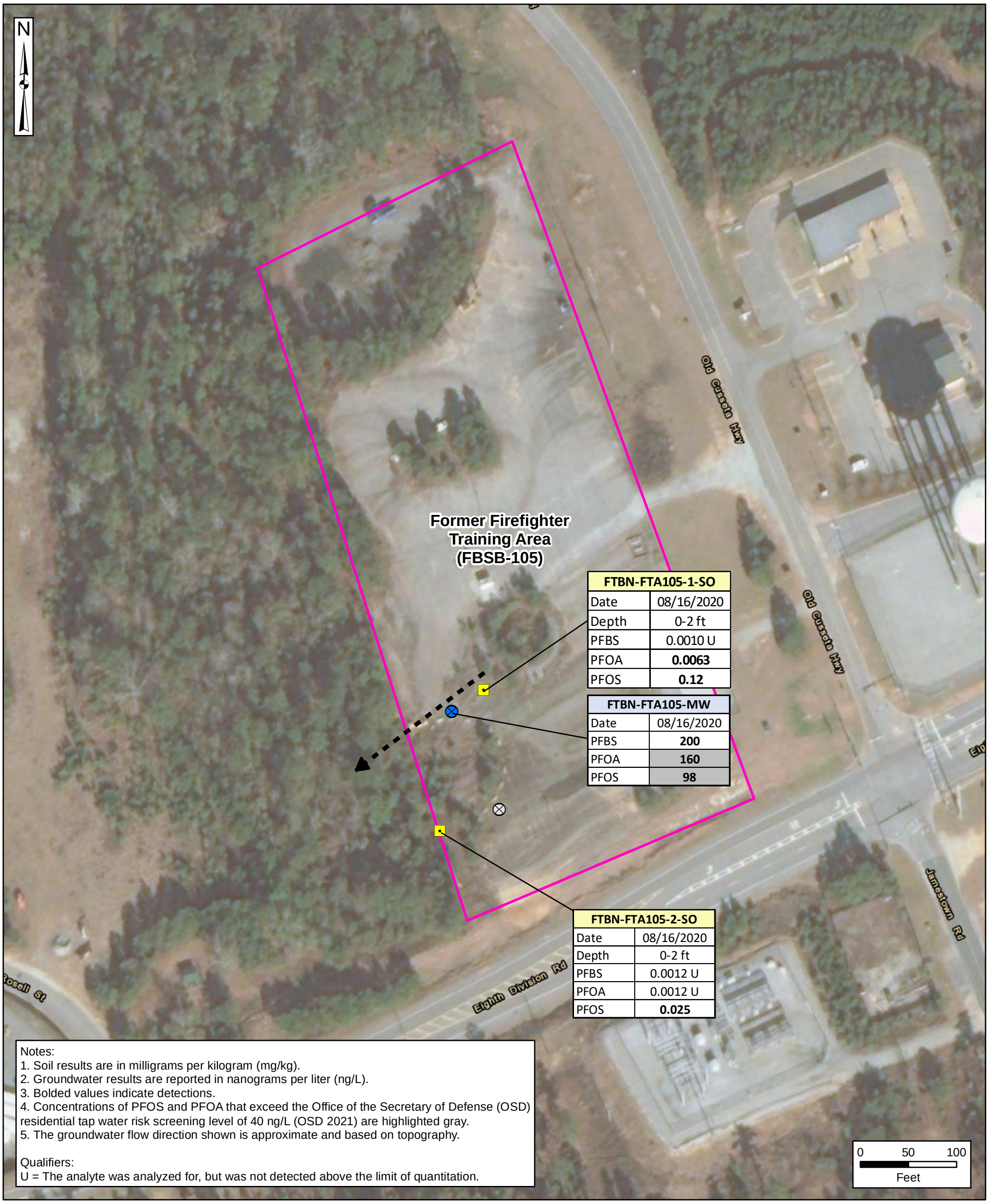
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-3
# AOPI Former Firefighter Training Area (FBSB-105)
# PFOS, PFOA, and PFBS Analytical Results






Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Bolded values indicate detections.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.
5. The groundwater flow direction shown is approximate and based on topography.

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

Installation Boundary
Area of Potential Interest (AOPI)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil Sampling Location
Groundwater Sampling Location
Attempted Groundwater Sampling Location; dry - no sample collected

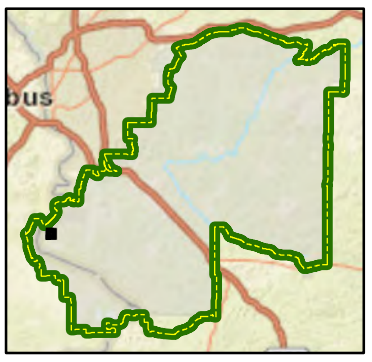
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

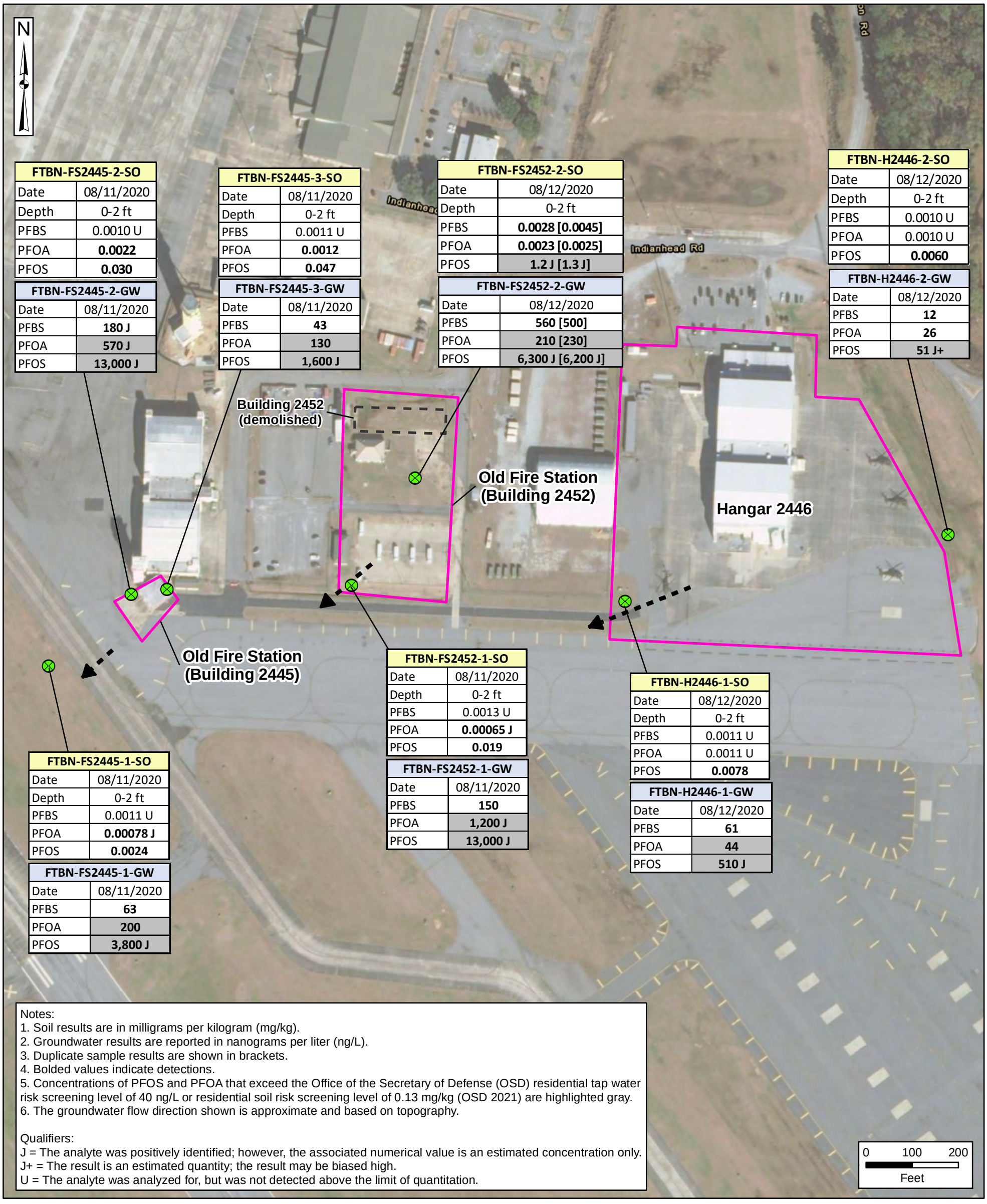
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

