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

Former Jefferson Proving Ground, Indiana

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

August 2023

PRELIMINARY ASSESSMENT/SITE INSPECTION OF PFAS AT FORMER JEFFERSON PROVING GROUND, INDIANA

Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

Former Jefferson Proving Ground, Indiana

Prepared for:

U.S. Army Corps of Engineers

Contract No.: W912DR-18-D-0004

Delivery Order No.: W912DR1818F0685

Prepared by:

Arcadis U.S., Inc.

7550 Teague Road

Suite 210

Hanover

Maryland 21076

Arcadis Ref.:

30001997

Date:

August 2023

Kevin Toth
Site Inspection Project Manager, Arcadis U.S., Inc.

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

Johnsie Lang
Technical Expert, Arcadis U.S., Inc.

CONTENTS

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

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), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) at Army installations nationwide. The PA identifies areas of potential interest (AOPIs) where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred. The SI includes multi-media sampling at AOPIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. This former Jefferson Proving Ground (JPG) PA/SI was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), National Oil and Hazardous Substances Pollution Contingency Plan, and Army/Department of Defense (DoD) policy and guidance.

Former JPG occupies approximately 55,265 acres of land along U.S. Highway 421 north of Madison, Indiana. 51,000 acres of the installation have limited public recreational use due to the potential for coming in contact with unexploded ordnance. The majority of the remaining property is leased, and a small portion contains approximately 30 to 35 residents.

The former JPG PA identified four AOPIs for investigation during the SI phase. SI sampling results from the four AOPIs were compared to risk-based screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, PFBS, PFNA, and PFHxS. Of the six PFAS compounds presented in the 06 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at former JPG because HFPO-DA is generally not a component of military specification aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS. PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil and/or groundwater at all four AOPIs; three of the four AOPIs had PFOS, PFOA, PFBS, PFNA, and/or PFHxS present at concentrations greater than the risk-based screening levels. The former JPG PA/SI identified the need for further study in a CERCLA remedial investigation. **Table ES-1** below summarizes the PA/SI sampling results and provides recommendations for further study in a remedial investigation or no action at this time at each AOPI.

Table ES-1. Summary of AOPIs Identified during the PA, PFOS, PFOA, PFBS, PFNA, and PFHxS Sampling at Former JPG, and Recommendations

AOPI Name	PFOS, PFOA, PFBS, PFNA, and/or PFHxS detected greater than OSD Risk Screening Levels? (Yes/No/ND)		Recommendation
	GW	SO	
Old Fire Training Pit	ND	No	No action at this time
Building 125 - Former Fire Station and Training Area	Yes	Yes	Further study in a remedial investigation
Building 127 - Former Fire Station	Yes	No	Further study in a remedial investigation
Building 186 Roof Fire	Yes	No	Further study in a remedial investigation

Notes:

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

GW – groundwater

ND – non-detect; PFOS, PFOA, PFBS, PFNA, and/or PFHxS were not detected at the limit of detection (LOD)

No – PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected at concentrations above the LOD and less than the OSD Risk Screening Levels

SO – soil

Yes – PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected at concentrations greater than the 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), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) at Army installations (installations) nationwide. The Army is the lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Executive Order 12580 and is conducting the PA/SI consistent with its authority under CERCLA, 42 United States Code §§ 9600, et seq. (as amended), and the Defense Environmental Restoration Program, 10 United States Code §§ 2701, et seq. The PFAS PA/SI included two distinct efforts. The PA identified locations that are areas of potential interest (AOPIs) at former Jefferson Proving Ground (JPG) 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 analytical results were compared to the Office of the Secretary of Defense (OSD) PFOS, PFOA, PFBS, PFNA, and PFHxS risk screening levels to determine whether further investigation is warranted. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI; therefore, there are no HFPO-DA SI analytical results to screen against the OSD risk screening levels. This report provides the PA/SI for former JPG and was completed in accordance with CERCLA and The National Oil and Hazardous Substances Pollution Contingency Plan.

1.1 Project Background

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

In 2016, the United States Environmental Protection Agency (USEPA) established a lifetime health advisory of 70 nanograms per liter (ng/L) in drinking water for PFOS or PFOA and for the sum of PFOS and PFOA when both are present (USEPA 2016). On 15 October 2019, the OSD provided guidance on the investigation of PFOS, PFOA, and PFBS at Department of Defense (DoD) restoration sites (OSD 2019). The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in tap water and soil, calculated using the USEPA's Regional Screening Level (RSL) calculator for residential and industrial/commercial worker receptor scenarios. Following the issuance of the 2019 OSD memo, on 08 April 2021, USEPA published an updated toxicity assessment for PFBS (USEPA 2021). Based on the updated toxicity assessment for PFBS, the OSD issued a memorandum on 15 September 2021 to include updated PFBS risk screening levels (OSD 2021). On 18 May 2022, the USEPA published an update to the RSLs table. The May 2022 RSL table included six PFAS constituents: PFOS, PFOA, PFBS, PFNA, PFHxS, and HFPO-DA (USEPA 2022). On 06 July 2022, the OSD issued a memorandum to include revised risk screening levels based on the May 2022 USEPA RSLs (OSD 2022). The July 2022 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program is provided for reference as **Appendix A**. 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 collected readily available information and conducted site reconnaissance. This PA evaluated and documented 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 former JPG, PA/SI development followed the process as described below. **Section 3** provides a summary of the PA activities completed, and **Section 6** provides a summary of the SI activities completed for former JPG. The PA and SI processes are documented in the PA/SI Quality Control Checklist included as **Appendix B**.

1.3.1 Pre-Site Visit

First, an installation kickoff teleconference was held between applicable points of contact (POCs) from United States Army Environmental Command (USAEC), United States Army Corps of Engineers (USACE), former JPG, and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred on 29 November 2022, 5 weeks before the site visit to discuss the goals and scope of the PA, project scheduling, installation access, timeline for the site visit, access to installation-specific databases, and to request available records.

Records review was conducted before the site visit to obtain electronically available documents from the installation and external sources for review. The purpose of the records research was to identify any area on the installation that may have been a location where PFAS-containing materials were used, stored, and/or disposed, as well as to gather information on the physical setting and site history at former JPG.

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

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

1.3.2 Preliminary Assessment Site Visit

The site visit was conducted on 04 to 05 January 2023. 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 former JPG. 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 installation declined an exit briefing.

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, PFBS, PFNA, and PFHxS presence or absence at each AOPI and determine whether further investigation is warranted. First, an SI kickoff and scoping teleconference was held between the Army PA team and the former JPG.

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

- discuss the AOPIs selected for sampling and the proposed sampling plan for each AOPI
- gauge regulatory involvement requirements or preferences
- identify overlapping unexploded ordnance (UXO) or cultural resource areas
- confirm the plan for investigation derived waste (IDW) handling and disposal
- identify specific installation access requirements and potential schedule conflicts
- discuss general SI deliverable and field work schedule information and logistics

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

The DQOs, sampling design and rationale, and field methods employed for the SI are summarized from the QAPP Addendum developed for former JPG (Arcadis 2023) 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, PFBS, PFNA, and PFHxS analysis by liquid chromatography with tandem mass spectrometry and compliant with the DoD Quality Systems Manual (QSM) 5.4 (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 former JPG, 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

Former JPG occupies approximately 55,265 acres of land along U.S. Highway 421 north of Madison, Indiana (**Figures 2-1 and 2-2**). The facility is located in portions of Ripley, Jennings, and Jefferson Counties. The installation is approximately 18 miles long (north to south) and varies from 3 to 6 miles wide (east to west). A major portion of former JPG is wooded, and the remainder is open grassland or recently cultivated farmland. Industrial buildings, workshops, administrative buildings, and personnel housing are located in the southern portion of the facility. The vast majority of the former JPG is bounded by farmland and cemeteries. A line of 268 gun positions ran east to west across the southern portion. Weapons were fired at targets located to the north of these gun positions. The immediate area of the gun positions is referred to as the Firing Line (**Figure 2-2**). In addition to the gun positions, the facility consisted of 50 impact areas, 13 permanent test complexes, and seven ammunition assembly plants (Montgomery Watson Harza [MWH] 2002). In an interview with one of the site contacts, it was reported there are approximately 30 to 35 residents at the former installation.

2.2 Mission and Brief Site History

Former JPG was used as a proving ground from 1941 through 1995. A wide assortment of conventional munitions and weapons were tested at the facility. These include propellants, projectiles, cartridges, mortars, grenades, fuzes, primers, boosters, rockets, tank ammunition, mines, and weapon components. The mission of former JPG was primarily to plan and conduct production acceptance tests, reconditioning tests, surveillance tests, and other studies of ammunition and weapons systems (MWH 2002).

The Defense Secretary's Commission on Base Realignment and Closure (BRAC) recommended former JPG among other bases for closure and/or realignment in December 1988. The Congress mandated former JPG be closed and its mission be realigned with Yuma Proving Ground in April 1989. As a result, USACE was given the responsibility for managing and conducting environmental investigations at former JPG in association with the BRAC Program. Under the BRAC program, the testing mission was realigned to Yuma Proving Ground and operational closure occurred on 30 September 1994. Final closure of former JPG occurred on 30 September 1995. Since that time a caretaker has assumed the day-to-day maintenance and compliance duties for those portions of former JPG that have not been turned over to another organization for reuse. Munitions testing by the U.S. Army at former JPG ceased by 30 September 1994 (MWH 2002).

2.3 Current and Projected Land Use

Since final closure of the facility in the fall of 1995, a local farmer has leased the area south of the firing line and is currently farming approximately 800 acres of the area. No information is available on the current farming activities. The farmer, in turn, has subleased a number of the buildings to private companies. As of 2002, about 32 private individuals under the farmer's subleases occupied the previous military housing area, which includes Buildings 1, 3, 4, 7, 8, 11, 12, 15, 16, 17, 20, 21, 23, and 33 (MWH 2002). These buildings are south-southeast of the AOPIs.

The Army coordinated cleanup actions with the Indiana Department of Natural Resources, USEPA (Region 3), and U.S. Nuclear Regulatory Commission. The primary contaminants of concern are unexploded munitions; petroleum, oil, and lubricants; asbestos; metals; volatile organic compounds; radioactive waste; and polychlorinated biphenyls. The affected media of concern is groundwater. All but one of the environmental sites requiring cleanup are in a response complete status. The last open site is north of the firing line to support regulatory compliance for the Nuclear Regulatory Commission license to hold depleted uranium. Requirements for long-term management, such as operation of groundwater treatment facilities, groundwater monitoring, and the associated 5-year review, remain on the transferred property. The final Environmental Condition of Property documents are completed and signed. USACE provided the final deed for the transfer of the last parcel to the proposed recipient in September 2017 (Headquarters, Department of the Army 2017).

In 2000, under an agreement with the U.S. Army and U.S. Air Force, the U.S. Fish and Wildlife Service (USFWS) was granted a 25-year real-estate permit for 51,024 acres north of the firing line, which became the Big Oaks National Wildlife Refuge. Public access and use of the area is limited due to the potential for coming in contact with UXO (**Figure 2-2**). The Army retains ownership of the land (the former JPG). The Air Force retains use of a bombing range. Large safety buffer areas separate the Air Force range from public use areas of the refuge. If the permit expires, the Army will retain the property in perpetuity, because cleanup of the UXO and depleted uranium in the impact area is not feasible (Headquarters, Department of the Army 2017).

2.4 Climate

The climate of southeastern Indiana is of a variable nature because of the characteristic path of the low- and high-pressure systems that routinely pass through the vicinity and the occasional influx of warm, humid air from the Gulf of Mexico. Thunderstorms, occurring as separate air-mass cells, squall lines, or widespread storm complexes with high rainfall intensities and damaging winds, are common during the spring and summer. Heavy fog, reducing prevailing visibility to 0.25 mile or less, occurs an average of 18 days a year. Such occurrences are rather evenly distributed from early spring through late summer. The prevailing direction of surface winds is southerly, and the velocity averages under 10 miles per hour (MWH 2002).

The climate at former JPG is mid-continental with frequent changes in temperature and humidity. Seasonal temperatures range from 100 (degrees Fahrenheit [°F]) or higher in the summer to 0°F or lower in the winter. The average date in the spring for the last occurrence of temperatures as low as 32°F is late April, and the first occurrence in the fall is generally in late October. Average annual temperature is 54°F During the summer, the temperatures average from the mid-70s to the mid-80s (°F). On an average, the temperature exceeds 90°F for approximately 39 days a year. Winter temperatures generally range from 22 to 35°F. The total annual precipitation is approximately 42 to 44 inches with nearly 50 percent (%) occurring during the growing season. On the average, 28 days of the year have precipitation greater than or equal to 0.5 inch. The region of former JPG is subject to tornadoes and severe thunderstorms. In 1974, tornadoes reportedly caused nine deaths and many injuries in the communities of Madison and Hanover. No damage was reported for former JPG from these storms (MWH 2002). Precipitation at former JPG is generally nonseasonal and varies from year to year. The fall months are usually the driest, and March and May are the wettest. The heaviest precipitation totals, as well as the rains of longest duration, are normally associated with low-pressure disturbances that generally move in a southwest-to-northeast direction through the Ohio Valley south of the installation. Snowfall usually occurs from November through March, though some snow has been observed in the months of October and April. As with rainfall, snow amounts vary considerably from year to year and from month to month. The average annual precipitation is 42 inches (MWH 2002).

2.5 Topography

Former JPG is located along the southern fringe of the Central Lowlands Physiographic Province in the Till Plains section, which is characterized by young till plains without pronounced morainic features. Topography of former JPG is flat to rolling, with most relief due to stream incision (**Figure 2-3**). The upland surface varies in elevation from approximately 840 feet to 930 feet above mean sea level, with a slope of less than 1 degree to the southwest. The topography of the area south of the Firing Line is generally flatter than the area north of the Firing Line because of less stream incision. Three streams and/or their tributaries drain the area south of the Firing Line: Harbert’s Creek, Hensley Creek, and Middle Fork Creek (MWH 2002).

2.6 Geology

Former JPG is located on the western flank of the Cincinnati Arch, a broad structural dome that separates the Illinois and Appalachian Basins. Most of former JPG is covered by a veneer of Pleistocene glacial deposits that overlies Silurian and Devonian bedrock. Pleistocene and Holocene drainage systems have breached and eroded the Paleozoic bedrock across the regional outcrop patterns, particularly along the Ohio River drainage (MWH 2002).

The bedrock stratigraphy is summarized as follows. The Salamonie Dolomite is comprised of the Osgood and Laurel members. The Osgood Member consists of a medium to dark gray calcareous shale with dolomite and siltstone interbeds. The Osgood is conformably overlain by the Laurel Member, which consists of light gray to tan dolomite and dolomitic limestone with some thin shale beds in the upper half, especially near the contact with the overlying Waldron Shale. The Waldron Shale is predominantly greenish-gray calcareous shale with thin siltstone and limestone interbeds. The Waldron is mostly non-fossiliferous, but crinoid fragments are locally abundant. The Louisville Limestone is the uppermost Silurian formation in the former JPG area, except in those places where it is absent beneath an unconformity. The Louisville consists of fine-grained, light gray to tan dolomitic limestone with some chert zones (MWH 2002).

The Geneva Dolomite is the oldest Devonian formation in the former JPG area. This formation is comprised of buff to medium brown, non-fossiliferous dolomite with minor wispy shale laminae. Overlying the Geneva Dolomite is the Jeffersonville Limestone, a light brown to tan fossiliferous limestone with minor chert nodules. The youngest formation that is present in the vicinity of the AOPIs is the North

Vernon Limestone of Devonian age. The North Vernon is a medium gray to blue gray, fossiliferous limestone (MWH 2002).

Older rocks that were not encountered during drilling of the monitoring wells, but are exposed along some stream drainages north of the Firing Line, are the Ordovician Dillsboro, Saluda, and Whitewater formations, and the Silurian Brassfield Limestone. The Dillsboro consists of gray calcareous shale and thin limestone interbeds that form easily erodible slopes. The Dillsboro is overlain by the Saluda Formation, a cliff forming unit up to 60 feet thick. The Saluda is comprised primarily of fine-grained, silty dolomites with interbedded limestones (MWH 2002).

The Whitewater Formation, which consists of limestone interbedded with thin shales and dolomites, is the uppermost Ordovician formation in the former JPG area. The Brassfield Limestone, which ranges in thickness from 0 to 10 feet, overlies the unconformity at the Ordovician-Silurian boundary. Where the Brassfield is absent, the unconformable contact is picked at the base of the Salamonie Dolomite. The Brassfield is a coarsely crystalline, grayish-orange dolomite containing clasts and reworked fossils derived from the underlying Whitewater (MWH 2002).

Fracturing of bedrock formations is noticeable in outcrops and in surface drainage patterns. Outcrops in the former JPG area commonly have straight, near-vertical faces typical of fracture-controlled weathering.

The glacial stratigraphy is summarized as follows. Pleistocene glacial deposits cover the bedrock in the former JPG area. The thickness of the glacial deposits ranges from a few feet to greater than 40 feet and average about 25 feet (MWH 2002).

A generalized profile of the glacial deposits encountered during the drilling of the soil borings and monitoring wells of the Phase II remedial investigation (MWH 2002) is described as follows. This profile is typical of areas where the glacial thickness is about 25 feet or greater. In areas with thinner glacial cover, all or parts of the lower units are missing. Overlying the bedrock in most places is greenish-gray clay that commonly contains numerous chert, dolomite, and limestone rock fragments. Small (0.5 inch) limonite spherules are also common. Overlying the clay is greenish-gray silt that also contains numerous limonite spherules. A thin (less than 1 inch), highly organic zone comprised of plant fragments overlies the greenish-gray silt. This organic layer marks the boundary from noncalcareous below to calcareous above. A light to medium gray clay and/or very fine silt zone overlies the organic zone (MWH 2002).

Overlying the gray clay and/or silt zone is a silt deposit with some gravel. The color of the unit grades from gray in the lower part to an oxidized brownish yellow to brown in the upperpart. The top of the silt with gravel unit marks a boundary from calcareous below to noncalcareous above. The uppermost zone is typically a mottled brownish yellow and light gray silt with variable clay and sand content. A saturated zone of 1 to 2 feet commonly occurs at the base of this unit just above the contact of the silt with the gravel (MWH 2002).

2.7 Hydrogeology

There are three hydrostratigraphic units in the area of the former JPG, including the unconsolidated glacial deposits, the underlying Silurian and Devonian limestones and dolomites, and the alluvial deposits in the Ohio River Valley south of the installation (MWH 2002). First encountered groundwater is estimated to be 5 to 20 feet below ground surface (bgs).

The unconsolidated glacial deposits range in thickness from 4 to 43 feet thick and are comprised predominantly of till. Groundwater movement within the till is characteristically slow because of the low hydraulic conductivity of the till and the relatively flat hydraulic gradients. The water table within the till loosely conforms to the configuration of the surface topography. The regional groundwater flow in the till, therefore, is in roughly the same direction as the surface water drainage, which is toward the west-southwest over most of the installation. Locally, the groundwater flow in the till can move toward the nearest surface-water drainage, or toward the nearest vertical fractures or joints in the till that transmit the water to the bedrock aquifer (MWH 2002).

The shallow bedrock groundwater in the vicinity of the former JPG is primarily stored in the bedrock hydrostratigraphic unit comprised predominantly of Silurian and Devonian limestone and dolomite members. The Louisville Limestone and the Laurel Member of the Salamonie Dolomite are the principal shallow-bedrock groundwater-producing units in the area containing the AOPIs. Thicknesses of these deposits range from 0 to 43 feet and 25 to 45 feet thick, respectively. Separating the Louisville and the Laurel is the Waldron Shale, which ranges from 4 to 12 feet thick and acts as an aquitard. The bedrock aquifer is unconfined to semi-confined and is recharged by infiltration of precipitation to the bedrock aquifer concentrated along fractures within the glacial till, and in areas where the creek channels are losing water to the groundwater system. Groundwater in the bedrock beneath former JPG shows a direct and rapid response to changing climatic conditions. The bedrock aquifer may be locally confined in areas where there is an absence of fractures in the till. The artesian potentiometric head may rise to a maximum of 10 feet bgs in the monitoring wells screened within the glacial till (MWH 2002).

The third hydrostratigraphic unit does not underlie the former JPG. This unit consists of the alluvium of the Ohio River Valley and is significant because it is the major source of groundwater in the region that is available for domestic use. The nearest occurrences of this hydrostratigraphic unit are 5 miles south of the former JPG. Because the bedrock groundwater flow direction at the former JPG is generally to the west-southwest, and the north-south stream drainages are located west of the former JPG, it is very unlikely that potential contamination present in groundwater at the former JPG could reach the Ohio River alluvial aquifers (MWH 2002).

2.8 Surface Water Hydrology

The former JPG has an extensive system of surface-water resources, including ponds, lakes, streams, and wetland areas, along with numerous ephemeral streams, ponding sites, and wet areas. Several drainages appear to have developed along major fracture lineaments. Surface water in the vicinity of former JPG is not used for domestic drinking water. The primary uses of surface water are for recreation and livestock watering. The surface-water quality is somewhat better than the groundwater quality, but the supply is limited as many streams are quite small and have intermittent flows (MWH 2002).

This discussion of surface-water features is focused on the drainages that are related to the area surrounding the AOPIs, even though there are seven major streams that drain the former JPG. Surface water at the former JPG flows along northeast-to-southwest-trending stream drainages, which eventually join the Muscatatuck River west of the former JPG. The streams are part of the White River Basin (a sub-basin of the Wabash River Basin, which is a sub-basin of the Ohio River). From the northern end to the southern end of the former JPG, these streams include the Otter Creek, Graham Creek, Little Graham

Creek, Marble Creek, Big Creek, Middle Fork Creek, tributaries to Hensley Creek, and Harbert's Creek (MWH 2002).

In the area surrounding the AOPIs, Hensley Creek and Harbert's Creek flow with an average of less than 25 cubic feet per second. The very southern portion of former JPG, including the airfield, the residential area, and Kreuger lake area, is drained by Harbert's Creek. Hensley Creek drains the wooded area south of West JPG Woodfill Road and west of North JPG Tokyo Road. Just north of West JPG Main Front Road is Middle Fork Creek, which has an approximate average flow of 50 cubic feet per second (MWH 2002).

Hensley Creek, Harbert's Creek, and Middle Fork Creek flow to the west-southwest. The channels created by these creeks are incised into the till or bedrock, or both. At some locations along these creeks, the depth of channel incision is deep enough that groundwater intercepts the creek. At these locations, the creek is gaining water from the discharge of groundwater to the creek. At other locations along the creek, the water table remains below the creek and the creek may lose water to the groundwater system (MWH 2002).

There are at least 10 ponds or lakes on the installation, varying in size from less than 1 acre to 165 acres (**Figure 2-2**). Most are stocked with various kinds of game fish by the Indiana Department of Natural Resources. The largest lake is Old Timbers Lake in the northeastern corner of the former JPG at the headwaters of Little Otter Creek, which drains into Otter Creek. This lake is approximately 165 acres in size. The second largest lake is Krueger Lake, which covers approximately 8 acres of the Harbert's Creek drainage basin in the southeastern portion of the former installation. Several smaller ponds and surface impoundments are also present at the former installation (MWH 2002).

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 former JPG.

2.9.1 Stormwater Management System Description

Stormwater from the former JPG is collected within the cantonment area through a deteriorated system of 120,704 linear feet of vitrified clay pipe. Numerous outfalls empty into the Middle Fork and Harbert's Creek drainage system. The largest outfall measures 42 inches. Actual discharge quantities are unknown. The stormwater system north of the firing line consists primarily of culverts and drainage ditches. On 01 July 1993, the Indiana Department of Environmental Management issued a National Pollutant Discharge Elimination System (NPDES) permit (number INR 00J002) to the former JPG. On 15 June 1994, the facility requested an extension for implementation of the Stormwater Pollution Prevention Plan until January 1995, at which time responsibility for execution of actions related to stormwater pollution prevention became part of the caretaker contractor's statement of work (AMC 1995).

According to storm drainage maps that were available during the PA site visit, the Old Fire Training Pit drains southward and discharges into Harbert's Creek. The Building 125 – Former Fire Station and Fire Training Area, Building 127 – Former Fire Station, and Building 186 Roof Fire AOPIs appear to drain northwest and discharge into Middle Fork Creek.

2.9.2 Sewer System Description

While the former JPG was active (1941 to 1995), the installation maintained and operated the onsite sewage treatment plant (STP), which is now privately owned and operated. Currently, the STP has an approximate area of 682 square feet with a capacity to process approximately 280,000 gallons of wastewater per day. The plant has a pumping station located in the basement of Building 177. The treatment facility consists of a settling tank, sludge-drying beds, and a trickling filter system, wherein the processed water is recirculated several times prior to discharge through a NPDES-permitted outfall into the Harberts Creek. Prior to disposal, the sludge is removed and placed in the sludge drying bed at the sludge application areas (CTI-URS 2019).

Historically, influent to the former plant included domestic and commercial wastewater, a small quantity of unspecified industrial wastewater, boiler blowdown water, rinses from an on-site photographic laboratory, and water from an oil/water separator located in Building 186. The oil/water separator in Building 186 did not receive stormwater. The sludge was previously stockpiled near the treatment plant and was reportedly spread on fields within the installation as a means of disposal. Currently, the plant treats domestic sewage from buildings at former JPG including residents, light industries, and storage facilities that are privately leased. The STP includes a water quality laboratory that has been used for testing water quality at the plant and the NPDES-permitted outfall since the 1960s. The laboratory is located on the first floor of Building 177 (CTI-URS 2019).

2.10 Potable Water Supply and Drinking Water Receptors

The groundwater under the former JPG is not used for drinking purposes or for other purposes in any significant capacity. The drinking water at the former JPG is obtained from the City of Madison Municipal Supply Systems and the Canaan Water System. The City of Madison withdraws its drinking water from the alluvial deposits in the Ohio River Valley approximately 5 miles south of the former JPG (MWH 2002).

In the vicinity of the former JPG, most of the potable water is obtained from the alluvial aquifer along the Ohio River Valley. The State of Indiana reports that there are 21 municipal water supply wells in Jefferson County, six in Ripley County, and zero in Jennings County (three counties associated with former JPG). The State of Indiana also reports that the non-community water supply wells in the three counties number seven in Jefferson County, 10 in Ripley County, and three in Jennings County. There are less than 4,000 wells per county in these three counties, including drilled or hand dug wells. It is assumed that only the wells tallied as water supply wells above are used for potable water supplies. There are very few wells in the vicinity of former JPG that are used for domestic water supplies (MWH 2002).

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 former JPG, which along with state and county geographic information system 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 provided as **Appendix C**.

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.

Although the mission of former JPG has precluded regular systematic surveys by state or federal biologists, two plant species known or expected to occur on the installation are on the federal or State of Indiana list of threatened species. Former JPG is within the range of the federally listed endangered species called the running buffalo clover (trifolium stoloniferum), which has been found in Switzerland County to the southeast of former JPG. In addition, the smooth white violet or red stem violet (viola blanda) is listed by the State of Indiana as a threatened species and is known to occur within the boundaries of former JPG (MWH 2002).

There are five federally endangered animals (four birds and one mammal) that may occur within the boundaries of former JPG. The four bird species are transients that may occur during migration, including the American peregrine falcon (Falco peregrinus), bald eagle (Haliaeetusleucocephalus), arctic peregrine falcon (Falco peregrinus tundrius), and Kirtland's warbler (Dendroica kirtlandii). In the summer of 1993, the Indiana bat (Myotis sodalis) was documented to exist at former JPG. Kirtland's snake (Natrix kirtlandi), a candidate species, is present within the boundaries of former JPG (MWH 2002).

The hardwood forests, mature pine stands, open fields, riparian corridors, scrub-shrub/old field, wetlands, ponds, lakes, and streams on former JPG provide an almost ideal habitat for the wide variety of game animals and fish that are harvested on the installation. Some stocking of gamebirds, fish, and other creatures has been accomplished to maintain stable populations of some species. Hunting is allowed on approximately 30,000 acres of designated land for employees of former JPG and their guests, and for a small number of state hunters drawn by lottery. Bag and creel checks are required before hunters and fishermen are allowed to leave the installation. The remaining 25,000 acres of land provide habitat for small game. This land is closed to hunters because of the danger of UXO. Mammals and fowl harvested on former JPG include whitetail deer, fox squirrel, eastern gray squirrel, eastern cottontail rabbit, and wild turkey. According to the Natural Resource Manager at former JPG, from 550 to 750 whitetail deer are harvested annually. The wild turkey harvest averages 50 birds per year. The USFWS conducted fish surveys of the streams within the boundaries of former JPG in June of 1993. According to their observations, at least some reaches of Otter Creek contained excellent fish diversity (MWH 2002).

2.12 Previous PFAS Investigations

There have not been any previous PFAS investigations at former JPG.

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 former JPG, data was collected from three principal sources of information and are described in the subsections below:

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

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

3.1 Records Review

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

3.2 Personnel Interviews

Interviews were conducted during the PA 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 former JPG is presented below (affiliation is with former JPG unless otherwise noted).

- USACE Technical Manager
- Facility Manager
- Former Engineering Technician
- Natural Cultural Resources Manager and Site Manager
- Data Manager and Mathematician

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

3.3 Site Reconnaissance

Site reconnaissance and visual surveys were conducted at the preliminary locations identified at former JPG during the records review process, the installation in-brief meeting, and/or during the installation personnel interviews. A photo log from the site reconnaissance is provided in **Appendix F**; photos were used to assist in verification of qualitative data collected in the field.

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

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

Former JPG was evaluated for all potential current and historical use, storage, and/or disposal of PFAS-containing materials. As such, this section is organized to summarize the aqueous film-forming foam (AFFF)-related uses first, and all remaining potential PFAS-containing materials in the subsequent section.

4.1 AFFF Use, Storage, and Disposal Areas

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

During the PA, several areas were identified as having the potential for use, storage, and/or disposal of AFFF. Two areas were identified as fire training areas where AFFF was used (Old Fire Training Pit and Building 125 – Former Fire Station and Fire Training Area); two areas were identified as fire stations in areas with AFFF use and storage (Building 125 – Former Fire Station and Fire Training Area and Building 127 – Former Fire Station); and one area was identified as a fire response area that used AFFF (Building 186 Roof Fire).

The Old Fire Training Pit was used by the former JPG fire department for fire training activities from the 1970s to 1989. The fire training typically included soaking wood debris with diesel and other petroleum products and igniting the wood. Reportedly, the pit would be filled with water, 30 to 50 gallons of fuel would be floated on the water, the fuel was set aflame, and the fire crew would then extinguish the flames with AFFF. A new fire training pit with a concrete floor and concrete walls was constructed and used from 1989 to 1995. The construction of the concrete pit was assumed to take place directly on top of the old fire training pit. Building 125 – Former Fire Station and Fire Training Area had fire training activities that took place in the ditches to the east and south of the building (i.e., the back of Building 125). According to an interview with one of the site contacts, the ditches were used for fire department nozzle testing.

Building 127 – Former Fire Station was the first fire station for the entire installation (from 1941 to the 1970s) and Building 125 – Former Fire Station and Fire Training Area, which is approximately 450 feet from Building 127, was the second fire station for the entire installation (from the 1970s to 1995), both of which were in operation while AFFF was being used at former JPG. Building 125 – Former Fire Station and Fire Training Area housed fire engines and had AFFF activities around the building. Building 127 –

Former Fire Station housed one or more fire engines and contained a hose tower, which is the structure in the center of the highest part of the building.

Building 186 Roof Fire was identified during the PA due to the fire response activity that occurred there in the 1970s. Tar was being applied to the roof of the building and the roof caught fire. The fire department used AFFF to suppress the fire.

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

Following document research, personnel interviews, and site reconnaissance at former JPG, the onsite STP and pesticide facilities 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**.

During the PA, the installation's STP was identified due to the STP receiving all sanitary waste from each of the buildings. Former JPG maintained and operated the onsite STP while the installation was active from 1941 to 1995. The wastewater collection system is predominantly maintained by gravity flow and low-lying areas are serviced by four lift stations. Sanitary sewer service is unavailable north of the firing line and septic tanks are utilized at Buildings 510, 708, 485, 194, and 269 (AMC 1995).

Approximately 28,000 linear feet of leaking vitrified clay pipes and lines were replaced in 1988 to 1989. The former JPG held a NPDES permit for its wastewater treatment plant which was effective through 30 June 1995 (AMC 1995). As of 1995, domestic sewage accounted for more than 97% of wastewater generated by the former JPG. Industrial wastewater accounted for a minimal amount of total wastewater production. The two principal sources contributing to the industrial wastewater flow were photographic wastes (averaging 170 gallons per day) and boiler blowdown (800 to 1,000 gallons per day during winter months). These amounts remained essentially constant, though the photographic waste stream ended 30 September 1994, with cessation of operations. Due to the age of the collection system, there have been excessive infiltration and inflow problems during heavy rainfall and wet weather periods (AMC 1995).

Currently, the STP has an approximate area of 682 square feet with a capacity to process approximately 280,000 gallons of wastewater per day. The plant has a pumping station located in the basement of Building 177. The treatment facility consists of a settling tank, sludge-drying beds, and a trickling filter system, wherein the processed water is recirculated several times prior to discharge through a NPDES-permitted outfall into the Harbert's Creek. Prior to disposal, the sludge is removed and placed in the sludge drying bed at the sludge application areas.

Historically, influent to the former plant included domestic and commercial wastewater, a small quantity of unspecified industrial wastewater, boiler blowdown water, rinses from an on-site photographic laboratory, and water from an oil/water separator located in Building 186. The oil/water separator in Building 186 did not receive stormwater. The sludge was previously stockpiled near the treatment plant and was reportedly spread on fields within the installation as a means of disposal. Currently, the plant treats domestic sewage from buildings at JPG including residents, light industries, and storage facilities that are privately leased.

During a telephonic interview with the Installation Management Command 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 Installation Management Command Pest Management Consultant provided records of potential PFAS-containing pesticides and insecticides used at and/or stored at Army installations and did not identify former JPG 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 former JPG) 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 fire departments, fire stations, or airports within close proximity of former JPG could potentially be off-post PFAS sources if they use, store, or dispose AFFF. Approximately six fire stations or fire departments and one airport (Madison Municipal Airport) appear to be within 5 miles from the installation boundary.

5 SUMMARY AND DISCUSSION OF PA RESULTS

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

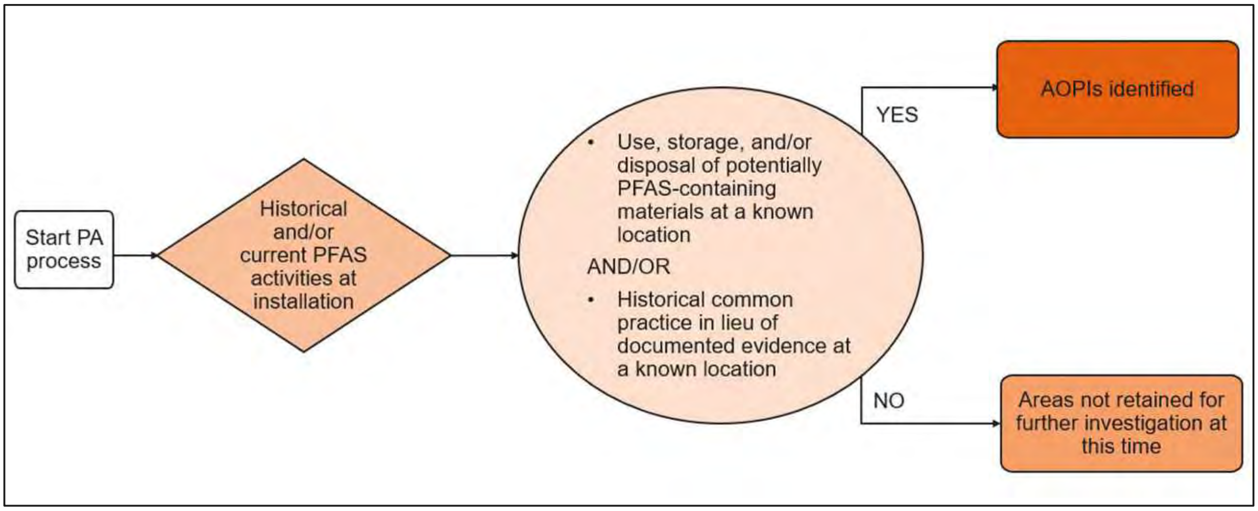


Figure 5-1: AOPI Decision Flowchart

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

Data limitations for this PA/SI at former JPG 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
Building 195 and 204 – Pesticide Storage Area and Temporary Storage Area	1960s to 1995	Building 195 is located adjacent (east) to Building 204 and was used for mixing, rinsing, and storing pesticides and herbicides. Building 204, a single-story brick building constructed of slab on grade, was used as a storage building for a variety of pesticides and herbicides.	No evidence of use, storage, or disposal of PFAS-containing materials. Based on interviews, former JPG is not expected to have used PFAS-containing pesticides. Additionally, there is no information available on spills at these buildings.
Sewage Treatment Plant and Sludge Application Areas	1941 to present	The STP has an approximate area of 682 square feet with a capacity to process approximately 280,000 gallons of wastewater per day. The plant has a pumping station, and the treatment facility consists of a settling tank, sludge-drying beds, and a trickling filter system. The processed water is recirculated prior to discharge through an outfall into the Harbert's Creek. Prior to disposal, the sludge is removed and placed in the sludge drying bed at the sludge application areas. Historically, influent to the former plant included domestic and commercial wastewater, a small quantity of unspecified industrial wastewater, boiler blowdown water, rinses from an on-site photographic laboratory, and water from an oil/water separator located in Building 186. Currently, the plant treats domestic sewage from residents, light industries, and storage facilities. The STP includes a water quality laboratory that has been used for testing water quality at the plant and the outfall since the 1960s.	No evidence of use, storage, or disposal of PFAS-containing materials. Additionally, the storm water system at the installation did not and does not direct drainage from any areas with use, storage, or disposal of PFAS-containing materials to the STP.