**Figure 7-4**
**Old Fire Station (Building 2452), Old Fire Station (Building 2445), and Hangar 2446 AOPI**
**PFOS, PFOA, and PFBS Analytical Results**






| FTBN-FS2445-2-SO | |
|---|---|
| Date | 08/11/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0010 U |
| PFOA | **0.0022** |
| PFOS | **0.030** |

| FTBN-FS2445-2-GW | |
|---|---|
| Date | 08/11/2020 |
| PFBS | **180 J** |
| PFOA | **570 J** |
| PFOS | **13,000 J** |

| FTBN-FS2445-3-SO | |
|---|---|
| Date | 08/11/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0011 U |
| PFOA | **0.0012** |
| PFOS | **0.047** |

| FTBN-FS2445-3-GW | |
|---|---|
| Date | 08/11/2020 |
| PFBS | **43** |
| PFOA | **130** |
| PFOS | **1,600 J** |

| FTBN-FS2452-2-SO | |
|---|---|
| Date | 08/12/2020 |
| Depth | 0-2 ft |
| PFBS | **0.0028 [0.0045]** |
| PFOA | **0.0023 [0.0025]** |
| PFOS | **1.2 J [1.3 J]** |

| FTBN-FS2452-2-GW | |
|---|---|
| Date | 08/12/2020 |
| PFBS | **560 [500]** |
| PFOA | **210 [230]** |
| PFOS | **6,300 J [6,200 J]** |

| FTBN-H2446-2-SO | |
|---|---|
| Date | 08/12/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0010 U |
| PFOA | 0.0010 U |
| PFOS | **0.0060** |

| FTBN-H2446-2-GW | |
|---|---|
| Date | 08/12/2020 |
| PFBS | **12** |
| PFOA | **26** |
| PFOS | **51 J+** |

| FTBN-FS2445-1-SO | |
|---|---|
| Date | 08/11/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0011 U |
| PFOA | **0.00078 J** |
| PFOS | **0.0024** |

| FTBN-FS2445-1-GW | |
|---|---|
| Date | 08/11/2020 |
| PFBS | **63** |
| PFOA | **200** |
| PFOS | **3,800 J** |

| FTBN-FS2452-1-SO | |
|---|---|
| Date | 08/11/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0013 U |
| PFOA | **0.00065 J** |
| PFOS | **0.019** |

| FTBN-FS2452-1-GW | |
|---|---|
| Date | 08/11/2020 |
| PFBS | **150** |
| PFOA | **1,200 J** |
| PFOS | **13,000 J** |

| FTBN-H2446-1-SO | |
|---|---|
| Date | 08/12/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0011 U |
| PFOA | 0.0011 U |
| PFOS | **0.0078** |

| FTBN-H2446-1-GW | |
|---|---|
| Date | 08/12/2020 |
| PFBS | **61** |
| PFOA | **44** |
| PFOS | **510 J** |

Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
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. The groundwater flow direction shown is approximate and based on topography.

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

Installation Boundary
Area of Potential Interest (AOPI)
Former Building Footporint
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil and Groundwater Sampling Location

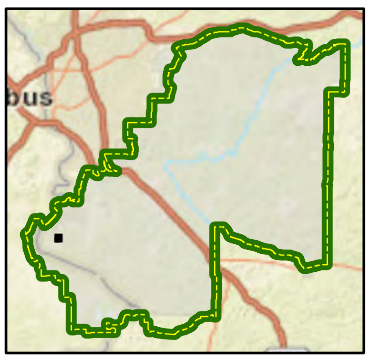
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

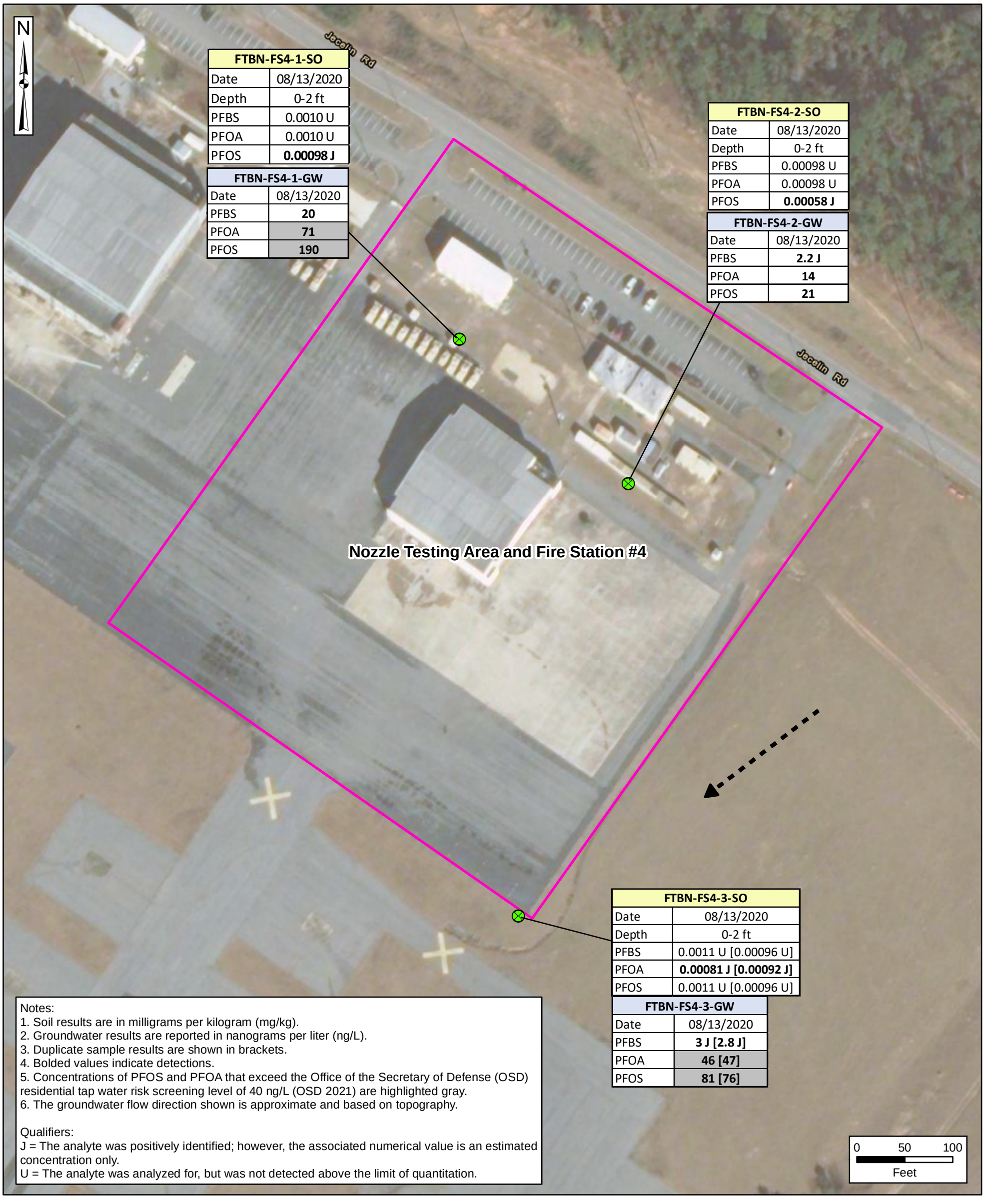
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-5
# AOPI Nozzle Testing Area and Fire Station #4
# PFOS, PFOA, and PFBS Analytical Results






| FTBN-FS4-1-SO | |
|---|---|
| Date | 08/13/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0010 U |
| PFOA | 0.0010 U |
| PFOS | **0.00098 J** |

| FTBN-FS4-1-GW | |
|---|---|
| Date | 08/13/2020 |
| PFBS | **20** |
| PFOA | **71** |
| PFOS | **190** |

| FTBN-FS4-2-SO | |
|---|---|
| Date | 08/13/2020 |
| Depth | 0-2 ft |
| PFBS | 0.00098 U |
| PFOA | 0.00098 U |
| PFOS | **0.00058 J** |

| FTBN-FS4-2-GW | |
|---|---|
| Date | 08/13/2020 |
| PFBS | **2.2 J** |
| PFOA | **14** |
| PFOS | **21** |

| FTBN-FS4-3-SO | |
|---|---|
| Date | 08/13/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0011 U [0.00096 U] |
| PFOA | **0.00081 J [0.00092 J]** |
| PFOS | 0.0011 U [0.00096 U] |

| FTBN-FS4-3-GW | |
|---|---|
| Date | 08/13/2020 |
| PFBS | **3 J [2.8 J]** |
| PFOA | **46 [47]** |
| PFOS | **81 [76]** |

Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
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. The groundwater flow direction shown is approximate and based on topography.

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.

Installation Boundary
Area of Potential Interest (AOPI)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil and Groundwater Sampling Location

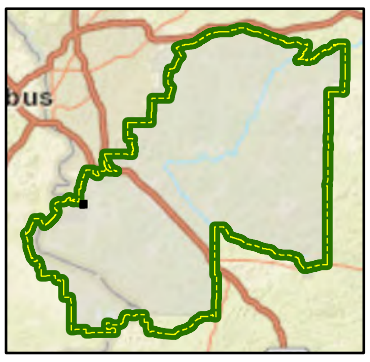
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

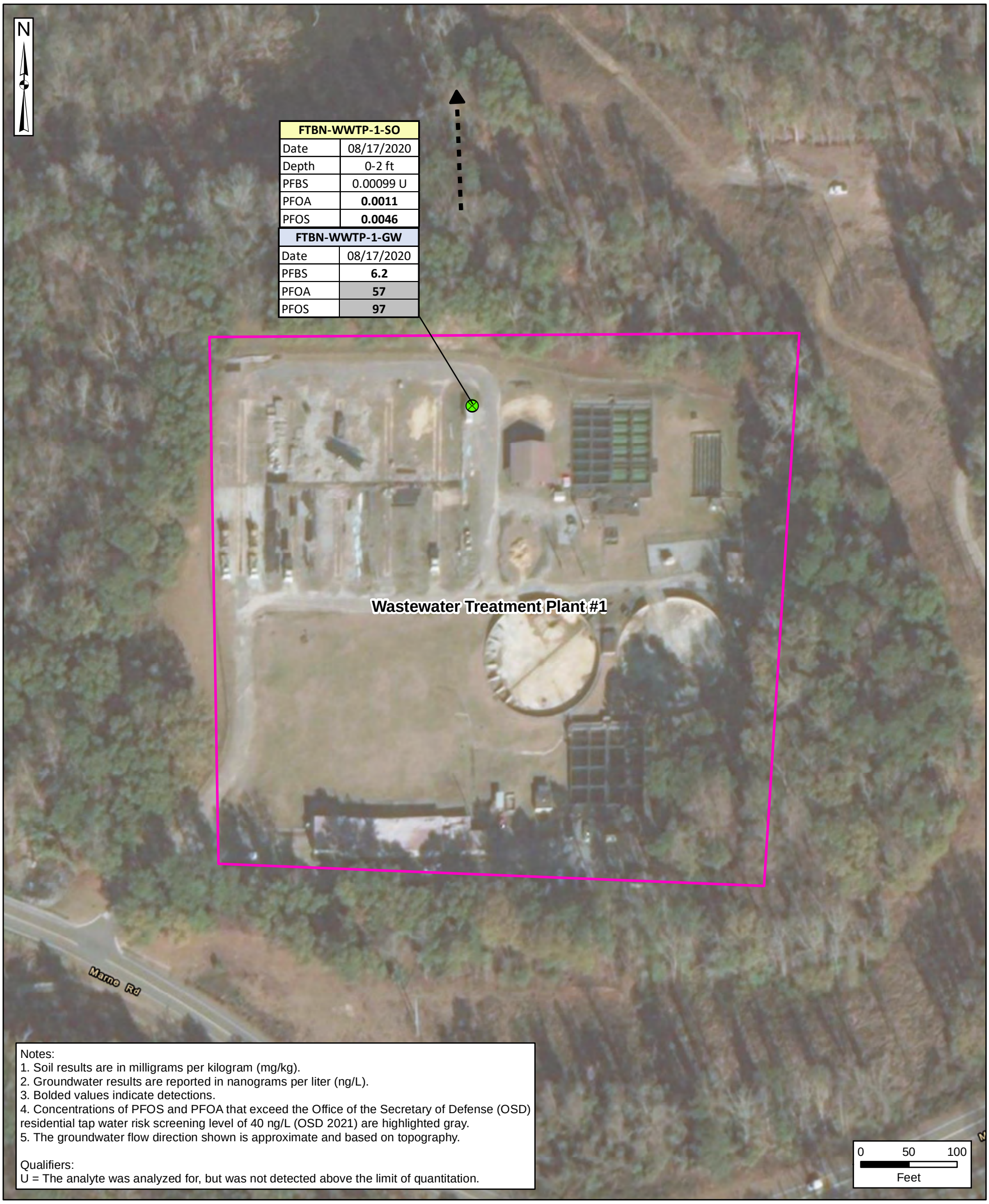
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-6
# AOPI Wastewater Treatment Plant #1
# PFOS, PFOA, and PFBS Analytical Results






Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Bolded values indicate detections.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.
5. The groundwater flow direction shown is approximate and based on topography.

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

Installation Boundary
Area of Potential Interest (AOPI)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil and Groundwater Sampling Location

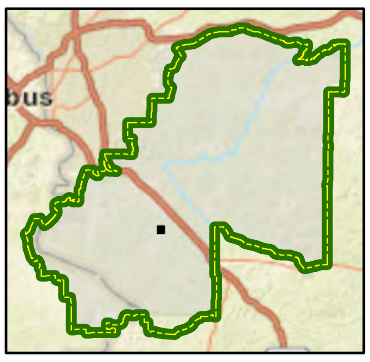
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