5.2 AOPIs

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

The AOPI locations are shown on **Figure 5-2**. Aerial photographs of each AOPI that also show the approximate extent of AFFF use (if applicable) are presented on **Figures 5-3 through 5-6**.

5.2.1 Old Fire Training Pit

The Old Fire Training Pit is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical fire training operations involving the use of AFFF. The Old Fire Training Pit was used by the former JPG fire department to train from the 1970s to 1989. The standard practice for fire training included soaking wood debris with diesel and other petroleum products and igniting the wood. It was also reported that during the training, the pit would be filled with water, and 30 to 50 gallons of fuel would be floated on the water and set aflame. The fire crew would then practice by extinguishing the flames with AFFF. A new fire training pit with a concrete floor and concrete walls was constructed and used from 1989 to 1995. The construction of the concrete pit was assumed to take place directly on top of the old fire training pit. Currently, the area is an open grass field and is bounded by concrete from the former airfield or more grass. Groundwater at the Old Fire Training Pit AOPI flows north to northeast, and stormwater drains southward through the installation stormwater system, eventually discharging into Harbert’s Creek. The IRP identifier for the Old Fire Training Pit is JPG-030. Previous investigations relating to this area are closed.

5.2.2 Building 125 – Former Fire Station and Fire Training Area

Building 125 – Former Fire Station and Fire Training Area is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to use and storage of AFFF. This building was the second fire station for the entire installation (from the 1970s to 1995) while AFFF was being used. Fire department operations moved from Building 127, which is approximately 450 feet to the northwest, to Building 125 in the 1970s. This building also housed fire engines. The ditch to the east and the ditch to the south (i.e., the back of Building 125) were used for fire department activities with AFFF. According to an interview with one of the site contacts, the ditches were used for fire department nozzle testing. Building 125 currently serves as an administrative building for the Army and the USFWS. This AOPI is bounded by West JPG Niblo Road to the north, a grassy area to the east, and active train tracks to the south and west. Groundwater at the Building 125 – Former Fire Station and Fire Training Area AOPI is estimated to flow northwest, west, and southwest, and stormwater drains to the northwest through the installation stormwater system, eventually discharging into Middle Fork Creek.

5.2.3 Building 127 – Former Fire Station

Building 127 – Former Fire Station is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to suspected discharge and the storage of AFFF. This building was the first fire station for the entire installation (from 1941 to the 1970s) while AFFF was being used.

Fire department operations moved from this building to Building 125, which is approximately 450 feet to the southeast, in the 1970s. This building housed one or more fire engines and contained a hose tower, which is the structure in the center of the highest part of the building. Building 127 is no longer used by former JPG and is currently abandoned. The northern and eastern side of the building are surrounded by grass, while the southern and western sides of the building are abutting the fire station driveway. The driveway is adjacent to West JPG Artillery Road and West JPG Niblo Road, which intersect immediately south of the building. Groundwater at the Building 127 – Former Fire Station AOPI is estimated to flow west, and stormwater drains to the northwest through the installation stormwater system, eventually discharging into Middle Fork Creek.

5.2.4 Building 186 Roof Fire

Building 186 Roof Fire is identified as an AOPI following records research, personnel interviews, and site reconnaissance due the use of AFFF. The installation used Building 186 as a temporary storage and motor pool facility. The building caught fire in the 1970s while tar was being applied to the roof and AFFF was used to suppress the fire. Building 186 is currently used by the State of Indiana. Historically, influent to the STP included water from an oil/water separator located in Building 186. The building is surrounded by paved surfaces, which are adjacent to West JPG Artillery Road to the northeast. Groundwater at the Building 186 Roof Fire AOPI is estimated to flow northwest and southwest, and stormwater drains to the northwest through the installation stormwater system, eventually discharging into Middle Fork Creek.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at former JPG, an SI for PFOS, PFOA, PFBS, PFNA, and PFHxS was conducted in accordance with CERCLA. SI sampling was completed at former JPG at four of the six AOPIs to evaluate presence or absence of PFOS, PFOA, PFBS, PFNA, and PFHxS in comparison with the OSD risk screening levels. As such, an installation-specific QAPP Addendum (Arcadis 2023) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A preliminary CSM was prepared for each of the installation's AOPIs in accordance with the USACE Engineer Manual on Conceptual Site Models, EM 200-1-12 (USACE 2012). The preliminary CSMs identified potential human receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSMs identified 10 soil, groundwater, surface water, and/or 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 April 2023 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 2023) 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 former JPG. Analytical results obtained through SI field activities are summarized in **Section 7**.

6.1 Data Quality Objectives

As identified during the DQO process and outlined in the site-specific QAPP Addendum (Arcadis 2023), 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, PFBS, PFNA, and PFHxS 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.

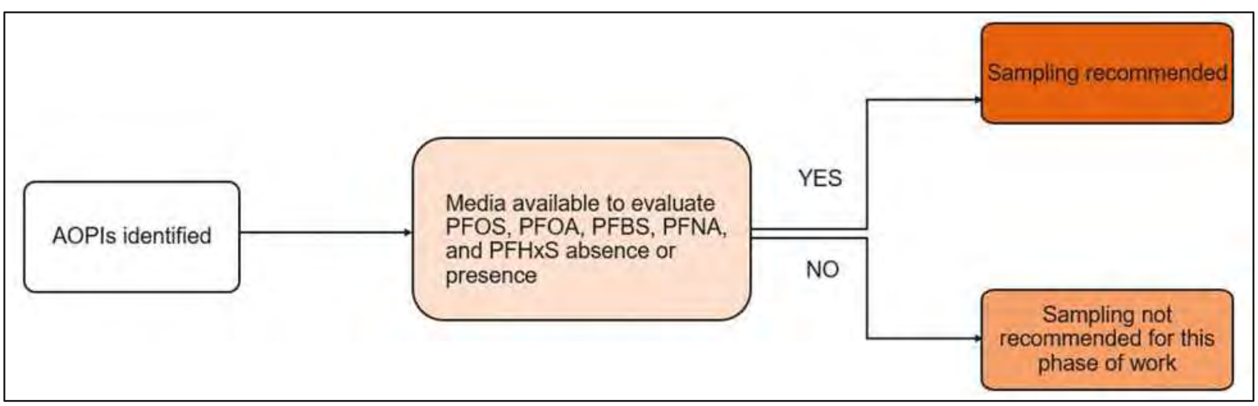


Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at former JPG is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2023). Briefly, groundwater samples were collected to inform the interpretation of PFOS, PFOA, PFBS, PFNA, and PFHxS presence and update the individual AOPI CSMs. Soil samples were collected to evaluate PFOS, PFOA, PFBS, PFNA, and PFHxS presence or absence, to evaluate the potential for those areas to be sources to surface water and groundwater as an influence to drinking water, and to update the individual AOPI CSMs.

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 2023), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2023). 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 2023). 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 G and H**, respectively.

6.3.1 Field Methods

Groundwater samples were collected following the installation of temporary monitoring wells via sonic drilling. Shallow (first encountered) groundwater was sampled but when groundwater was not encountered immediately, a temporary well was set to recharge. Groundwater samples were analyzed for select PFAS, and field parameters were measured during purging and allowed to stabilize or purge for a maximum of 20 minutes, whichever came sooner, to ensure a representative sample is collected and, potentially, to inform the interpretation of analytical data. If low-flow purging was not possible, a bailer was used to collect the groundwater sample. Coordinates for each borehole’s groundwater sampling location were recorded using a handheld global positioning system.

Composite shallow subsurface soil samples (less than 6 feet bgs) were collected via hand auger from native soil. Soil samples were analyzed for select PFAS, and total organic carbon (TOC), pH, and grain size were analyzed in one soil sample per AOPI. Soil lithological descriptions were logged and documented. Coordinates for each soil sampling location were recorded using a handheld global positioning system.

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

6.3.2 Quality Assurance/Quality Control

Worksheets #20 of the PQAPP and QAPP Addendum provide QA/QC requirements for field duplicates (FDs), matrix spike (MS)/matrix spike duplicates (MSDs), equipment blanks (EBs), and source blanks (SBs) 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 2023), typically at a rate of 1 per 20 parent samples. FD and MS/MSD samples were collected for media sampled for PFOS, PFOA, PFBS, PFNA, and PFHxS, and TOC only. EBs were collected for media sampled for PFOS, PFOA, PFBS, PFNA, and PFHxS, at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2023). The decontaminated reusable equipment from which EBs were collected include hand augers, water-level meters, pumps, drill cutting shoes, and bailers, as applicable to the sampled media. SBs were collected from the water used to pressure-wash drill tooling. Analytical results for blank samples are discussed in **Section 7.7**.

6.3.3 Field Change Reports

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

FCR-JPG-01

- A second mobilization was required to complete sampling. During this remobilization, a different drill rig (sonic) was used to drill to the required depths and additional QA/QC samples, including FDs, MSs, MSDs, and EBs, were collected.

FCR-JPG-02

- The location of the Old Fire Training Pit AOPI samples were moved north approximately 500 feet due to information provided by one of the site contacts.

6.3.4 Decontamination

Non-dedicated reusable sampling equipment (e.g., hand augers, drill cutting shoes and casing, and 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 in Department of Transportation-approved 55-gallon drums, labeled as non-hazardous, segregated by medium: waters and soil, and transported to a staging area. The IDW water will be collected by a waste disposal contractor, taken offsite, and properly disposed of. The IDW soil will be disposed at the installation. Equipment IDW includes personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, Lexan tubes, and high-density polyethylene and silicon tubing) that may come in contact with sampling media. Analytical results for IDW samples collected during the SI are discussed in **Section 7.5**.

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, PFBS, PFNA, and PFHxS, 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, PFBS, PFNA, and PFHxS, were analyzed for in groundwater and soil samples using an analytical method that is ELAP-accredited and compliant with QSM 5.4 (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 2023) 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% 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 J**).

6.4.2 Data Validation

All analytical data generated during the SI, except grain size and data generated from IDW profiling, 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 5.4 (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 J**. The Level IV analytical reports are included within **Appendix J** 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 former JPG. Documentation generated during the data usability assessments, which were compiled into a DUSR (**Appendix J**), 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 former JPG 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 J**), and as indicated in the full analytical tables (**Appendix K**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and former JPG QAPP Addendum (Arcadis 2023). Data qualifiers applied to laboratory analytical results for samples collected during the SI at former JPG 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, PFBS, PFNA, PFHxS, and HFPO-DA 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 6-1**.

Table 6-1 OSD Risk Screening Levels Calculated for PFOS, PFOA, PFBS, PFNA, PFHxS, and HFPO-DA 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	4	0.013	0.16
PFOA	6	0.019	0.25
PFBS	601	1.9	25
PFNA	6	0.019	0.25
PFHxS	39	0.13	1.6
HFPO-DA[3]	6	0.023	0.35

Notes:
1. Risk screening levels for tap water and soil provided by the OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July 06 (**Appendix A**).
2. All soil data will be screened against both the Residential Scenario and Industrial/Commercial risk screening levels (if collected from less than 2 feet bgs), regardless of the current and projected land use of the AOPI.
3. Of the six PFAS compounds presented in the 06 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at former JPG because HFPO-DA is generally not a component of military specification AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.
mg/kg = milligram per kilogram
ng/L = nanograms per liter
ppm = parts per million
ppt = parts per trillion

The OSD residential tap water risk screening levels will be used to compare all groundwater for this Army PFAS PA/SI. While the current and most likely future land uses of the AOPIs at former JPG are industrial/commercial, both residential and industrial/commercial soil risk screening levels for PFOS, PFOA, PFBS, PFNA, and PFHxS 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, PFBS, PFNA, or PFHxS are detected greater than the applicable OSD risk screening levels, further study in a remedial investigation is recommended in **Section 8**.

7 SUMMARY AND DISCUSSION OF SI RESULTS

This section summarizes the analytical results obtained from samples collected during the SI at former JPG (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 2023). The sample results discussion below focuses on the PFOS, PFOA, PFBS, PFNA, and PFHxS 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, PFBS, PFNA, and PFHxS. **Table 7-3** summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix K** includes the full suite of analytical results for these media, as well as for the QA/QC samples. An overview of AOPIs at former JPG with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2 through 7-5** show the PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results in groundwater and soil for each AOPI. Non-detected results are reported as less than the LOQ. Detections of PFOS, PFOA, PFBS, PFNA, and/or PFHxS greater than the applicable OSD risk screening levels are highlighted in summary tables and on figures. Final qualifiers applied to the data by the laboratory and the project chemist (as defined in **Section 6.4.3**) are presented on the analytical tables. Groundwater data collected during the SI are reported in ng/L, or parts per trillion, and soil data are reported in mg/kg, or parts per million.

Field parameters measured for groundwater during low-flow purging and sample collection are provided on the field forms in **Appendix H**. Soil descriptions are provided on the field forms in **Appendix H**. The results of the SI are grouped by AOPI and discussed for each medium as applicable. Groundwater was generally first encountered at depths of approximately 17 to 28 feet bgs.

Table 7-3 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Yes/No)
Old Fire Training Pit	No
Building 125 - Former Fire Station and Training Area	Yes
Building 127 - Former Fire Station	Yes
Building 186 Roof Fire	Yes

7.1 Old Fire Training Pit

The subsections below summarize the groundwater and soil PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with the Old Fire Training Pit AOPI (**Figure 7-2**).

7.1.1 Groundwater

One groundwater sample was collected from a temporary well via direct push technology at first encountered groundwater at the Old Fire Training Pit AOPI (JPG-OFTP-GW-1 [FD sample JPG-FD-1-

GW-032923 was collected at JPG-OFTP-GW-1]). The groundwater analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS are shown on **Figure 7-2** and **Table 7-1**, and are summarized below:

- PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in the groundwater sample collected.

7.1.2 Soil

Three soil samples were collected via hand auger at the Old Fire Training Pit AOPI (JPG-OFTP-SO-1, JPG-OFTP-SO-2, JPG-OFTP-SO-3 [FD sample JPG-FD-1-SO-032923 was collected at JPG-OFTP-SO-1]). The soil analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS are shown on **Figure 7-2** and **Table 7-2**, and are summarized below:

- PFOS was detected at a concentration less than the OSD risk screening level of 0.013 mg/kg at JPG-OFTP-SO-1 at 0.00099 J (the analyte was positively identified; however, the associated numerical value is an estimated concentration only) mg/kg and JPG-OFTP-SO-2 at 0.00077 J mg/kg.
- PFOA, PFBS, PFNA, and PFHxS were not detected in the soil samples collected.

7.2 Building 125 - Former Fire Station and Training Area

The subsections below summarize the groundwater and soil PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with the Building 125 - Former Fire Station and Training Area AOPI (**Figure 7-3**).

7.2.1 Groundwater

One groundwater sample was collected from a temporary well via sonic drilling at first encountered groundwater at the Building 125 - Former Fire Station and Training Area AOPI (JPG-B125-GW-1 [FD sample JPG-FD-1-GW-041223 was collected at JPG-B125-GW-1]). The groundwater analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS are shown on **Figure 7-3** and **Table 7-1**, and are summarized below:

- PFOS was detected at a concentration greater than the OSD risk screening level of 4 ng/L at JPG-B125-GW-1 at 130 ng/L and JPG-FD-1-GW at 150 ng/L.
- PFOA was detected at a concentration greater than the OSD risk screening level of 6 ng/L at JPG-B125-GW-1 at 9.2 ng/L and JPG-FD-1-GW at 9.4 ng/L.
- PFBS was detected at a concentration less than the OSD risk screening level of 601 ng/L at JPG-B125-GW-1 at 17 ng/L and JPG-FD-1-GW at 20 ng/L.
- PFNA was not detected in the groundwater sample collected.
- PFHxS was detected at a concentration greater than the OSD risk screening level of 39 ng/L at JPG-B125-GW-1 at 120 ng/L and JPG-FD-1-GW at 140 ng/L.

7.2.2 Soil

Five soil samples were collected via hand auger at the Building 125 - Former Fire Station and Training Area AOPI (JPG-B125-SO-1, JPG-B125-SO-2, JPG-B125-SO-3, JPG-B125-SO-4, JPG-B125-SO-5). The soil analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS are shown on **Figure 7-3** and **Table 7-2**, and are summarized below:

- PFOS was detected at a concentration less than the OSD risk screening level of 0.013 mg/kg at JPG-B125-SO-1, JPG-B125-SO-2, JPG-B125-SO-4, and JPG-B125-SO-5 at 0.0019 mg/kg, 0.0028 mg/kg, 0.0017 mg/kg, and 0.001 J mg/kg, respectively. PFOS was detected at a concentration greater than the OSD risk screening level of 0.013 mg/kg at JPG-B125-SO-3 at 0.036 mg/kg.
- PFOA was detected at a concentration less than the OSD risk screening level of 0.019 mg/kg at JPG-B125-SO-3 at 0.00082 J mg/kg.
- PFNA was detected at a concentration less than the OSD risk screening level of 0.019 mg/kg at JPG-B125-SO-3 at 0.0019 mg/kg.
- PFBS and PFHxS were not detected in the soil samples collected.

7.3 Building 127 - Former Fire Station

The subsections below summarize the groundwater and soil PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with the Building 127 - Former Fire Station AOPI (**Figure 7-4**).

7.3.1 Groundwater

One groundwater sample was collected from a temporary well via sonic drilling at first encountered groundwater at the Building 127 - Former Fire Station AOPI (JPG-B127-GW-1). The groundwater analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS are shown on **Figure 7-4** and **Table 7-1**, and are summarized below:

- PFOS was detected at a concentration greater than the OSD risk screening level of 4 ng/L at JPG-B127-GW-1 at 120 ng/L.
- PFOA was detected at a concentration greater than the OSD risk screening level of 6 ng/L at JPG-B127-GW-1 at 6.7 ng/L.
- PFBS was detected at a concentration less than the OSD risk screening level of 601 ng/L at JPG-B127-GW-1 at 5.1 ng/L.
- PFNA was detected at a concentration less than the OSD risk screening level of 6 ng/L at JPG-B127-GW-1 at 2.1 J ng/L.
- PFHxS was detected at a concentration greater than the OSD risk screening level of 39 ng/L at JPG-B127-GW-1 at 61 ng/L.

7.3.2 Soil

Five soil samples were collected via hand auger at the Building 127 - Former Fire Station AOPI (JPG-B127-SO-1, JPG-B127-SO-2, JPG-B127-SO-3, JPG-B127-SO-4, JPG-B127-SO-5 [FD sample JPG-FD-1-SO-041123 was collected at JPG-B127-SO-1]). The soil analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS are shown on **Figure 7-4** and **Table 7-2**, and are summarized below:

- PFOS, PFOA, PFBS, and PFNA were not detected in the soil samples collected.
- PFHxS was detected at a concentration less than the OSD risk screening level of 0.13 mg/kg at JPG-B127-SO-4 at 0.0012 mg/kg.

7.4 Building 186 Roof Fire

The subsections below summarize the groundwater and soil PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with the Building 186 Roof Fire AOPI (**Figure 7-5**).

7.4.1 Groundwater

Two groundwater samples were collected from temporary wells via sonic drilling at first encountered groundwater at the Building 186 Roof Fire AOPI (JPG-B186-GW-1, JPG-B186-GW-2). The groundwater analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS are shown on **Figure 7-5** and **Table 7-1**, and are summarized below:

- PFOS was detected at a concentration greater than the OSD risk screening level of 4 ng/L at JPG-B186-GW-1 at 140 ng/L.
- PFOA was detected at a concentration greater than the OSD risk screening level of 6 ng/L at JPG-B186-GW-1 at 8.1 ng/L.
- PFBS was detected at a concentration less than the OSD risk screening level of 601 ng/L at JPG-B186-GW-1 at 12 ng/L.
- PFNA was not detected in the groundwater samples collected.
- PFHxS was detected at a concentration greater than the OSD risk screening level of 39 ng/L at JPG-B186-GW-1 at 89 ng/L.

7.4.2 Soil

Five soil samples were collected via hand auger at the Building 186 Roof Fire AOPI (JPG-B186-SO-1, JPG-B186-SO-2, JPG-B186-SO-3, JPG-B186-SO-4, JPG-B186-SO-5). The soil analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS are shown on **Figure 7-5** and **Table 7-2**, and are summarized below:

- PFOS was detected at a concentration less than the OSD risk screening level of 0.013 mg/kg at JPG-B186-SO-1 and JPG-B186-SO-5 at 0.0019 mg/kg and 0.00055 J mg/kg, respectively.
- PFOA, PFBS, PFNA, and PFHxS were not detected in the soil samples collected.

7.5 Investigation Derived Waste

One composite sample of the purge and decontamination wastewater and one composite sample of the soil were collected from the 55-gallon drums currently in storage at Building 125. The results indicated the following concentrations in the wastewater: 7.5 ng/L PFOS, 2.5 J ng/L PFOA, 3.2 J ng/L PFBS, and 4.3 ng/L PFHxS (**Appendix K**). PFNA was not detected in the wastewater sample collected. The PFOS concentration exceeds the OSD risk screening level of 4 ng/L. The IDW water will be collected by a waste disposal contractor, taken offsite, and properly disposed of. The soil results indicated that PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in the composite sample collected. The IDW soil will be disposed at the installation.

The IDW disposal plan will be coordinated with former JPG. The full analytical results (i.e., for all constituents analyzed) for IDW samples collected during the SI are included in **Appendix K**.

7.6 TOC, pH, and Grain Size

In addition to sampling soil for PFOS, PFOA, PFBS, PFNA, and PFHxS, 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 5,110 to 7,580 mg/kg. The TOC at this installation was within range of that typically observed in topsoil. The combined percentage of fines (i.e., silt and clay) in soils at former JPG ranged from 70 to 81.2% with an average of 76.1%. In general, PFAS constituents tend to be more mobile in soils with less than 20% fines (silt and clay) and lower TOC. The pH of the soil was neutral, ranging from 6.7 to 8.8 and averaging 7.5. Based on these geochemical and physical soil characteristics (i.e., low TOC and high percentage of fines) observed underlying the installation during the SI, the following interpretation was made. 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 at former JPG.

7.7 Blank Samples

Detections of PFOS, PFOA, PFBS, PFNA, and PFHxS constituents are summarized below for blank samples. Most detected concentrations were low-level. Other than those noted below, concentrations of PFOS, PFOA, PFBS, PFNA, and PFHxS in all other blank samples were not detected. The source blank (JPG-SB-1) analytical results indicated there were no detections of PFOS, PFNA, and PFHxS, a detection of PFOA at 2.1 ng/L J, which is less than the OSD risk screening level of 6 ng/L, and a detection of PFBS at 3.0 J ng/L, which is less than the OSD risk screening level of 601 ng/L.

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

7.8 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2023) were re-evaluated and updated, if necessary, based on the SI sampling results. The CSMs presented on **Figures 7-6 and 7-7** 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, PFBS, PFNA, and PFHxS are each negatively charged at environmentally-relevant pH. The media potentially affected by PFOS, PFOA, PFBS, PFNA, and PFHxS 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 historical use and/or storage of PFAS-containing materials at the AOPIs, affected media are likely to consist of soil and groundwater, and could include 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 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, PFBS, PFNA, and PFHxS may be evaluated at a future date if those pathways warrant further consideration.

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

- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil at all four AOPIs. The former JPG is mostly undeveloped or rural residential with open grassland and recently cultivated farmland. Future on-site workers, recreational users, and hypothetical future residents could contact constituents in soil at the AOPIs via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathways for these receptors are complete.
- The AOPIs are wholly located on-site (i.e., within the boundary of the former JPG). Therefore, the soil exposure pathway for off-site receptors is incomplete.
- Constituents in soil could migrate to surface water via stormwater runoff or shallow groundwater discharge. Surface water is not used as a drinking water source. On-site residents and

recreational users are not expected to contact surface water and sediment; therefore, these exposure pathways are incomplete. However, on-site workers could contact constituents in surface water and sediment through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-site workers are potentially complete.

- Surface water at the former JPG flows along northeast-to-southwest-trending stream drainages, which eventually join the Muscatatuck River west of the former JPG. Recreational users downstream of the former JPG could contact constituents in surface water and sediment through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for off-site recreational users are potentially complete.

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

Figure 7-6 shows the CSM for the Old Fire Training Pit AOPI, where AFFF was used during fire department training activities from the 1970s to 1989.

- PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in the one groundwater sample that was collected from first encountered groundwater at the Old Fire Training Pit AOPI. However, PFOS was detected in two of the three soil samples and could migrate to groundwater in the future. The former JPG obtains drinking water from the City of Madison via supply wells located along the Ohio River. The groundwater under the former JPG is not used for drinking water or for other purposes in any significant capacity due to the low yield of the shallow-bedrock groundwater-producing units in the area containing the AOPIs. It is highly unlikely that potable wells would be installed at the former JPG in the future. Nonetheless, as a conservative measure, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-site workers and hypothetical future residents are potentially complete to account for potential future potable use of the on-site groundwater downgradient of the AOPI.
- Recreational users are not likely to contact groundwater during outdoor recreational activities. Therefore, the groundwater exposure pathway for on-site recreational users is incomplete.
- Groundwater originating at the AOPI flows offsite through the former installation’s west to southwest boundary. Due to the absence of land use controls that prevent potable use of off-site groundwater, the groundwater exposure pathway for off-site drinking water receptors is potentially complete.

Figure 7-7 shows the CSM for the Building 125 – Former Fire Station, Building 127 – Former Fire Station, and Building 186 Roof Fire AOPIs. These AOPIs are associated with the historical use and/or storage of AFFF by fire department personnel.

- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in groundwater samples collected from temporary wells at first encountered groundwater at the three AOPIs. The former JPG obtains drinking water from the City of Madison via supply wells located along the Ohio River. The groundwater under the former JPG is not used for drinking water or for other purposes in any significant capacity due to the low yield of the shallow-bedrock groundwater-producing units in the area containing the AOPIs. It is highly unlikely that potable wells would be installed at the former JPG in the future. Nonetheless, as a conservative measure, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-site workers and hypothetical future residents are potentially complete to account for potential future potable use of the on-site groundwater downgradient of the AOPI.

- Recreational users are not likely to contact groundwater during outdoor recreational activities. Therefore, the groundwater exposure pathway for on-site recreational users is incomplete.
- Groundwater originating at the AOPIs flows offsite through the former installation’s west to southwest boundary. Due to the absence of land use controls that prevent potable use of off-site groundwater, the groundwater exposure pathway for off-site drinking water receptors is potentially complete.

Following the SI sampling, all four 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, PFBS, PFNA, and PFHxS to the OSD risk screening levels (**Table 6-1**).

8 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA/SI included two distinct efforts. The PA identified AOPIs at former JPG 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, PFBS, PFNA, and PFHxS to the environment occurred.

The OSD provided residential risk screening levels based on the USEPA oral reference dose for PFOS, PFOA, PFBS, PFNA, and PFHxS in soil and groundwater (tap water) and industrial/commercial risk screening levels for PFOS, PFOA, PFBS, PFNA, and PFHxS 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, PFBS, PFNA, and PFHxS use, storage, and/or disposal at former JPG. Following the evaluation, four AOPIs were identified.

The groundwater at former JPG is not used for drinking purposes or for other purposes in any significant capacity. The drinking water at the former JPG is obtained from the City of Madison Municipal Supply Systems and the Canaan Water System, which withdraw their drinking water from the alluvial deposits in the Ohio River Valley approximately 5 miles south of the former JPG. In the vicinity of the former JPG, most of the potable water is obtained from the alluvial aquifer along the Ohio River Valley.

All AOPIs were sampled during the SI at former JPG to identify presence or absence of PFOS, PFOA, PFBS, PFNA, and PFHxS at each AOPI. Of the six PFAS compounds presented in the 06 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at former JPG because HFPO-DA is generally not a component of military specification AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS. The SI scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the former JPG QAPP Addendum (Arcadis 2023).

Groundwater samples were collected at four AOPIs. The presence of PFOS, PFOA, PFBS, PFNA, and/or PFHxS was identified in groundwater samples from three AOPIs. The highest PFOS detection in groundwater was from the Building 125 - Former Fire Station and Training Area AOPI at 150 ng/L, which exceeded the OSD risk screening level of 4 ng/L. The highest PFOA concentration detected in groundwater was from the Building 125 - Former Fire Station and Training Area AOPI at 9.4 ng/L, which exceeded the OSD risk screening level of 6 ng/L. The highest PFBS detection in groundwater was from the Building 125 - Former Fire Station and Training Area AOPI at 20 ng/L, which was less than the OSD risk screening level of 601 ng/L. The only detection of PFNA in groundwater was from the Building 127 - Former Fire Station AOPI at 2.1 J ng/L, which was less than the OSD risk screening level of 6 ng/L. The highest PFHxS concentration detected in groundwater was from the Building 125 - Former Fire Station and Training Area AOPI at 140 ng/L, which exceeded the OSD risk screening level of 39 ng/L. In total, three AOPIs had concentrations of PFOS, PFOA, PFBS, PFNA, and/or PFHxS in groundwater that exceeded OSD risk screening levels.

Soil samples were collected at four AOPIs. The presence of PFOS, PFOA, PFBS, PFNA, and/or PFHxS was identified in soil samples from four AOPIs. The highest PFOS detection in soil was from the Building 125 - Former Fire Station and Training Area AOPI at 0.036 mg/kg, which exceeded the OSD risk screening level of 0.013 mg/kg. The only PFOA detection in soil was from the Building 125 - Former Fire Station and Training Area AOPI at 0.00082 J mg/kg, which was lower than the OSD risk screening level of 0.019 mg/kg. PFBS was not detected in any soil samples collected. The only PFNA detection in soil was from the Building 125 - Former Fire Station and Training Area AOPI at 0.0016 mg/kg, which was lower than the OSD risk screening level of 0.019 mg/kg. The only PFHxS detection in soil was from the Building 127 - Former Fire Station AOPI at 0.0012 mg/kg, which was lower than the OSD risk screening level of 0.13 mg/kg. In total, one AOPI had concentrations of PFOS, PFOA, PFBS, PFNA, and/or PFHxS in soil that exceeded OSD risk screening levels.

Following the SI sampling, all four AOPIs with confirmed PFOS, PFOA, PFBS, PFNA, and/or PFHxS presence were considered to have complete or potentially complete exposure pathways. The soil exposure pathways for future on-site workers, recreational users, and hypothetical future residents are complete. The groundwater under the former JPG is not used for drinking water or for other purposes in any significant capacity due to the low yield of the shallow-bedrock groundwater-producing units in the area. It is highly unlikely that potable wells would be installed at the former JPG in the future. Nonetheless, as a conservative measure, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-site workers and hypothetical future residents are potentially complete to account for potential future potable use of the on-site groundwater downgradient of the AOPIs. Due to the absence of land use controls that prevent potable use of off-site groundwater, the groundwater exposure pathway for off-site drinking water receptors is potentially complete. Constituents in soil could migrate to surface water via stormwater runoff or shallow groundwater discharge. Therefore, the surface water and sediment exposure pathways are potentially complete for on-site workers and for off-site downstream recreational users.

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, PFBS, PFNA, and PFHxS to the OSD risk screening levels (**Table 6-1**). **Table 8-1** below summarizes the AOPIs identified at former JPG, PFOS, PFOA, PFBS, PFNA, and PFHxS sampling and recommendations for each AOPI; further investigation is warranted at former JPG. 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, PFBS, PFNA, and PFHxS Sampling at Former JPG, and Recommendations

AOPI Name	PFOS, PFOA, PFBS, PFNA, and/or PFHxS detected greater than OSD Risk Screening Levels? (Yes/No/ND)		Recommendation
	GW	SO	
Old Fire Training Pit	ND	No	No action at this time
Building 125 - Former Fire Station and Training Area	Yes	Yes	Further study in a remedial investigation
Building 127 - Former Fire Station	Yes	No	Further study in a remedial investigation
Building 186 Roof Fire	Yes	No	Further study in a remedial investigation

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
ND – non-detect; PFOS, PFOA, PFBS, PFNA, and/or PFHxS were not detected at the limit of detection (LOD)
No – PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected at concentrations above the LOD and less than the OSD Risk Screening Levels
SO – soil
Yes – PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected at concentrations greater than the OSD Risk Screening Levels

Data collected during the PA (**Sections 3 through 5**) and SI (**Sections 6 through 7**) were sufficient to draw conclusions and recommendations summarized above. The data limitations relevant to the development of this PA/SI for PFOS, PFOA, PFBS, PFNA, and PFHxS at former JPG are discussed below.

The installation is not active, is now operated by the USFWS and contractors, and some buildings and/or facilities of interest are abandoned or are reported to have been demolished. Due to former JPG closing in 1995, personnel interviews were limited due to the passing of certain former JPG personnel. Additionally, there is no information available on the volume or type of AFFF used, stored, and/or disposed of at the installation.

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, PFBS, PFNA, and PFHxS use) were limited to available installation personnel, whose knowledge of AFFF use may have been restricted by their time spent at the installation or previous roles held that limited their relevant knowledge of potential AFFF (or other PFAS-containing material) use.

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

The searches for ecological receptors and off-post PFOS, PFOA, PFBS, PFNA, and PFHxS 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, PFBS, PFNA, and PFHxS analytical data is limited to the results of the SI, which include groundwater and soil samples from the four AOPIs. Available data, including PFOS, PFOA, PFBS, PFNA, and PFHxS, is listed in **Appendix K**, which were analyzed per the selected analytical method. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI at former JPG; therefore, there are no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels.

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

9 REFERENCES

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

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

Arcadis. 2023. Final UFP QAPP Addendum, Revision 0, USAEC PFAS PA/SI, Jefferson Proving Ground, Indiana. March.

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

Army Material Command (AMC). 1995. Final Environmental Impact Statement. September.

CTI-URS. 2019. Site Closure Report Sewage Treatment Plant and Sewage Sludge Application Areas (Sites 2 & 27). July.

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

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

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

DoD and Department of Energy. 2021. Consolidated Quality Systems Manual for Environmental Laboratories, Version 5.4

Headquarters, Department of the Army. 2017. Legacy Base Realignment and Closure Installations Conveyance Progress Reports Section 1: Installation with Conveyances Remaining. October.

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

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

Montgomery Watson Harza (MWH). 2002. Phase II Remedial Investigation. September.

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

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

OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July.

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

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

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

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

USEPA. 2022. Regional Screening Levels (RSLs) – Generic Tables. Tables as of May 2022. Access online: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

ACRONYMS

ºF	degrees Fahrenheit
%	percent
AFFF	aqueous film-forming foam
AMC	Army Materiel Command
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	United States Army
bgs	below ground surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	conceptual site model
DoD	Department of Defense
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
FCR	Field Change Report
FD	field duplicate
GW	groundwater
HFPO-DA	hexafluoropropylene oxide dimer acid
IDW	investigation-derived waste
installation	United States Army or Reserve installation
IRP	Installation Restoration Program
J	The analyte was positively identified; however, the associated numerical value is an estimated concentration only.
JPG	Jefferson Proving Ground
LOD	limit of detection
LOQ	limit of quantitation
mg/kg	milligrams per kilogram (parts per million)

MS	matrix spike
MSD	matrix spike duplicate
MWH	Montgomery Watson Harza
ND	non-detect
ng/L	nanograms per liter (parts per trillion)
NPDES	National Pollutant Discharge Elimination System
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexane sulfonate
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	parts per million
ppt	parts per trillion
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RSL	Regional Screening Level
SB	source blank
SI	site inspection
SO	soil
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
STP	sewage treatment plant
TGI	technical guidance instruction
TOC	total organic carbon

U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UXO	unexploded ordnance

TABLES

Table 7-1 - Groundwater PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Former Jefferson Proving Ground, Indiana

AOPI	Location	Sample/ Duplicate ID	Sample Date	Analyte	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)		PFNA (ng/L)		PFHxS (ng/L)	
				OSD Tapwater Risk Screening Level	4		6		601		6		39	
				Sample Type	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Building 125 - Former Fire Station and Fire Training Area	JPG-B125-GW-1	JPG-B125-GW-1-041223	4/12/2023	N	**130**		**9.2**		**17**		3.6	U	**120**	
		JPG-FD-1-GW-041223	4/12/2023	FD	**150**		**9.4**		**20**		3.6	U	**140**	
Building 127 - Former Fire Station	JPG-B127-GW-1	JPG-B127-GW-1-041123	4/11/2023	N	**120**		**6.7**		**5.1**		**2.1**	J	**61**	
Building 186 Roof Fire	JPG-B186-GW-1	JPG-B186-GW-1-041223	4/12/2023	N	**140**		**8.1**		**12**		3.7	U	**89**	
	JPG-B186-GW-2	JPG-B186-GW-2-041223	4/12/2023	N	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U
Old Fire Training Pit	JPG-OFTP-GW-1	JPG-OFTP-GW-1-032923	3/29/2023	N	3.8	U	3.8	U	3.8	U	3.8	U	3.8	U
		JPG-FD-1-GW-032923	3/29/2023	FD	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U

Table 7-1 - Groundwater PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Former Jefferson Proving Ground, Indiana

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection.
2. Gray shaded values indicate the result was detected greater than the 2022 Office of the Secretary of Defense (OSD) risk screening levels, (OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July).