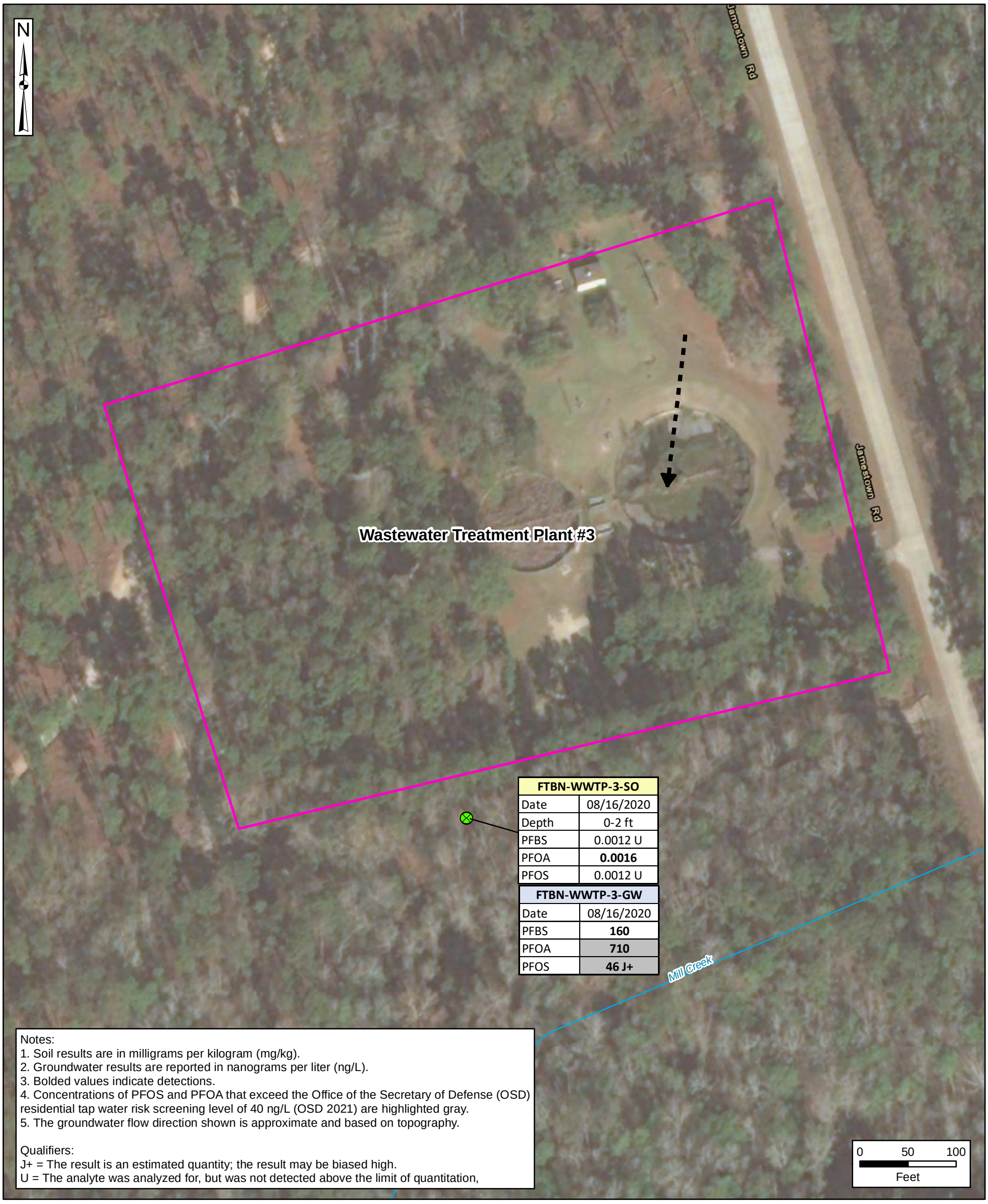
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-7
# AOPI Wastewater Treatment Plant #3
# PFOS, PFOA, and PFBS Analytical Results






| FTBN-WWTP-3-SO | |
|---|---|
| Date | 08/16/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0012 U |
| PFOA | **0.0016** |
| PFOS | 0.0012 U |

| FTBN-WWTP-3-GW | |
|---|---|
| Date | 08/16/2020 |
| PFBS | **160** |
| PFOA | **710** |
| PFOS | **46 J+** |

Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Bolded values indicate detections.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.
5. The groundwater flow direction shown is approximate and based on topography.

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,

Installation Boundary
Area of Potential Interest (AOPI)
River/Stream (Perennial)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil and Groundwater Sampling Location

PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

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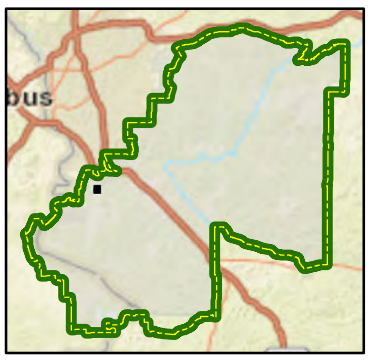
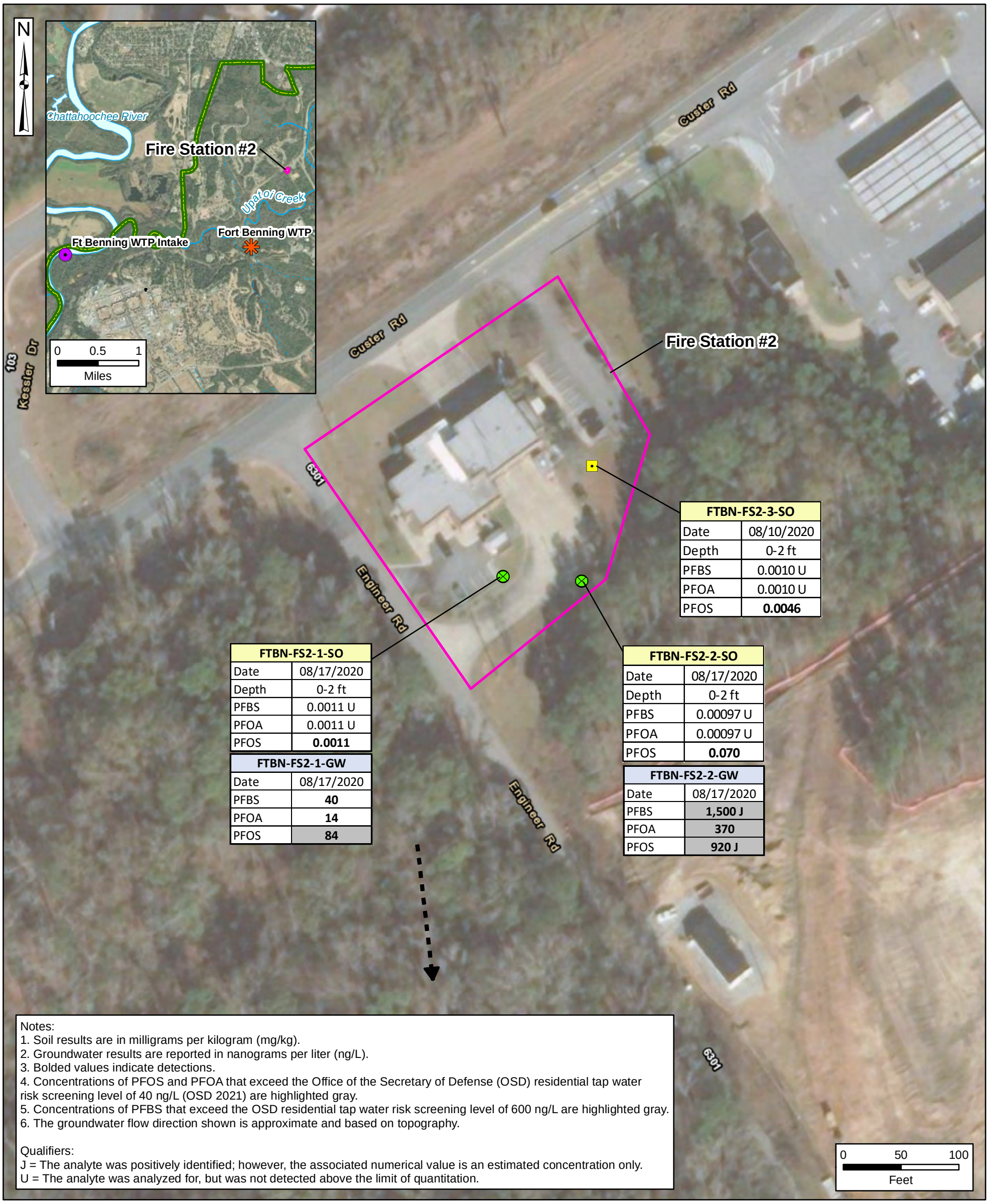
Fort Benning, GA

# Figure 7-8
# AOPI Fire Station #2
# PFOS, PFOA, and PFBS Analytical Results






| FTBN-FS2-3-SO | |
|---|---|
| Date | 08/10/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0010 U |
| PFOA | 0.0010 U |
| PFOS | **0.0046** |

| FTBN-FS2-1-SO | |
|---|---|
| Date | 08/17/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0011 U |
| PFOA | 0.0011 U |
| PFOS | **0.0011** |

| FTBN-FS2-1-GW | |
|---|---|
| Date | 08/17/2020 |
| PFBS | **40** |
| PFOA | **14** |
| PFOS | **84** |

| FTBN-FS2-2-SO | |
|---|---|
| Date | 08/17/2020 |
| Depth | 0-2 ft |
| PFBS | 0.00097 U |
| PFOA | 0.00097 U |
| PFOS | **0.070** |

| FTBN-FS2-2-GW | |
|---|---|
| Date | 08/17/2020 |
| PFBS | **1,500 J** |
| PFOA | **370** |
| PFOS | **920 J** |

Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Bolded values indicate detections.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.
5. Concentrations of PFBS that exceed the OSD residential tap water risk screening level of 600 ng/L are highlighted gray.
6. The groundwater flow direction shown is approximate and based on topography.