Acronyms/Abbreviations:
-- = not applicable
AOPI = area of potential interest
FD = field duplicate sample
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
PFNA = perfluorononanoic acid
PFHxS = perfluorohexane sulfonate
Qual = qualifier

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

Table 7-2 Soil PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Former Jefferson Proving Ground, Indiana

AOPI	Location	Sample ID / Duplicate ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)		PFNA (mg/kg)		PFHxS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	0.16		0.25		25		0.25		1.6	
				OSD Residential Risk Screening Level	0.013		0.019		1.9		0.019		0.13	
				Sample Type	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Building 125 - Former Fire Station and Fire Training Area	JPG-B125-SO-1	JPG-B125-SO-1-032823	3/28/2023	N	**0.0019**		0.0011	U	0.0011	U	0.0011	U	0.0011	U
	JPG-B125-SO-2	JPG-B125-SO-2-032823	03/28/2023	N	**0.0028**		0.001	U	0.001	U	0.001	U	0.001	U
	JPG-B125-SO-3	JPG-B125-SO-3-032823	03/28/2023	N	**0.036**		**0.00082**	J	0.0011	U	**0.0016**		0.0011	U
	JPG-B125-SO-4	JPG-B125-SO-4-032823	03/28/2023	N	**0.0017**		0.00099	U	0.00099	U	0.00099	U	0.00099	U
	JPG-B125-SO-5	JPG-B125-SO-5-032823	03/28/2023	N	**0.001**	J	0.0011	U	0.0011	U	0.0011	U	0.0011	U
Building 127 - Former Fire Station	JPG-B127-SO-1	JPG-B127-SO-1-041123	04/11/2023	N	0.0012	U	0.0012	U	0.0012	U	0.0012	U	0.0012	U
		JPG-FD-1-SO-041123	04/11/2023	FD	0.0011	U	0.0011	U	0.0011	U	0.0011	U	0.0011	U
	JPG-B127-SO-2	JPG-B127-SO-2-032923	03/29/2023	N	0.0011	U	0.0011	U	0.0011	U	0.0011	U	0.0011	U
	JPG-B127-SO-3	JPG-B127-SO-3-032923	03/29/2023	N	0.0011	U	0.0011	U	0.0011	U	0.0011	U	0.0011	U
	JPG-B127-SO-4	JPG-B127-SO-4-032923	03/29/2023	N	0.001	U	0.001	U	0.001	U	0.001	U	**0.0012**	
	JPG-B127-SO-5	JPG-B127-SO-5-032923	03/29/2023	N	0.0011	U	0.0011	U	0.0011	U	0.0011	U	0.0011	U
Building 186 Roof Fire	JPG-B186-SO-1	JPG-B186-SO-1-032923	03/29/2023	N	**0.0019**		0.001	U	0.001	U	0.001	U	0.001	U
	JPG-B186-SO-2	JPG-B186-SO-2-041223	04/12/2023	N	0.0011	U	0.0011	U	0.0011	U	0.0011	U	0.0011	U
	JPG-B186-SO-3	JPG-B186-SO-3-032923	03/29/2023	N	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
	JPG-B186-SO-4	JPG-B186-SO-4-032923	03/29/2023	N	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
	JPG-B186-SO-5	JPG-B186-SO-5-032923	03/29/2023	N	**0.00055**	J	0.0011	U	0.0011	U	0.0011	U	0.0011	U
Old Fire Training Pit	JPG-OFTP-SO-1	JPG-OFTP-SO-1-032923	03/29/2023	N	**0.00099**	J	0.0012	U	0.0012	U	0.0012	U	0.0012	U
		JPG-FD-1-SO-032923	03/29/2023	FD	0.0011	U	0.0011	U	0.0011	U	0.0011	U	0.0011	U
	JPG-OFTP-SO-2	JPG-OFTP-SO-2-032923	03/29/2023	N	**0.00077**	J	0.001	U	0.001	U	0.001	U	0.001	U
	JPG-OFTP-SO-3	JPG-OFTP-SO-3-032923	03/29/2023	N	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U

Table 7-2 Soil PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Former Jefferson Proving Ground, Indiana

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. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July).
3. Gray shaded values indicate the result was detected greater than the residential scenario risk screening levels (OSD 2022).
4. Gray shaded and italicized values indicate the result was detected greater than the industrial/commercial scenario (i.e., and therefore greater than the residential scenario) risk screening levels (OSD 2022).

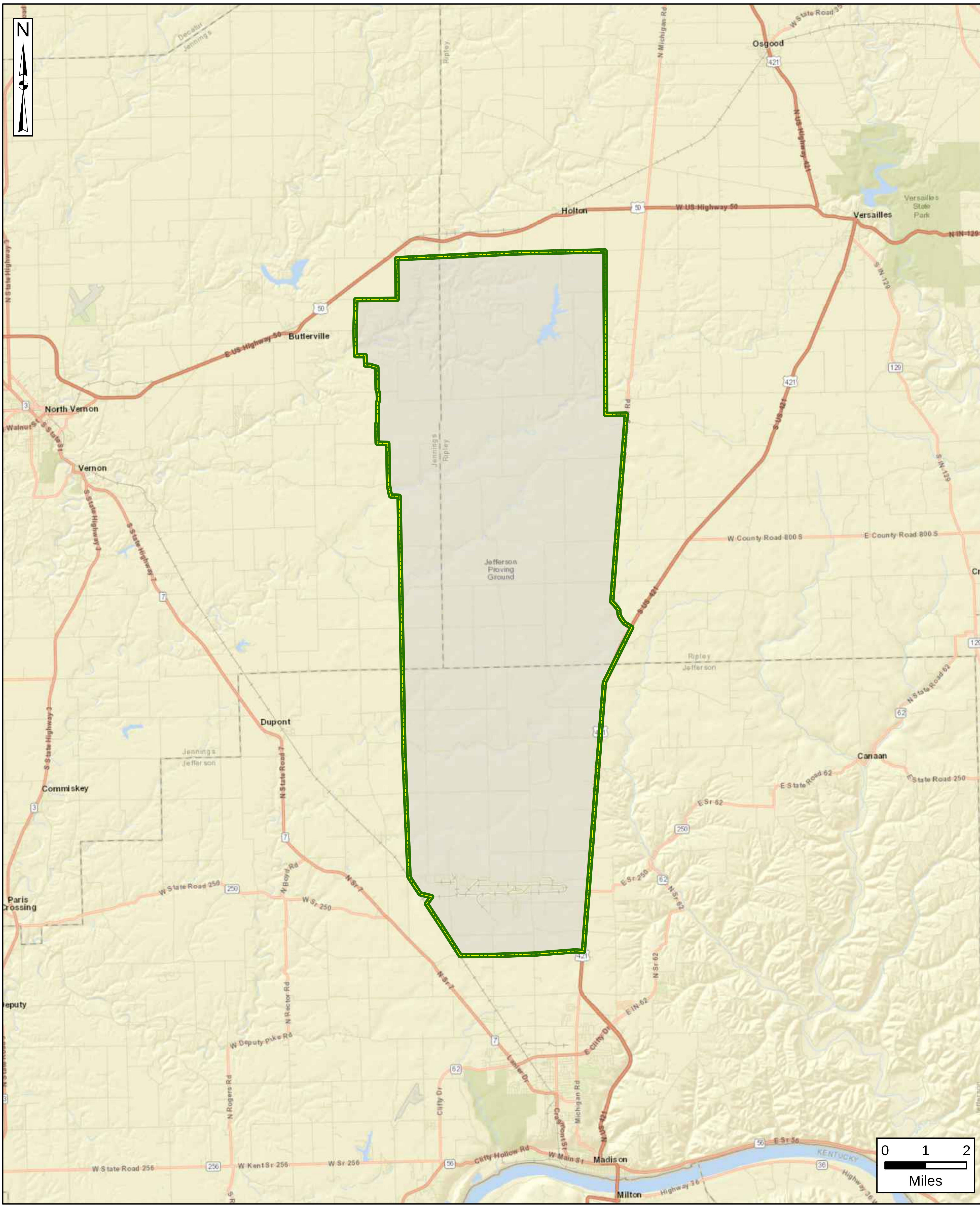
Acronyms/Abbreviations:
-- = not applicable
AOPI = area of potential interest
FD = field duplicate sample
ID = identification
mg/kg = milligrams per kilogram (parts per million)
N = primary sample
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
PFNA = perfluorononanoic acid
PFHxS = perfluorohexane sulfonate
Qual = qualifier

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

FIGURES

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 2-1
Site Location



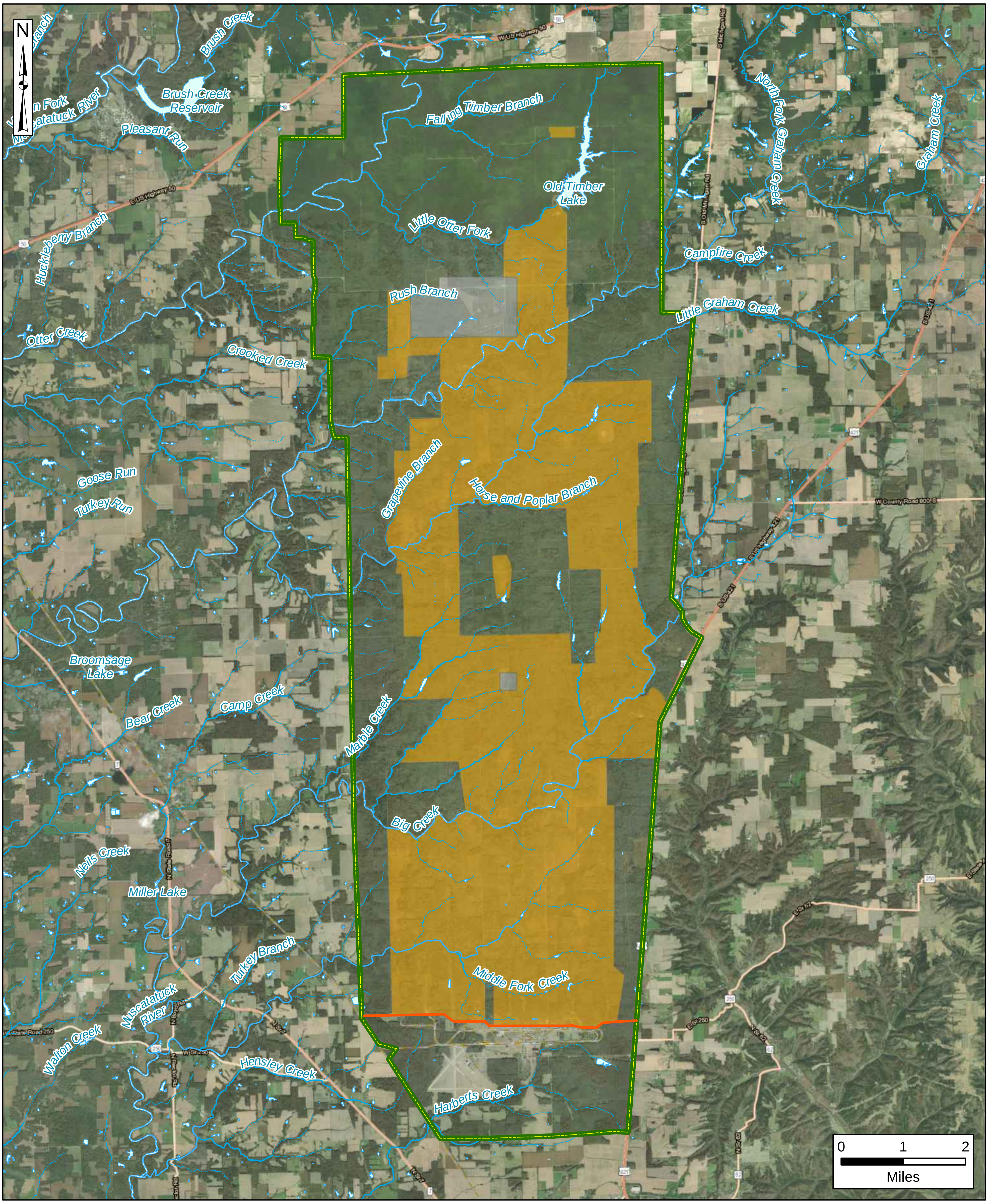
Installation Boundary

Data Sources:
ESRI, ArcGIS Online, Street Map

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 2-2
Site Layout



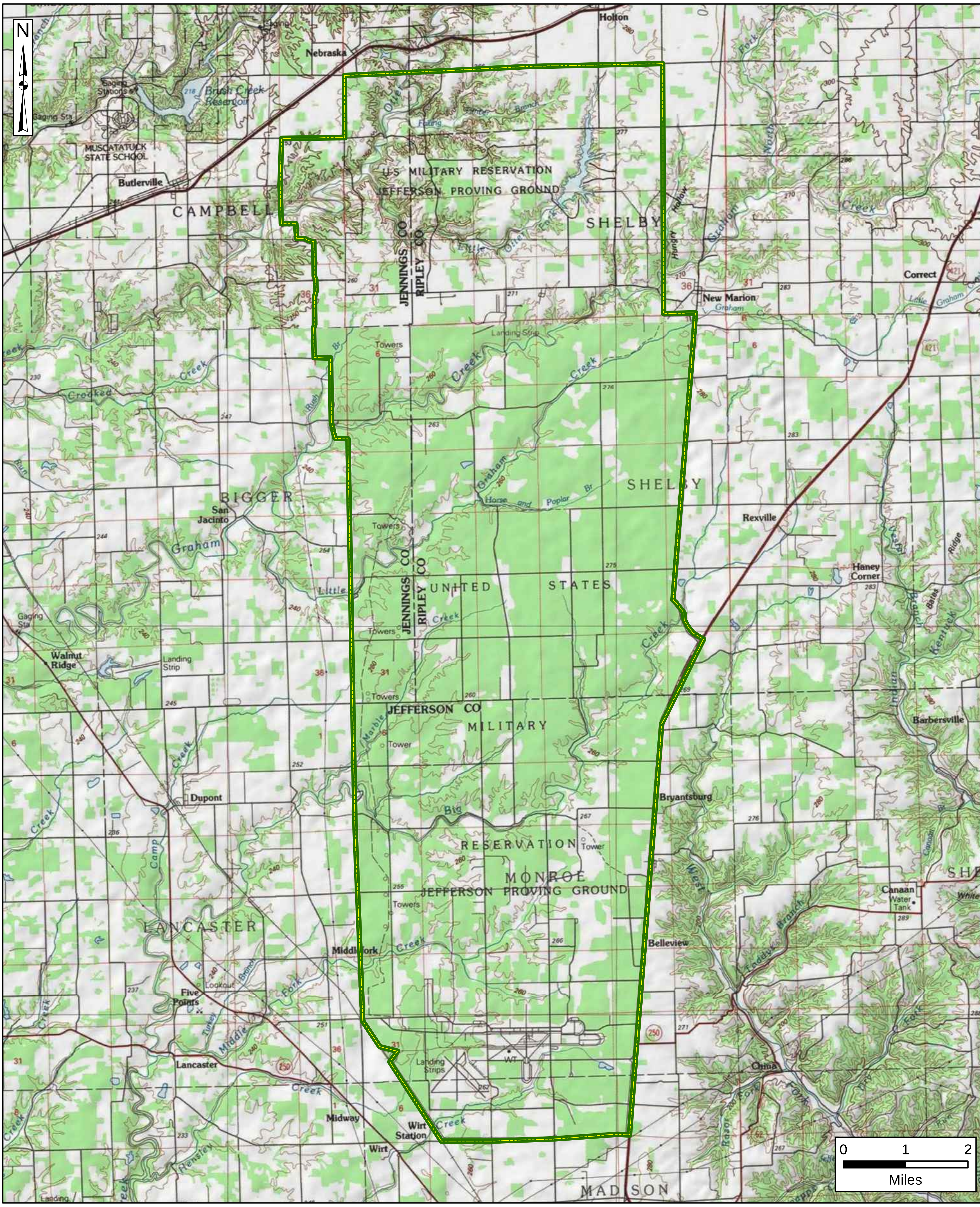
Installation Boundary
River/Stream (Perennial)
Stream (Intermittent)
Water Body
Closed - No Access
Air National Guard Range - No Access
Firing Line

Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 2-3
Topographic Map



Installation Boundary

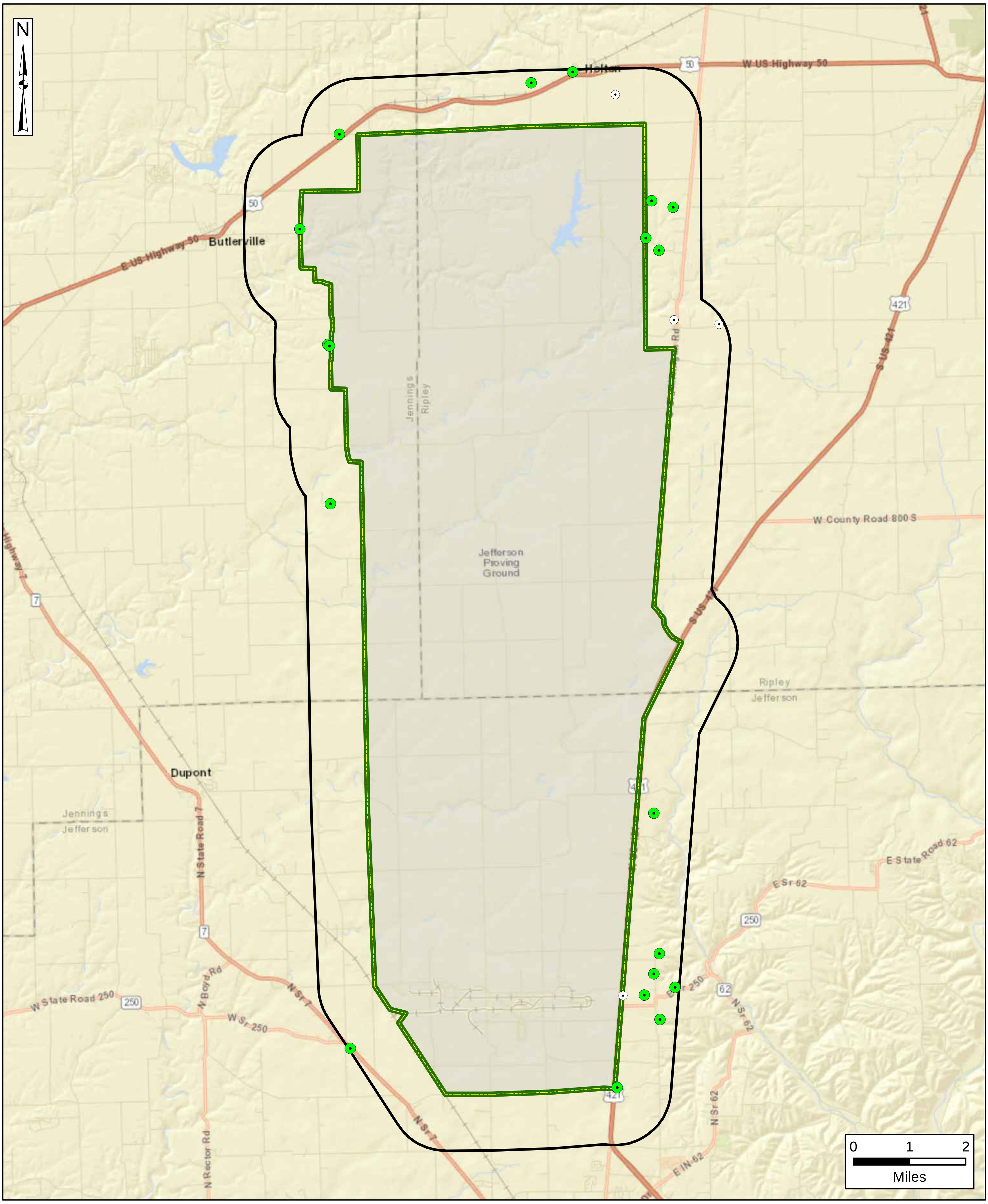
Note: Elevations shown are in feet.

Data Sources:
ESRI, ArcGIS Online, USGS Topo Map

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 2-4
Off-Post Potable Supply Wells



Installation Boundary

1-Mile Radius

Domestic Use Well

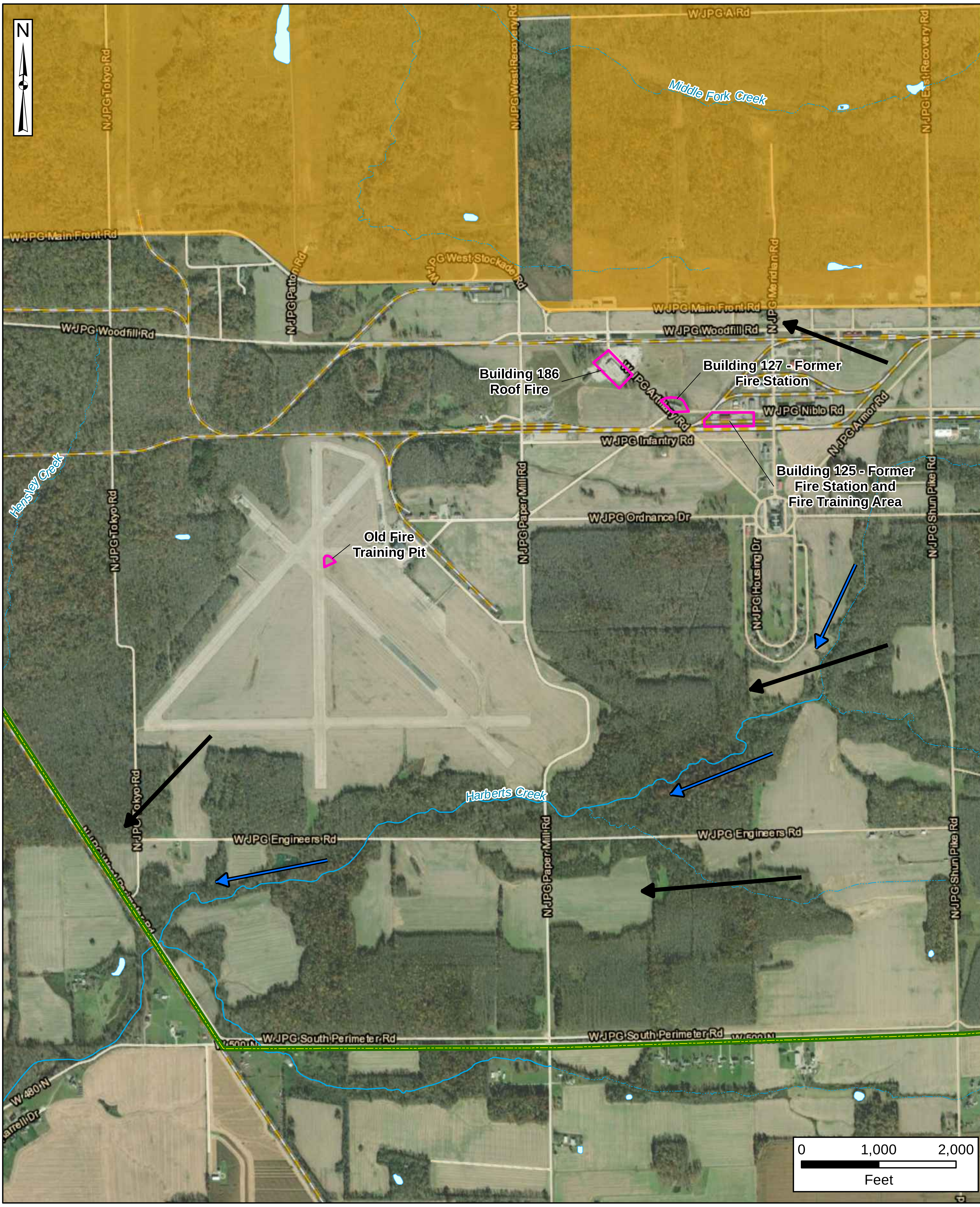
Well Use Not Reported

Data Sources:
EDR Well Data, 2023
INDNR Well Data, 2019
ESRI, ArcGIS Online, StreetMap

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 5-2
AOPI Locations



Installation Boundary	Closed - No Access
River/Stream (Perennial)	AOPI
Stream (Intermittent)	
Water Body	
Surface Water Flow Direction	
Regional Groundwater Flow Direction	

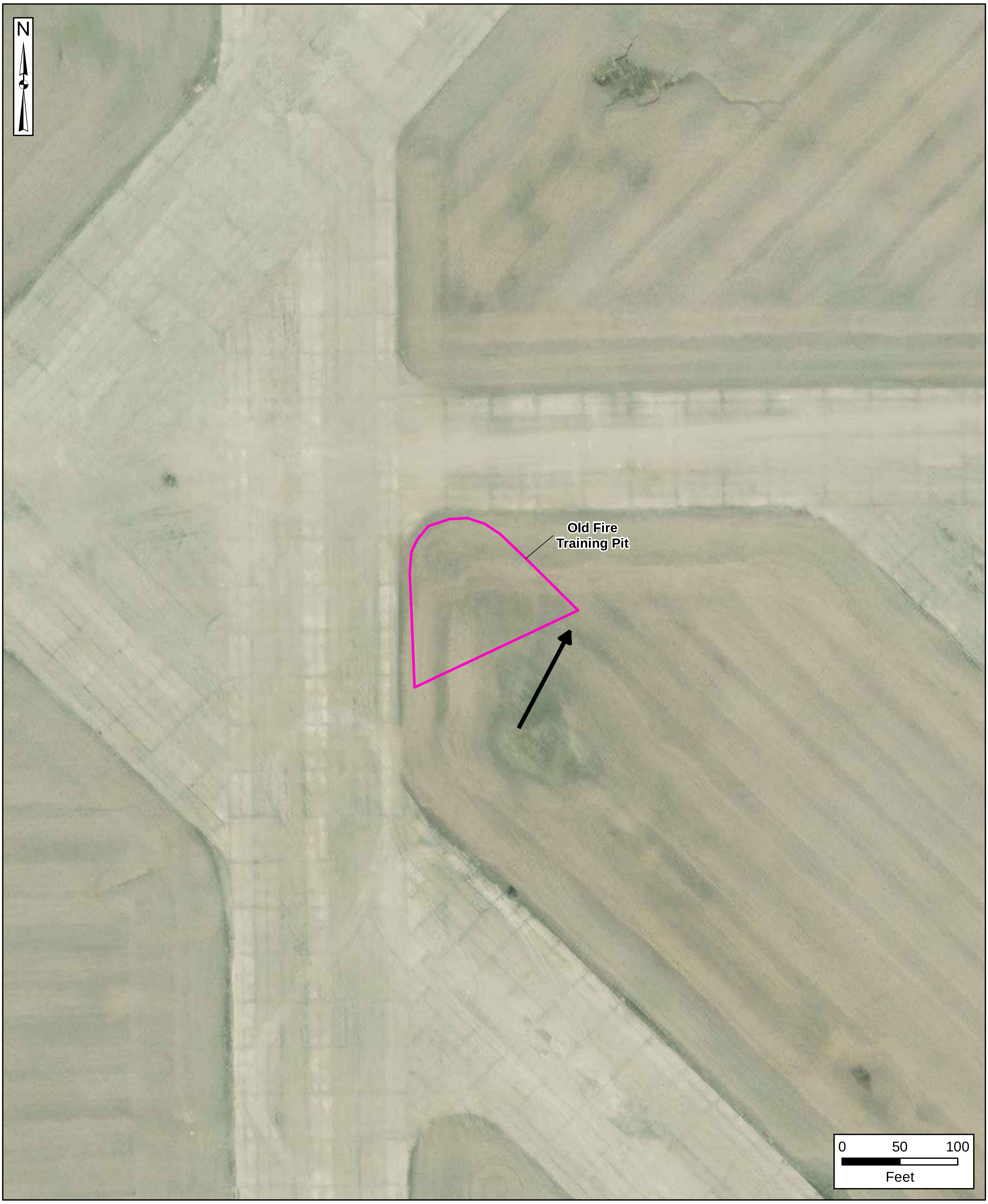
AOPI = area of potential interest

Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery
Surface and Groundwater Flow, Montgomery Watson
Harza. 2002. Phase II Remedial Investigation. September.

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 5-3
Aerial Photo of
Old Fire Training Pit AOPI



Installation Boundary

AOPI

Groundwater Flow Direction

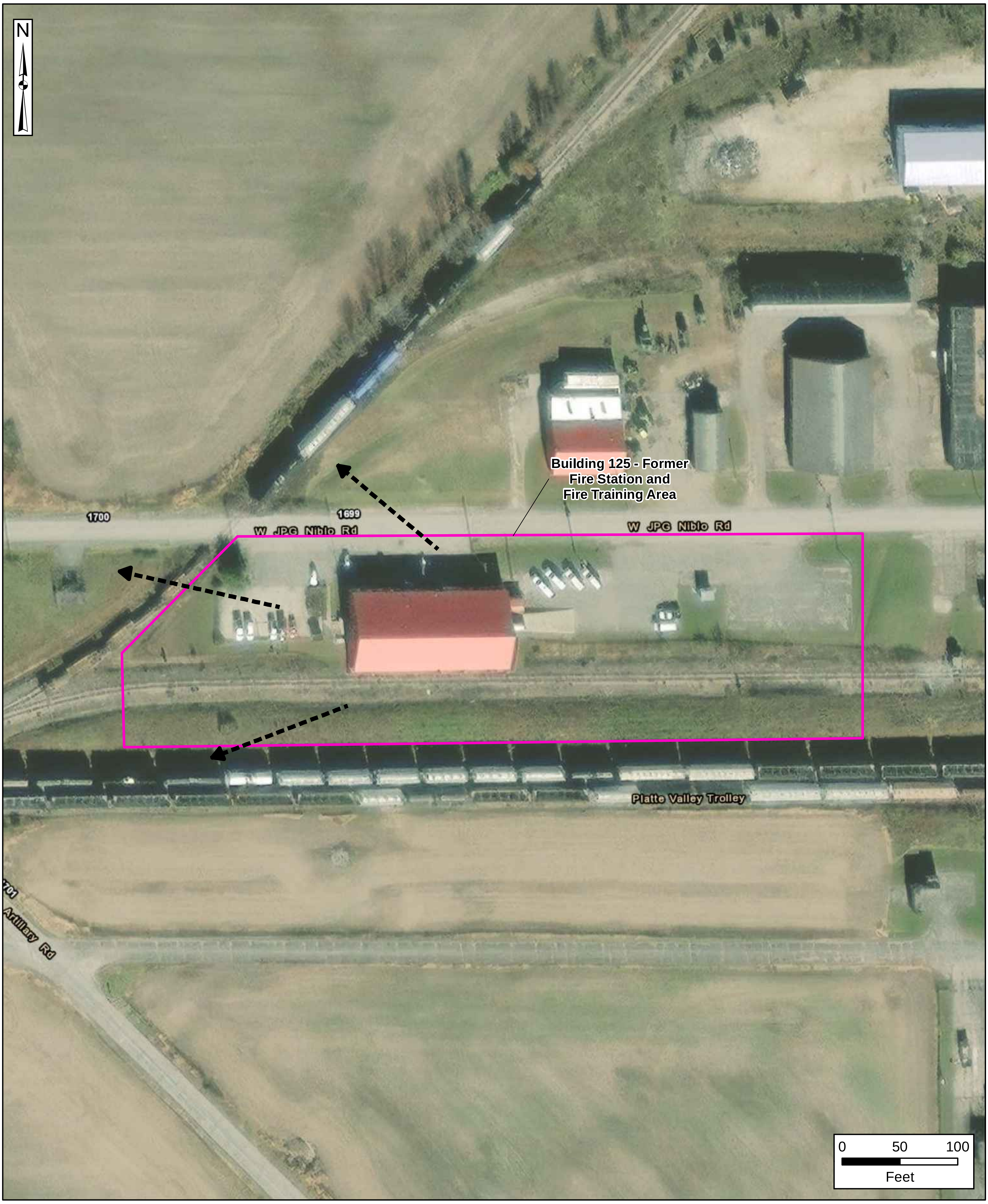
AOPI = area of potential interest

Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 5-4
Aerial Photo of Building 125 -
Former Fire Station and Fire Training Area AOPI



Installation Boundary

AOPI

Inferred Groundwater Flow Direction

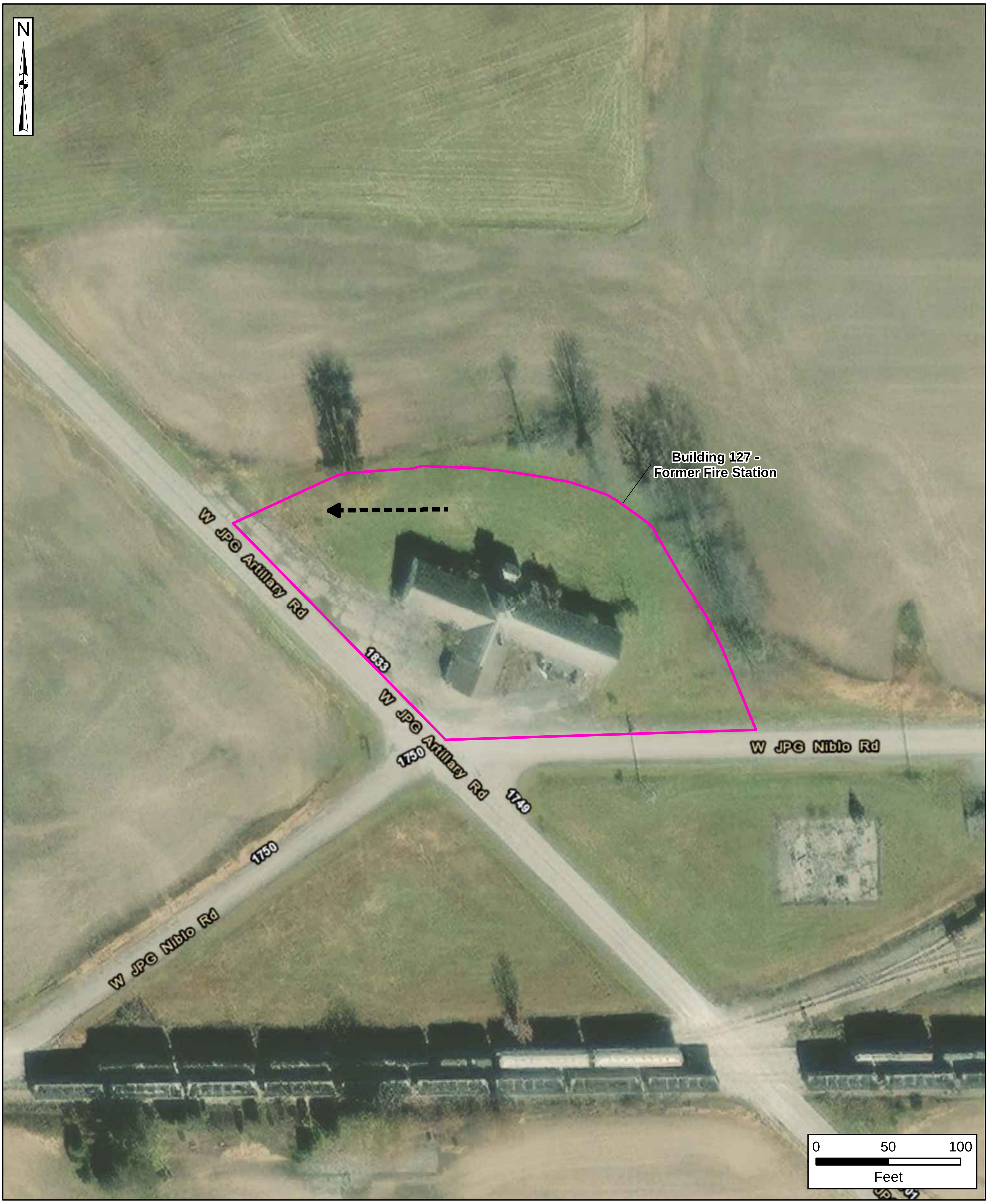
AOPI = area of potential interest

Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 5-5
Aerial Photo of
Building 127 - Former Fire Station AOPI



Installation Boundary

AOPI

Inferred Groundwater Flow Direction

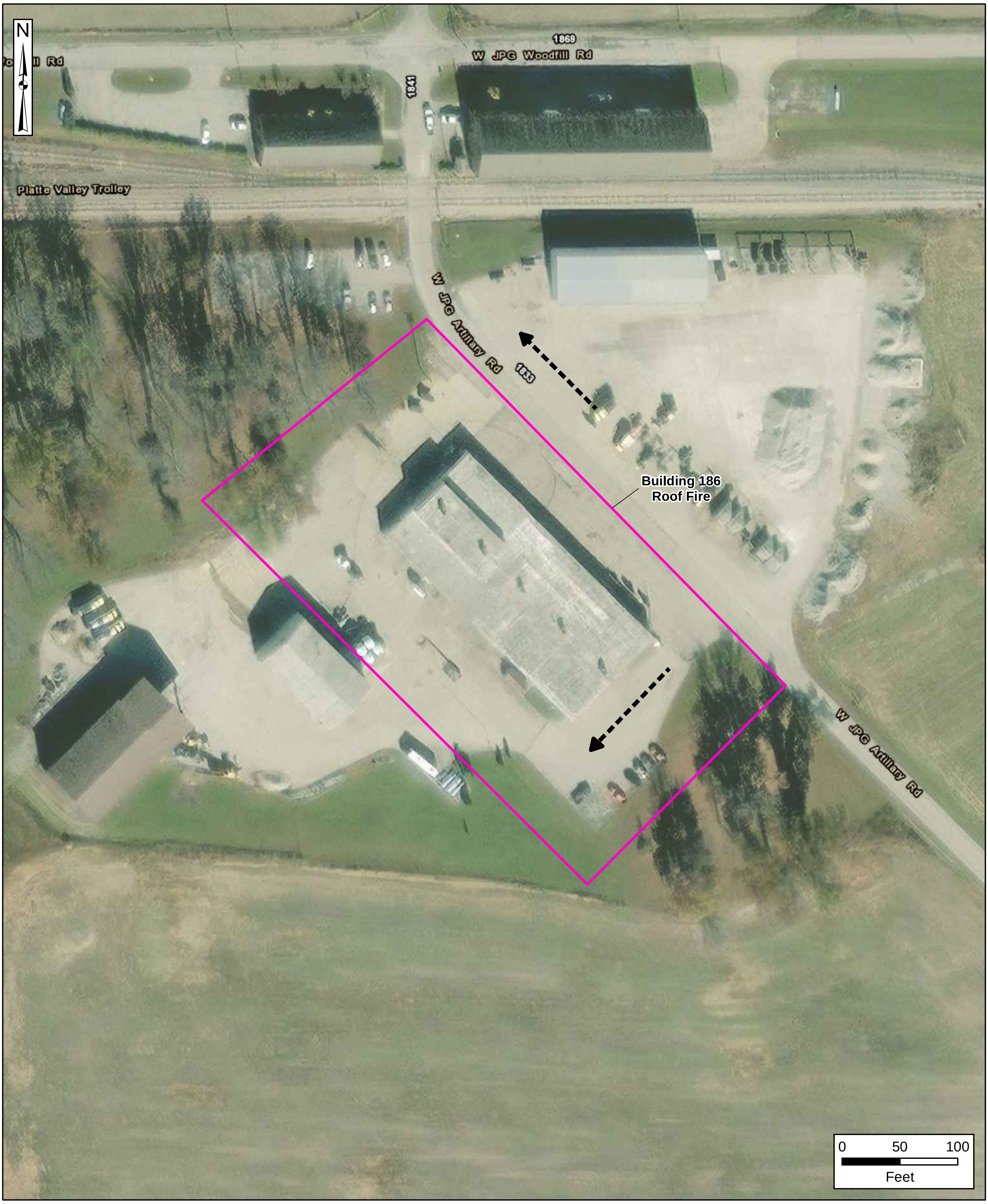
AOPI = area of potential interest

Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 5-6
Aerial Photo of
Building 186 Roof Fire AOPI