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.

- Installation Boundary
- Area of Potential Interest (AOPI)
- Inferred Groundwater Flow Direction (Unconfined Aquifer)
- Intake
- Fort Benning WTP
- Soil Sampling Location
- Soil and Groundwater Sampling Location

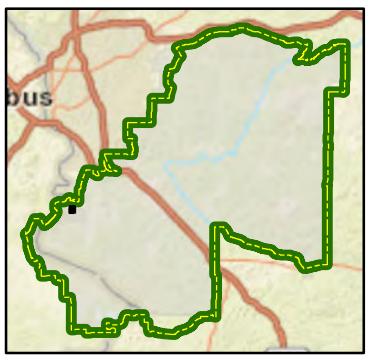
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
WTP = Water Treatment Plant

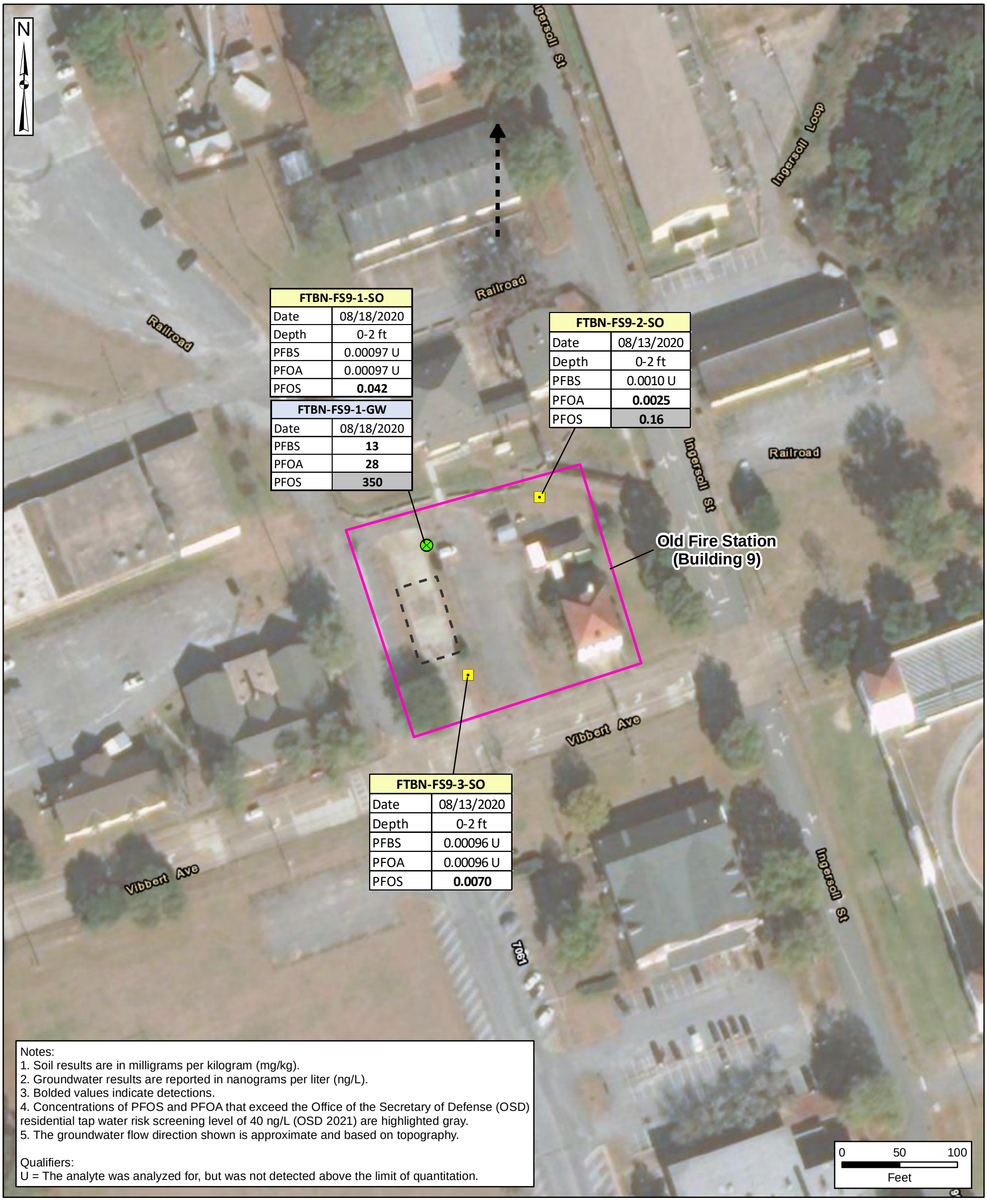
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-9
# AOPI Old Fire Station (Building 9)
# PFOS, PFOA, and PFBS Analytical Results






Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Bolded values indicate detections.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.
5. The groundwater flow direction shown is approximate and based on topography.

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

- Installation Boundary
- Area of Potential Interest (AOPI)
- Former Building Footprint
- Inferred Groundwater Flow Direction (Unconfined Aquifer)
- Soil Sampling Location
- Soil and Groundwater Sampling Location

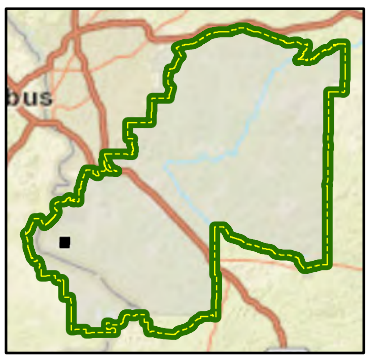
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