Installation Boundary

AOPI

Inferred Groundwater Flow Direction

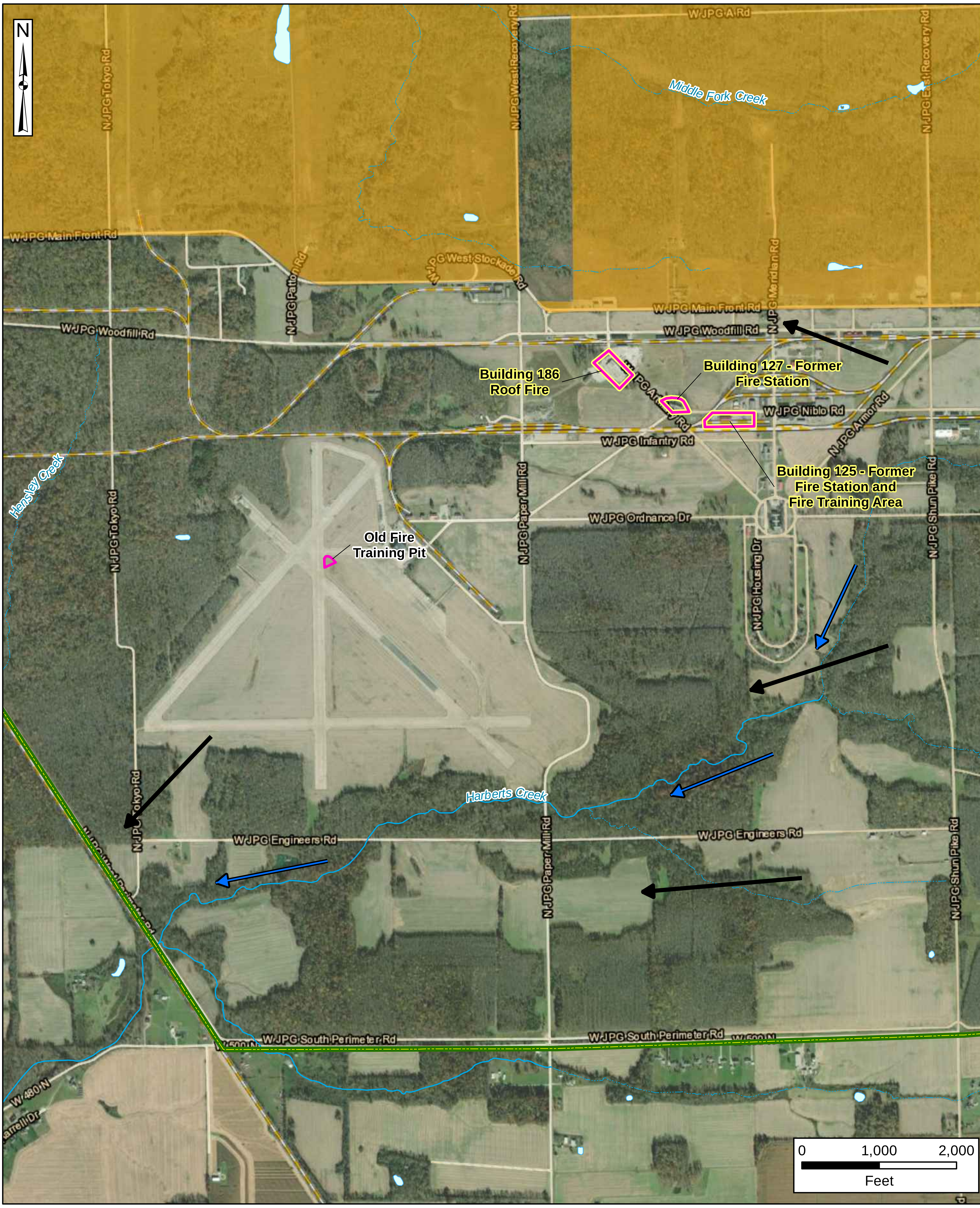
AOPI = area of potential interest

Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

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



Installation Boundary
River/Stream (Perennial)
Stream (Intermittent)
Water Body
Surface Water Flow Direction
Regional Groundwater Flow Direction

Closed - No Access
AOPI
AOPI with OSD Risk Screening Level Exceedance

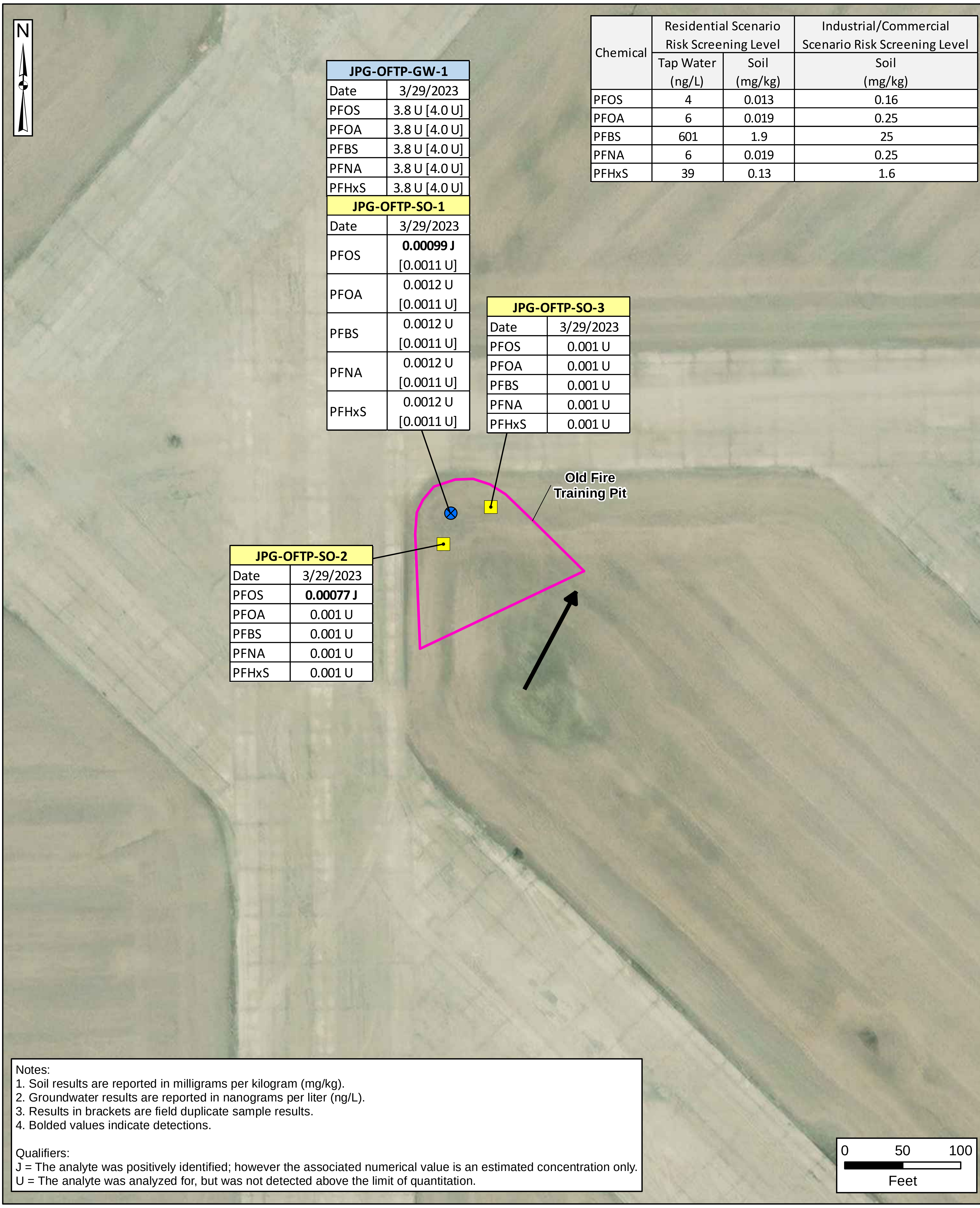
AOPI = area of interest
OSD = Office of the Secretary of Defense

Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery
Surface and Groundwater Flow, Montgomery Watson
Harza. 2002. Phase II Remedial Investigation. September.

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 7-2
Old Fire Training Pit AOPI
PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results



Chemical	Residential Scenario Risk Screening Level		Industrial/Commercial Scenario Risk Screening Level
	Tap Water (ng/L)	Soil (mg/kg)	Soil (mg/kg)
PFOS	4	0.013	0.16
PFOA	6	0.019	0.25
PFBS	601	1.9	25
PFNA	6	0.019	0.25
PFHxS	39	0.13	1.6

JPG-OFTP-GW-1	
Date	3/29/2023
PFOS	3.8 U [4.0 U]
PFOA	3.8 U [4.0 U]
PFBS	3.8 U [4.0 U]
PFNA	3.8 U [4.0 U]
PFHxS	3.8 U [4.0 U]

JPG-OFTP-SO-1	
Date	3/29/2023
PFOS	**0.00099 J** [0.0011 U]
PFOA	0.0012 U [0.0011 U]
PFBS	0.0012 U [0.0011 U]
PFNA	0.0012 U [0.0011 U]
PFHxS	0.0012 U [0.0011 U]

JPG-OFTP-SO-3	
Date	3/29/2023
PFOS	0.001 U
PFOA	0.001 U
PFBS	0.001 U
PFNA	0.001 U
PFHxS	0.001 U

JPG-OFTP-SO-2	
Date	3/29/2023
PFOS	**0.00077 J**
PFOA	0.001 U
PFBS	0.001 U
PFNA	0.001 U
PFHxS	0.001 U

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

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

Installation Boundary
AOPI
Groundwater Flow Direction

Sample Locations
Shallow Soil
Shallow Soil and Grab Groundwater

AOPI = area of potential interest
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

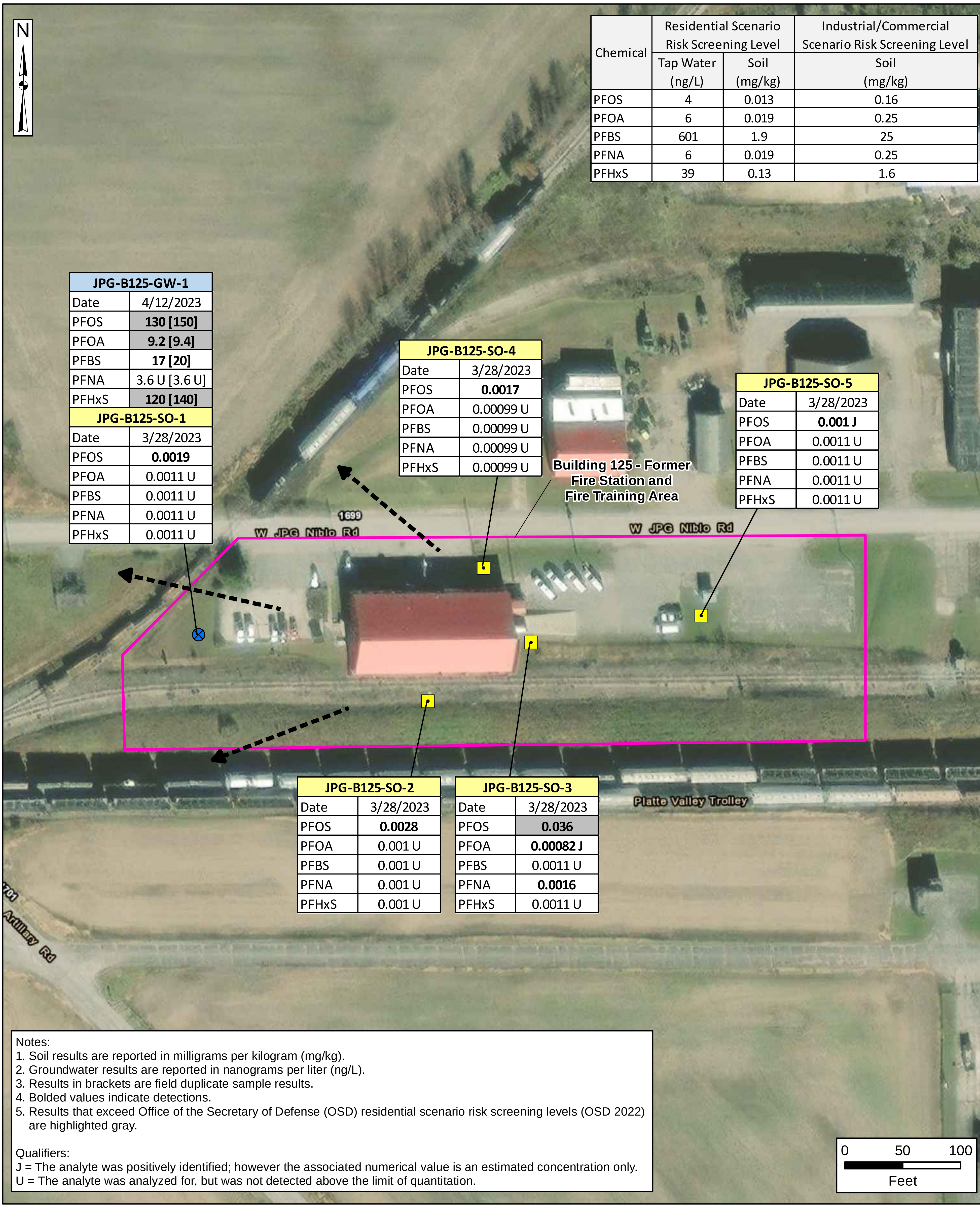
Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 7-3
Building 125 - Former Fire Station and Training Area AOPI
PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results

Chemical	Residential Scenario Risk Screening Level		Industrial/Commercial Scenario Risk Screening Level
	Tap Water (ng/L)	Soil (mg/kg)	Soil (mg/kg)
PFOS	4	0.013	0.16
PFOA	6	0.019	0.25
PFBS	601	1.9	25
PFNA	6	0.019	0.25
PFHxS	39	0.13	1.6



JPG-B125-GW-1	
Date	4/12/2023
PFOS	**130 [150]**
PFOA	**9.2 [9.4]**
PFBS	**17 [20]**
PFNA	3.6 U [3.6 U]
PFHxS	**120 [140]**

JPG-B125-SO-1	
Date	3/28/2023
PFOS	**0.0019**
PFOA	0.0011 U
PFBS	0.0011 U
PFNA	0.0011 U
PFHxS	0.0011 U

JPG-B125-SO-4	
Date	3/28/2023
PFOS	**0.0017**
PFOA	0.00099 U
PFBS	0.00099 U
PFNA	0.00099 U
PFHxS	0.00099 U

JPG-B125-SO-5	
Date	3/28/2023
PFOS	**0.001 J**
PFOA	0.0011 U
PFBS	0.0011 U
PFNA	0.0011 U
PFHxS	0.0011 U

JPG-B125-SO-2	
Date	3/28/2023
PFOS	**0.0028**
PFOA	0.001 U
PFBS	0.001 U
PFNA	0.001 U
PFHxS	0.001 U

JPG-B125-SO-3	
Date	3/28/2023
PFOS	**0.036**
PFOA	**0.00082 J**
PFBS	0.0011 U
PFNA	**0.0016**
PFHxS	0.0011 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Results in brackets are field duplicate sample results.
4. Bolded values indicate detections.
5. Results that exceed Office of the Secretary of Defense (OSD) residential scenario risk screening levels (OSD 2022) are highlighted gray.

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

Installation Boundary
AOPI
Inferred Groundwater Flow Direction

Sample Locations
Shallow Soil
Shallow Soil and Grab Groundwater

AOPI = area of potential interest
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

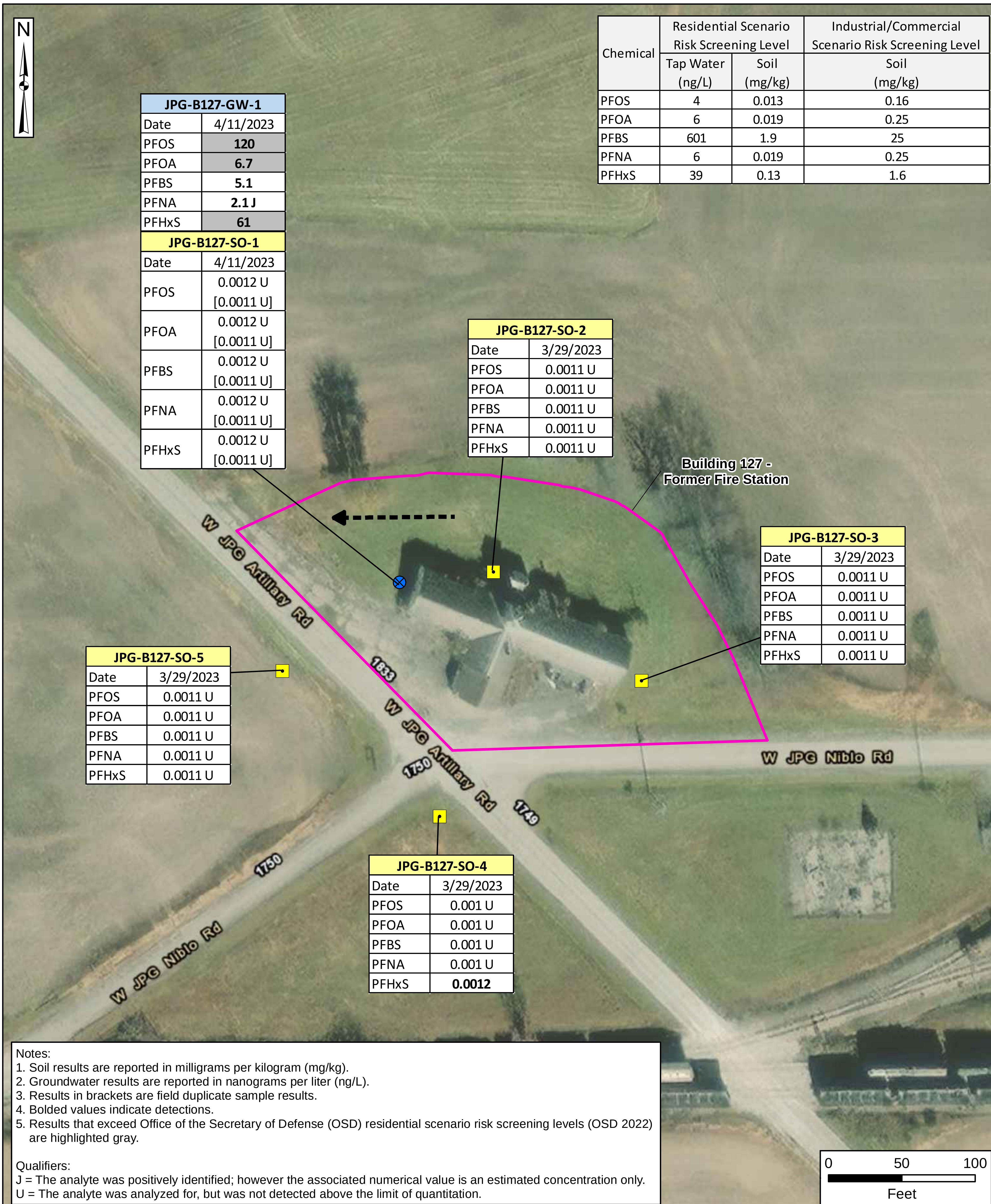
Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

ARCADIS

Figure 7-4
Building 127 - Former Fire Station AOPI
PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results



Chemical	Residential Scenario Risk Screening Level		Industrial/Commercial Scenario Risk Screening Level
	Tap Water (ng/L)	Soil (mg/kg)	Soil (mg/kg)
PFOS	4	0.013	0.16
PFOA	6	0.019	0.25
PFBS	601	1.9	25
PFNA	6	0.019	0.25
PFHxS	39	0.13	1.6

JPG-B127-GW-1	
Date	4/11/2023
PFOS	**120**
PFOA	**6.7**
PFBS	**5.1**
PFNA	**2.1 J**
PFHxS	**61**

JPG-B127-SO-1	
Date	4/11/2023
PFOS	0.0012 U [0.0011 U]
PFOA	0.0012 U [0.0011 U]
PFBS	0.0012 U [0.0011 U]
PFNA	0.0012 U [0.0011 U]
PFHxS	0.0012 U [0.0011 U]

JPG-B127-SO-2	
Date	3/29/2023
PFOS	0.0011 U
PFOA	0.0011 U
PFBS	0.0011 U
PFNA	0.0011 U
PFHxS	0.0011 U

JPG-B127-SO-3	
Date	3/29/2023
PFOS	0.0011 U
PFOA	0.0011 U
PFBS	0.0011 U
PFNA	0.0011 U
PFHxS	0.0011 U

JPG-B127-SO-5	
Date	3/29/2023
PFOS	0.0011 U
PFOA	0.0011 U
PFBS	0.0011 U
PFNA	0.0011 U
PFHxS	0.0011 U

JPG-B127-SO-4	
Date	3/29/2023
PFOS	0.001 U
PFOA	0.001 U
PFBS	0.001 U
PFNA	0.001 U
PFHxS	**0.0012**

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Results in brackets are field duplicate sample results.
4. Bolded values indicate detections.
5. Results that exceed Office of the Secretary of Defense (OSD) residential scenario risk screening levels (OSD 2022) are highlighted gray.

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

0 50 100
Feet

Installation Boundary
AOPI
Inferred Groundwater Flow Direction

Sample Locations
Shallow Soil
Shallow Soil and Grab Groundwater

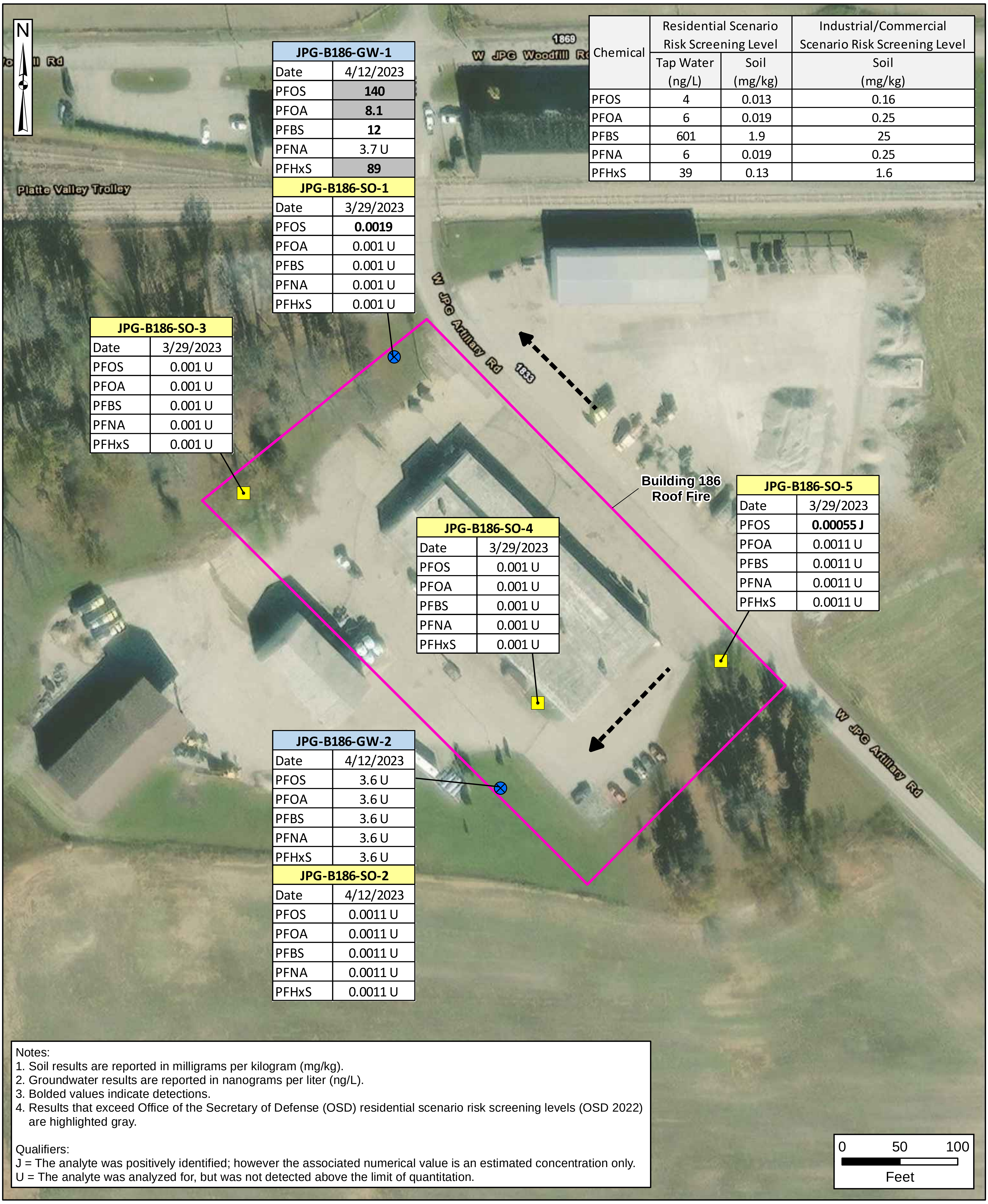
AOPI = area of potential interest
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North

USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, IN

Figure 7-5
Building 186 Roof Fire AOPI
PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results



Chemical	Residential Scenario Risk Screening Level		Industrial/Commercial Scenario Risk Screening Level
	Tap Water (ng/L)	Soil (mg/kg)	Soil (mg/kg)
PFOS	4	0.013	0.16
PFOA	6	0.019	0.25
PFBS	601	1.9	25
PFNA	6	0.019	0.25
PFHxS	39	0.13	1.6

JPG-B186-GW-1	
Date	4/12/2023
PFOS	**140**
PFOA	**8.1**
PFBS	**12**
PFNA	3.7 U
PFHxS	**89**

JPG-B186-SO-1	
Date	3/29/2023
PFOS	**0.0019**
PFOA	0.001 U
PFBS	0.001 U
PFNA	0.001 U
PFHxS	0.001 U

JPG-B186-SO-3	
Date	3/29/2023
PFOS	0.001 U
PFOA	0.001 U
PFBS	0.001 U
PFNA	0.001 U
PFHxS	0.001 U

JPG-B186-SO-5	
Date	3/29/2023
PFOS	**0.00055 J**
PFOA	0.0011 U
PFBS	0.0011 U
PFNA	0.0011 U
PFHxS	0.0011 U

JPG-B186-SO-4	
Date	3/29/2023
PFOS	0.001 U
PFOA	0.001 U
PFBS	0.001 U
PFNA	0.001 U
PFHxS	0.001 U

JPG-B186-GW-2	
Date	4/12/2023
PFOS	3.6 U
PFOA	3.6 U
PFBS	3.6 U
PFNA	3.6 U
PFHxS	3.6 U

JPG-B186-SO-2	
Date	4/12/2023
PFOS	0.0011 U
PFOA	0.0011 U
PFBS	0.0011 U
PFNA	0.0011 U
PFHxS	0.0011 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Bolded values indicate detections.
4. Results that exceed Office of the Secretary of Defense (OSD) residential scenario risk screening levels (OSD 2022) are highlighted gray.

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

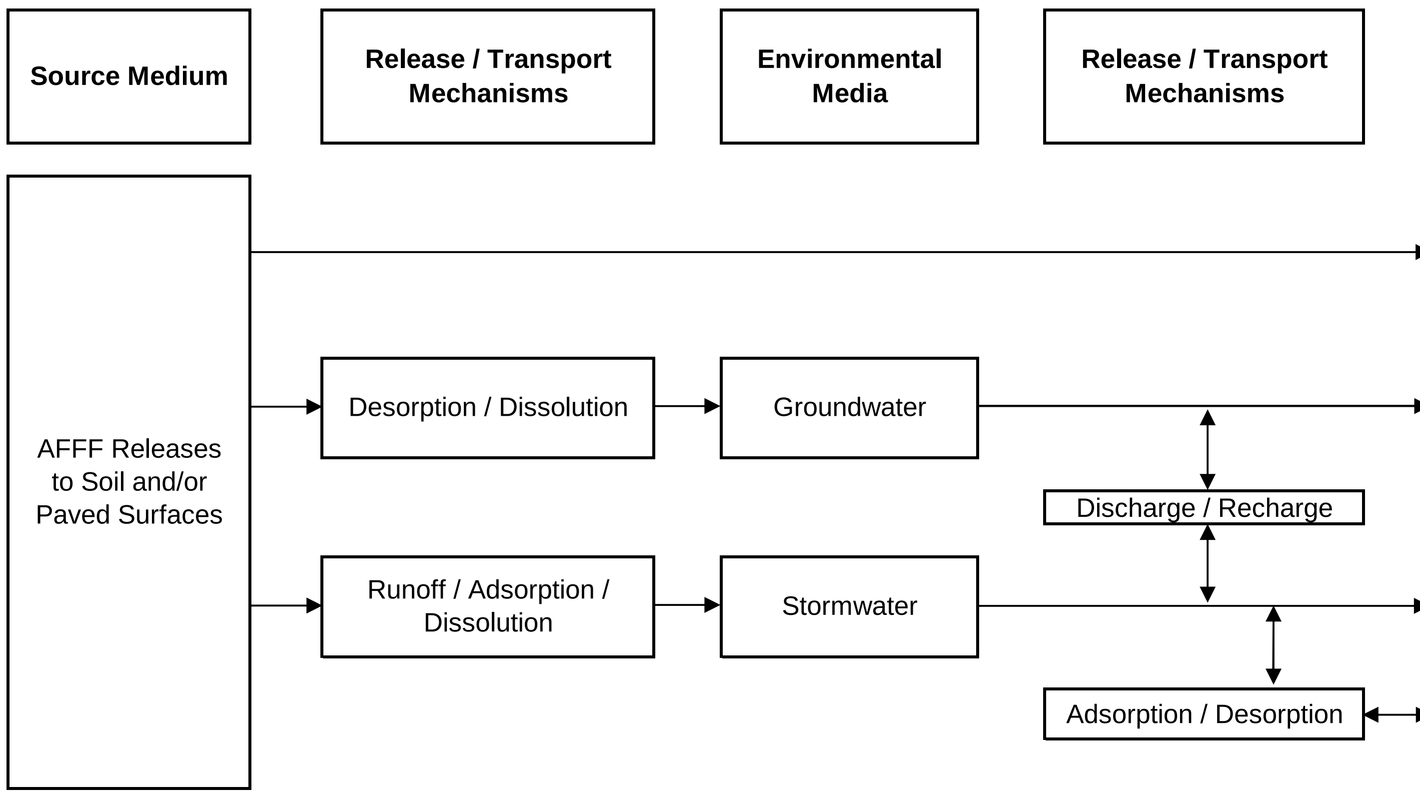
Installation Boundary
AOPI
Inferred Groundwater Flow Direction

Sample Locations
Shallow Soil
Shallow Soil and Grab Groundwater

AOPI = area of potential interest
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
NHD, Hydrology Data, 2023
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 16 North



Exposure Media	Exposure Route	Human Receptors: On-Site [1]: Site Worker	Human Receptors: On-Site [1]: Resident	Human Receptors: On-Site [1]: Recreational User	Human Receptors: Off-Site: All Types of Receptors [3]
Soil	Ingestion	●	●	●	○
	Dermal Contact	●	●	●	○
	Inhalation (dust)	●	●	●	○
Groundwater	Ingestion	◐	◐	○	◐
	Dermal Contact	◐	◐	○	◐
Surface Water [2]	Ingestion	◐	○	○	◐
	Dermal Contact	◐	○	○	◐
Sediment	Ingestion	◐	○	○	◐
	Dermal Contact	◐	○	○	◐

Legend:

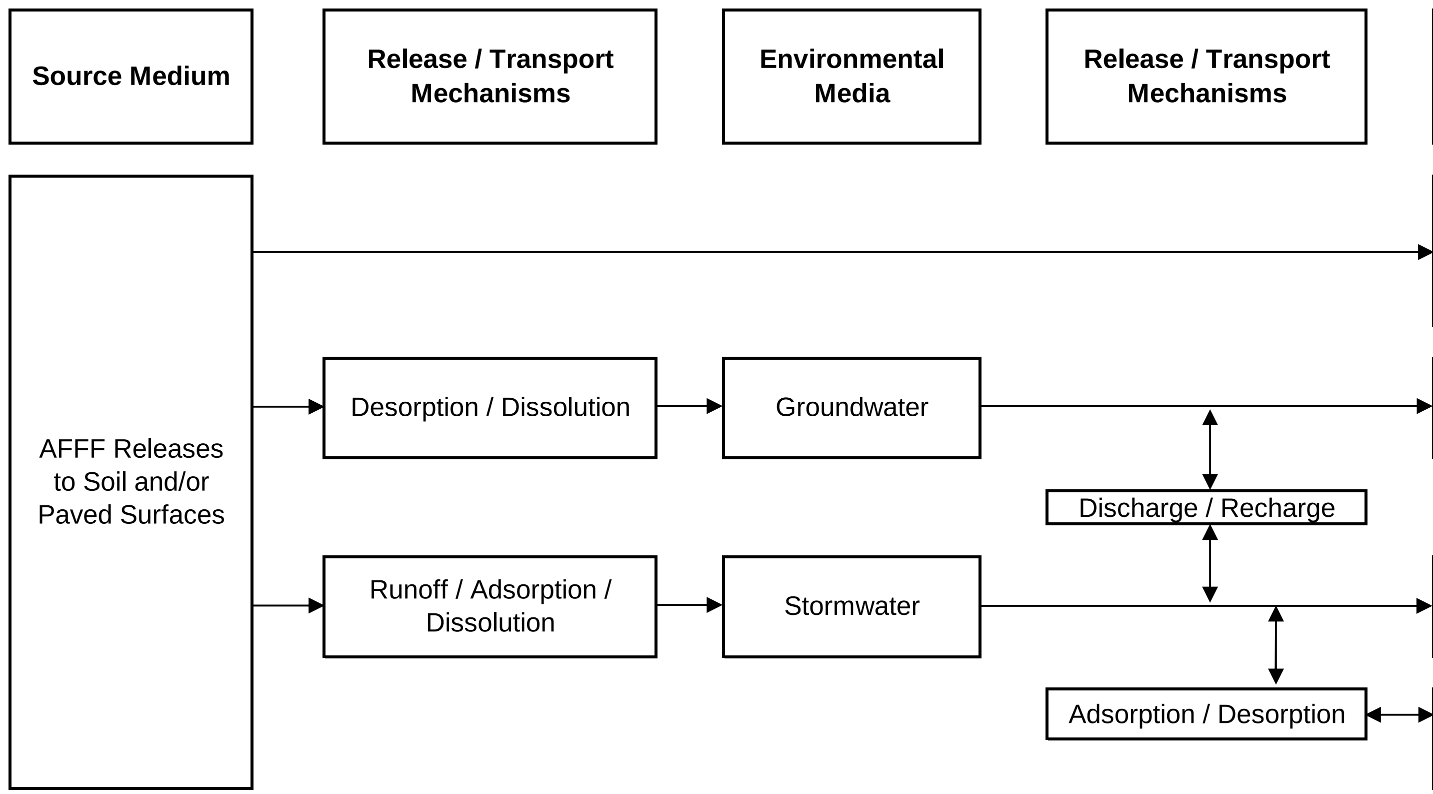
● = Complete Exposure Pathway
◐ = Potentially Complete Exposure Pathway
○ = Incomplete Exposure Pathway

Notes:
[1] On-site refers to within the former boundary of the installation.
[2] Surface water exposure pathway for Site Workers and Residents describes a drinking water scenario, and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario.
[3] All types of off-installation human receptors include drinking water receptors and recreational users.

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

Conceptual Site Model for the Old Fire Training Pit AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Former Jefferson Proving Ground, Indiana

Figure 7-6



Exposure Media	Exposure Route	Human Receptors: On-Site [1] Site Worker	On-Site [1] Resident	On-Site [1] Recreational User	Off-Site All Types of Receptors [3]
Soil	Ingestion	●	●	●	○
	Dermal Contact	●	●	●	○
	Inhalation (dust)	●	●	●	○
Groundwater	Ingestion	◐	◐	○	◐
	Dermal Contact	◐	◐	○	◐
Surface Water [2]	Ingestion	◐	○	○	◐
	Dermal Contact	◐	○	○	◐
Sediment	Ingestion	◐	○	○	◐
	Dermal Contact	◐	○	○	◐

Legend:
- ● = Complete Exposure Pathway
- ◐ = Potentially Complete Exposure Pathway
- ○ = Incomplete Exposure Pathway

Notes:
[1] On-site refers to within the former boundary of the installation.
[2] Surface water exposure pathway for Site Workers and Residents describes a drinking water scenario, and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario.
[3] All types of off-installation human receptors include drinking water receptors and recreational users.

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

ARCADIS

Conceptual Site Model for the Building 125 – Former Fire Station, Building 127 - Former Fire Station, and Building 186 Roof Fire AOPIs
USAEC PFAS Preliminary Assessment / Site Inspection

Figure 7-7

Arcadis U.S., Inc.

7550 Teague Road

Suite 210

Hanover, Maryland 21076

Tel 410 987 0032

Fax 410 987 4392

www.arcadis.com