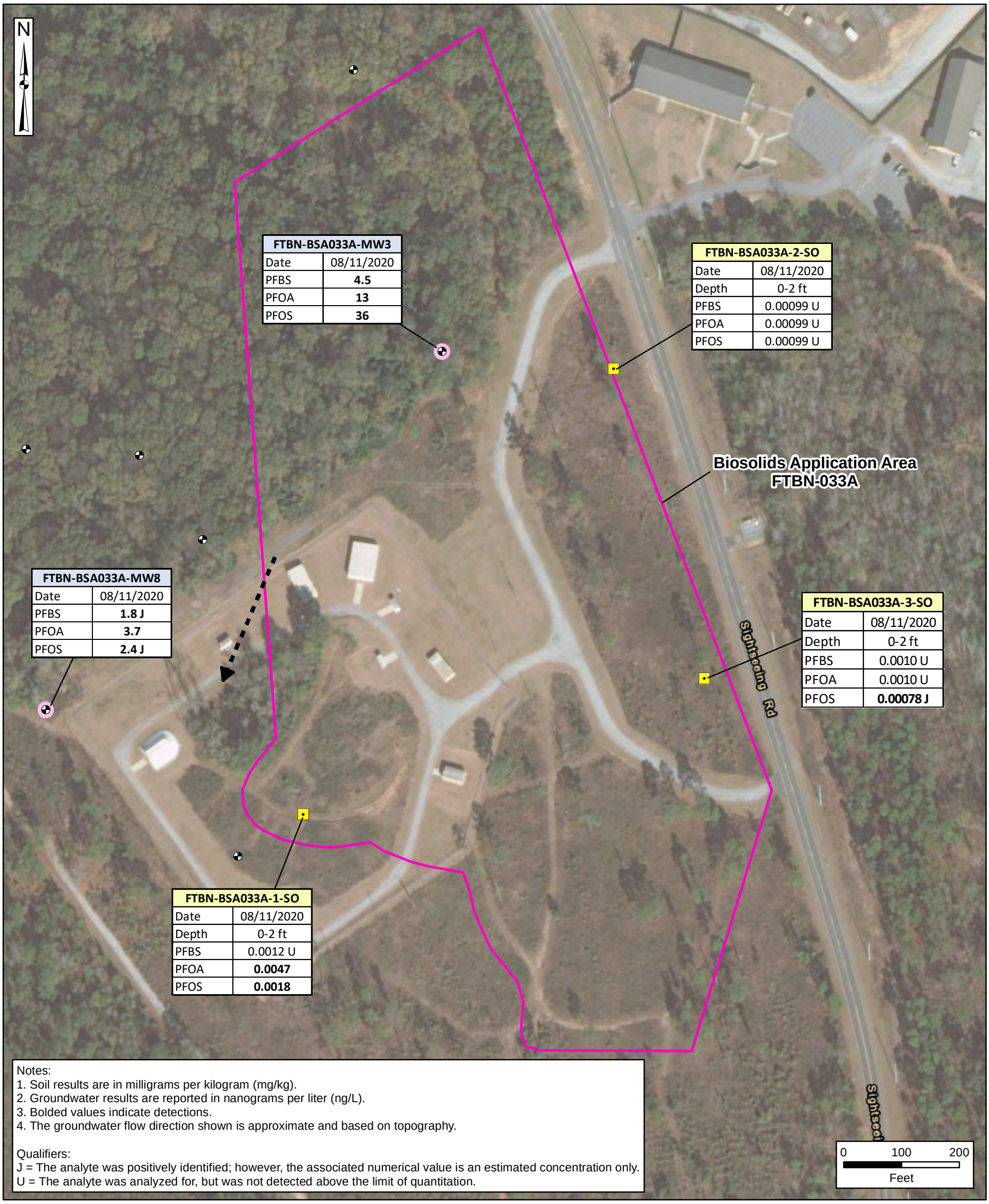
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-10
# AOPI Biosolids Application Area FTBN-033A
# PFOS, PFOA, and PFBS Analytical Results






Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Bolded values indicate detections.
4. The groundwater flow direction shown is approximate and based on topography.

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.

Installation Boundary
Area of Potential Interest (AOPI)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Monitoring Well
Soil Sampling Location
Groundwater Sampling Location (Well)

PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

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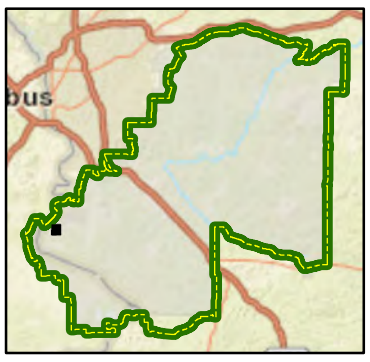
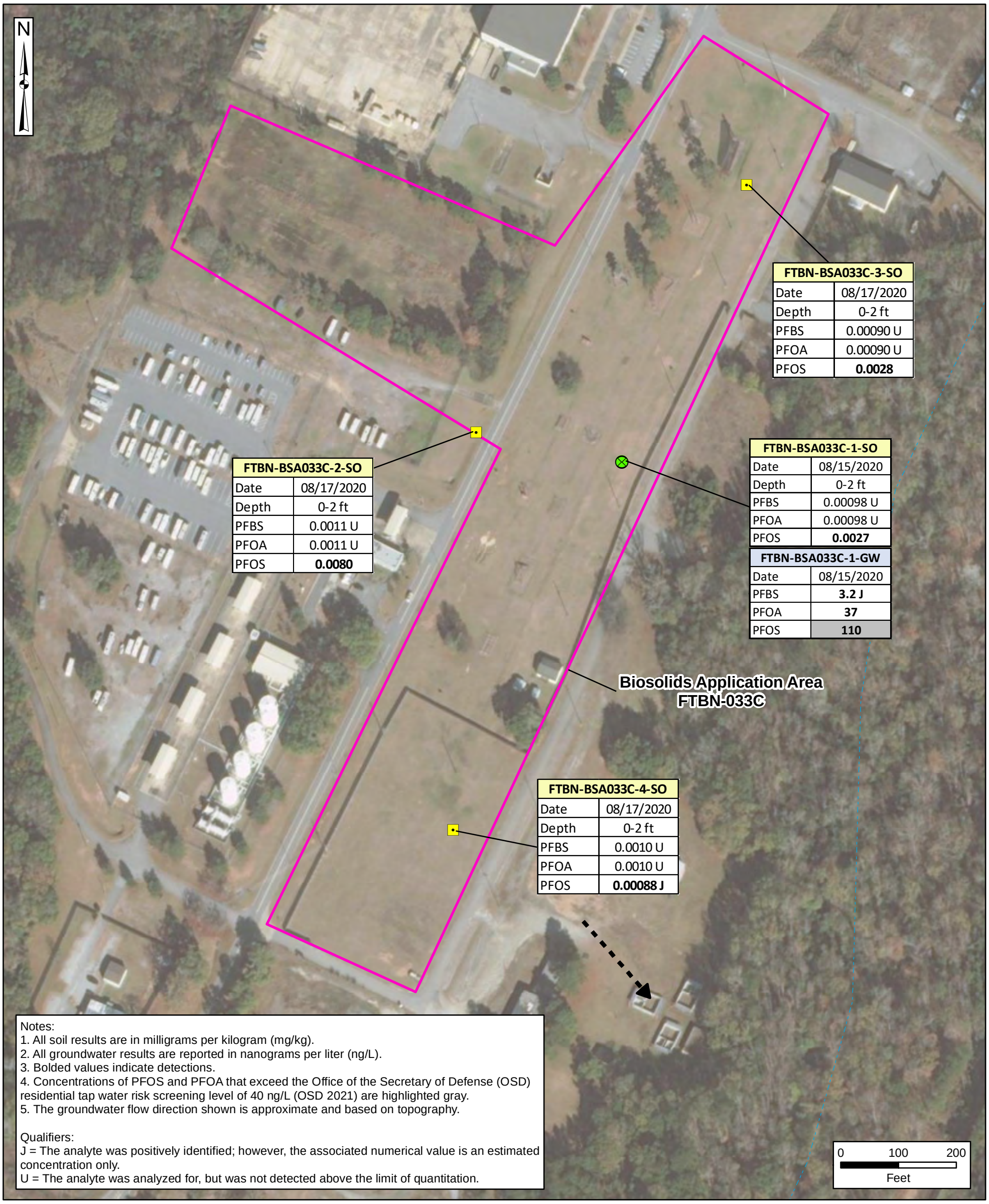
Fort Benning, GA

# Figure 7-11
# AOPI Biosolids Application Area FTBN-033C
# PFOS, PFOA, and PFBS Analytical Results






Notes:
1. All soil results are in milligrams per kilogram (mg/kg).
2. All groundwater results are reported in nanograms per liter (ng/L).
3. Bolded values indicate detections.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.
5. The groundwater flow direction shown is approximate and based on topography.

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.

Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil Sampling Location
Soil and Groundwater Sampling Location

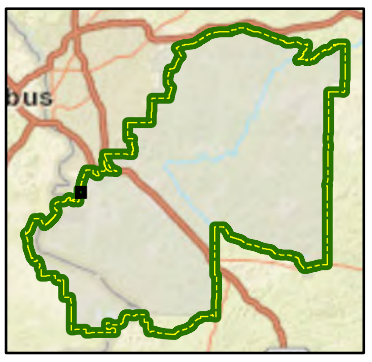
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

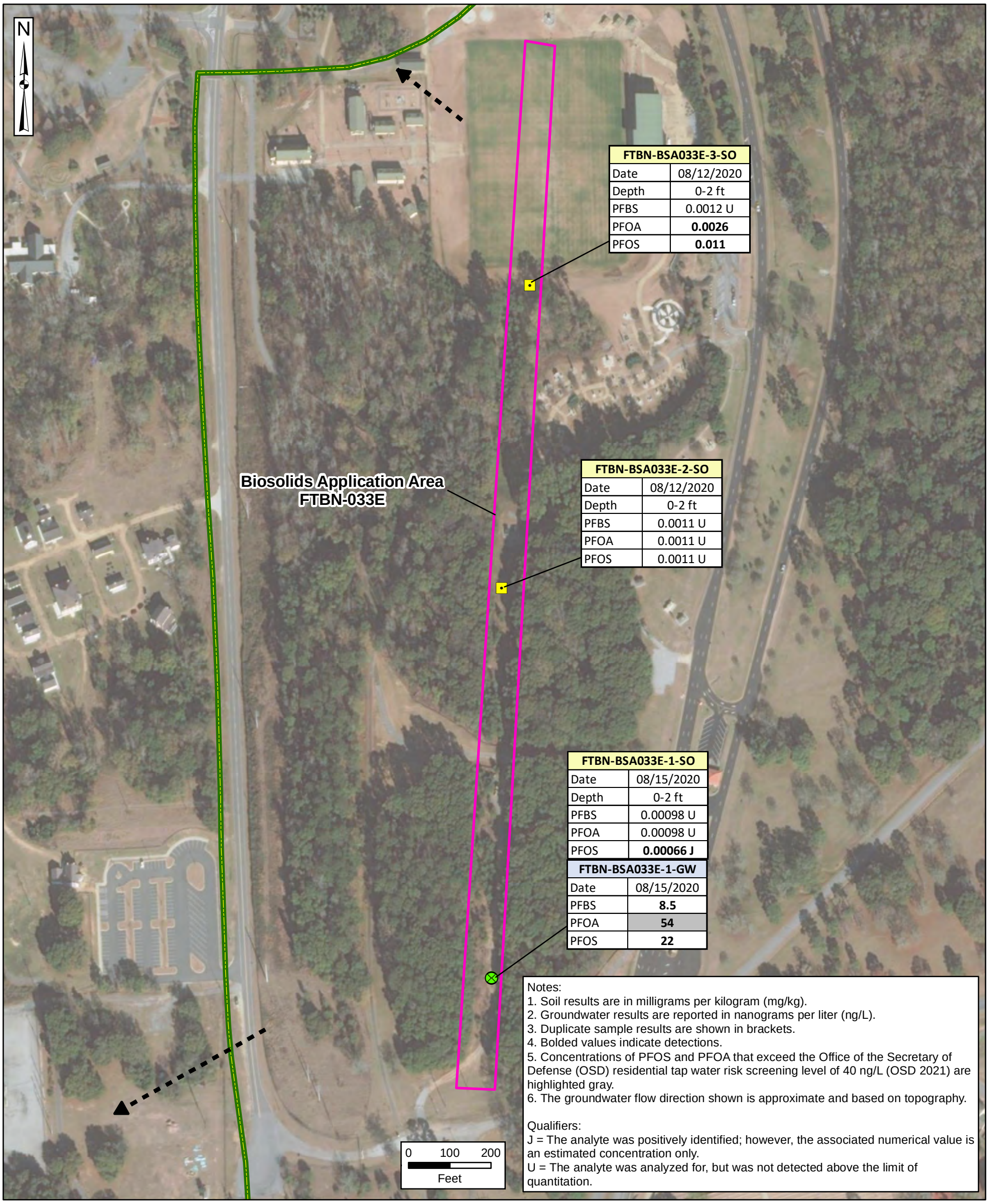
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-12
# AOPI Biosolids Application Area FTBN-033E
# PFOS, PFOA, and PFBS Analytical Results






Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
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. The groundwater flow direction shown is approximate and based on topography.

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.

- Installation Boundary
- Area of Potential Interest (AOPI)
- Inferred Groundwater Flow Direction (Unconfined Aquifer)
- Soil Sampling Location
- Soil and Groundwater Sampling Location

PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

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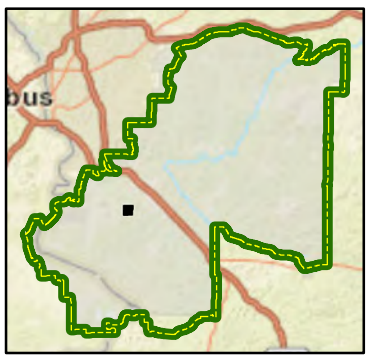
Fort Benning, GA

# Figure 7-13
# AOPI Biosolids Application Area FTBN-033K
# PFOS, PFOA, and PFBS Analytical Results



| FTBN-BSA033K-1-SO | |
|---|---|
| Date | 08/18/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0011 U |
| PFOA | **0.0048** |
| PFOS | **0.0056** |

| FTBN-BSA033K-2-SO | |
|---|---|
| Date | 08/18/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0011 U |
| PFOA | 0.0011 U |
| PFOS | 0.0011 U |

| FTBN-BSA033K-3-SO | |
|---|---|
| Date | 08/18/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0012 U |
| PFOA | **0.00077 J** |
| PFOS | **0.0017** |

Biosolids Application Area
FTBN-033K

Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on topography.

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.

0 100 200
Feet

Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil Sampling Location *

* A groundwater sample co-located with FTBN-033K-1-SO was planned but was not collected because groundwater not encountered.

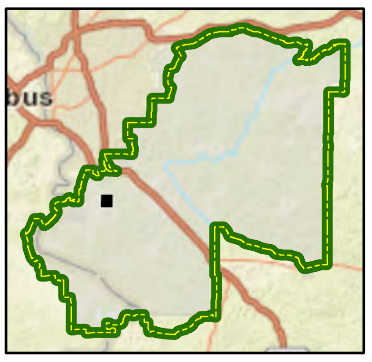
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

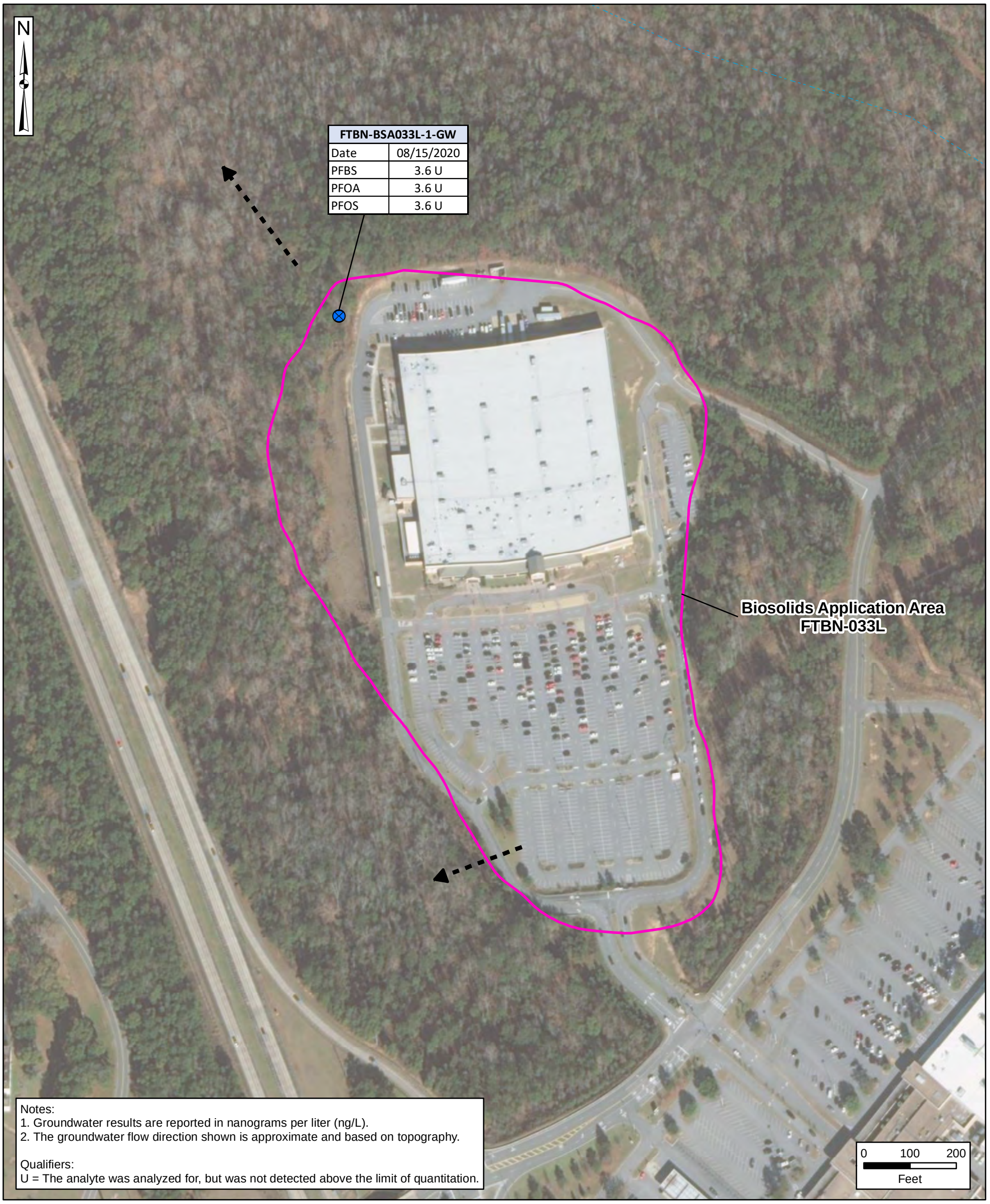
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-14
# AOPI Biosolids Application Area FTBN-033L
# PFOS, PFOA, and PFBS Analytical Results






Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Groundwater Sampling Location

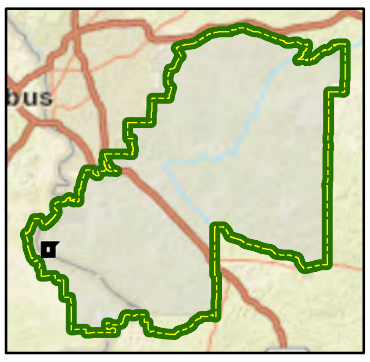
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-15
# AOPI Biosolids Application Area FTBN-033M
# PFOS, PFOA, and PFBS Analytical Results



| FTBN-BSA033M-1-SO | |
|---|---|
| Date | 08/10/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0012 U |
| PFOA | 0.0012 U |
| PFOS | 0.0012 U |

| FTBN-BSA033M-1-GW | |
|---|---|
| Date | 08/11/2020 |
| PFBS | 3.4 U |
| PFOA | 3.4 U |
| PFOS | 3.4 U |

| FTBN-BSA033M-2-SO | |
|---|---|
| Date | 08/10/2020 |
| Depth | 0-2 ft |
| PFBS | 0.00095 U |
| PFOA | 0.00095 U |
| PFOS | 0.00095 U |

| FTBN-BSA033M-3-SO | |
|---|---|
| Date | 08/10/2020 |
| Depth | 0-2 ft |
| PFBS | 0.0010 U |
| PFOA | 0.0010 U |
| PFOS | 0.0010 U |

Biosolids Application Area
FTBN-033M

Chattahoochee River

Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. The groundwater flow direction shown is approximate and based on topography.

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

0 200 400
Feet

Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil Sampling Location
Soil and Groundwater Sampling Location

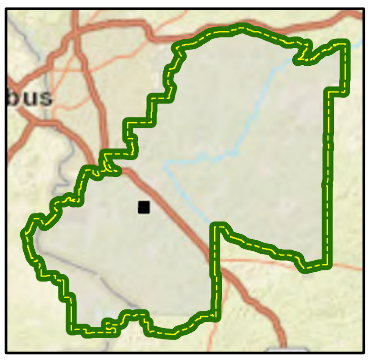
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

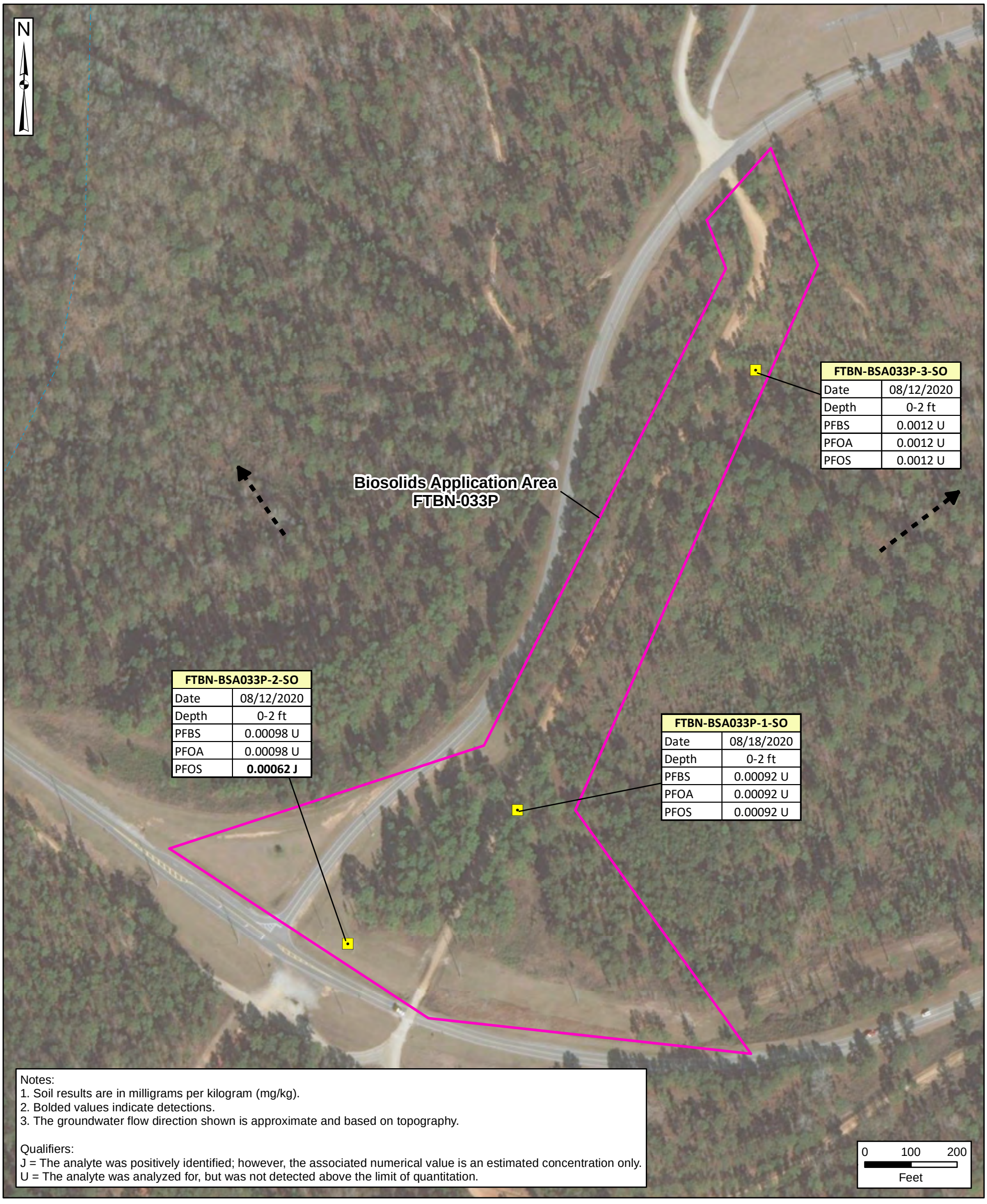
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Benning, GA

# Figure 7-16
# AOPI Biosolids Application Area FTBN-033P
# PFOS, PFOA, and PFBS Analytical Results






Notes:
1. Soil results are in milligrams per kilogram (mg/kg).
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on topography.

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.

Installation Boundary
Area of Potential Interest (AOPI)
Stream (Intermittent)
Inferred Groundwater Flow Direction (Unconfined Aquifer)
Soil Sampling Location *

* A groundwater sample co-located with FTBN-033P-1-SO was planned but was not collected because groundwater not encountered.

PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North