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

Detroit Arsenal, Michigan

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Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

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EXECUTIVE SUMMARY

The United States Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), at Army installations (installations) nationwide. The PA identifies areas of potential interest (AOPIs) where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred. The SI 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 Detroit Arsenal (DTA) 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.

DTA is situated in Warren, Michigan, approximately three miles north of the Detroit city limits. DTA is divided into east and west sides, which are separated by railroad tracks. The majority of the property to the east of the railroad tracks is managed by the Army Base Realignment and Closure division.

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

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

AOPI Name	PFOS, PFOA, and/or PFBS Detected Greater than OSD Risk Screening Levels?		Recommendation
	GW	SO	
AOPI A	No	No	No action at this time
AOPI B	No	No	No action at this time
AOPI C	No	No	No action at this time
AOPI D	No	No	No action at this time
AOPI E	Yes	No	Further study in a remedial investigation
AOPI F	Yes	No	Further study in a remedial investigation

AOPI Name	PFOS, PFOA, and/or PFBS Detected Greater than OSD Risk Screening Levels?		Recommendation
	GW	SO	
AOPI G	No	No	No action at this time
AOPI H	Yes	Yes	Further study in a remedial investigation
AOPI I	No	No	No action at this time

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
SO – soil

1 INTRODUCTION

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

1.1 Project Background

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

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

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

1.2 PA/SI Objectives

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

1.2.1 PA Objectives

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

1.2.2 SI Objectives

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

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

1.3 PA/SI Process Description

For DTA, 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 DTA. 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), and Arcadis U.S., Inc. (Arcadis), collectively referred to as the Army PA Team, and DTA. The kickoff call occurred on 24 October 2018 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 DTA.

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

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

1.3.2 Preliminary Assessment Site Visit

The site visit was conducted from 27 to 29 November 2018. An in-brief meeting was held to provide installation staff with the objectives of the site visit and team introductions. **Section 3** includes information regarding personnel interviewed.

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

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

An exit briefing was offered to installation personnel at the conclusion of the site visit to raise any items identified during the site visit, discuss any follow-up items, and review the schedule for submitting deliverables. The exit briefing was conducted on 29 November 2018 with the installation, USAEC, and USACE to discuss preliminary findings of the PA site visit.

1.3.3 Post-Site Visit

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

1.3.4 Site Inspection Planning and Field Work

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

The objectives of the SI kickoff teleconference were to:

- discuss the AOPIs selected for sampling
- gauge regulatory involvement requirements or preferences
- confirm the plan for investigation-derived waste (IDW) handling and disposal
- identify specific installation access requirements and potential schedule conflicts
- discuss general SI deliverable and field work schedule information and logistics

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

- discuss the AOPIs selected for sampling and proposed sampling plan
- regulatory involvement requirements or preferences
- provide an updated SI deliverable and field work schedule.

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

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

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

1.3.5 Data Analysis, Validation, and Reporting

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

2 INSTALLATION OVERVIEW

The following subsections provide general information about DTA, 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

DTA is situated north of Eleven Mile Road and east of Mound Road in Warren, Michigan, approximately 3 miles north of the Detroit city limits (**Figure 2-1**). The DTA is divided into an east side and a west side by a railroad right-of-way. DTA property consists of approximately 112 acres west of the railroad and the footprints of two former buildings east of the railroad (**Figure 2-2**). DTA is a secure, active military installation located in a predominantly urban area (USACE 2017).

2.2 Mission and Brief Site History

DTA was originally established along the Detroit River in 1817. The arsenal served as an army depot for repairing guns and storing ammunition/gunpowder. In 1832 the arsenal was moved to what is now Dearborn, Michigan and its construction was finalized in 1837. The arsenal was sold after the American Civil War in 1875, after remaining in use in this location for approximately 40 years. The arsenal was re-opened in Warren, Michigan during World War II and the Chrysler Corporation was awarded a contract to start mass producing tanks there in August of 1940. Due to the large number of tanks that were produced there, the arsenal was renamed the Detroit Tank Arsenal on 29 May 1941. During the 1940s, the facility produced M3 as well as M4 Sherman tanks. In the 1950s, tank production shifted to producing the M47 Patton tank in response to the Korean War. During the 1960s, the plant produced M60A2 tanks. The facility was used to produce M-60 and M-1 Abrams Main Battle Tank versions and performed research and development of tank and automotive materials starting in the late 1970s. Tank production ceased in 1987, and the plant closed permanently in 1996. Currently, the DTA is home to the Army Tank-automotive and Armaments Command Life Cycle Management Command headquarters, a branch that is devoted to providing a “cradle-to-grave” approach to research and development of automotive materials and armaments weapons systems (USACE 2017).

2.3 Current and Projected Land Use

DTA is located in a combined industrial/residential area. The industrial area is dominated by the automotive industry and includes metal fabrication plants, research laboratories, and scrap yards. Residential (single-family housing and mobile homes) and commercial properties consisting of schools, hospitals, and other properties associated with an urban environment. Dense commercial, industrial, and residential land use extends to Utica (9 miles to the north), Lake St. Clair (8 miles to the east), the Canadian border (11 miles to the south), and through Novi (28 miles to the west). No residents are present at DTA and the expected future land use is industrial/commercial. As shown on **Figure 2-2**, most of the eastern half of DTA property was transferred under Base Realignment and Closure (BRAC) in 1995 and is no longer Army owned property. This area did contain the former tank plant but now contains

various industrial and commercial operations. A portion of the eastern property that contains the footprints of two former buildings were retained by the Army due to ongoing use of the buildings in 1995.

DTA is easily accessible by all forms of private and commercial transportation. A railroad yard provides rail service to the site, and an interstate highway is located immediately adjacent to DTA. It has a staff of approximately 7,000 personnel, which includes military personnel, civilians, and contractors.

In areas of DTA not covered by pavement, vegetative cover exists. All vegetation has been introduced and no areas of natural vegetation exist at DTA (USACE 2004).

2.4 Climate

The average daily temperature is 23 degrees Fahrenheit (°F) in January and 72°F in July with extremes of -22°F and 104°F. Average annual precipitation is 29.6 inches and annual snowfall averages 24.6 inches (Safford et al. 1985).

2.5 Topography

DTA is located in a dry glacial lakebed roughly 1 mile south of Red Run, which flows into the Clinton River (Safford et al. 1985) and the mean elevation is 620 feet above mean sea level (**Figure 2-3**). Land use surrounding the DTA is urban and industrial. The region is located within the central lowlands physiographic province. The topography is gently rolling to level. Except for major streams (i.e., Clinton River, Red Run River, and Bear Creek) and other drainage courses, there is little topographic relief (USACE 2017).

2.6 Geology

The regional bedrock formations are Mississippian and Devonian in age and consist of shale, limestone, dolomite, and sandstone. The Coldwater Shale is the predominant geologic unit within Macomb County. Other units within the county include the Antrim Shale, Sunbury Shale, Berea Sandstone, and the Bedford Shale. Bedrock at DTA is typically encountered between 140 to 180 feet below ground surface (bgs). Overlaying the bedrock are unconsolidated sediments from glacial drift and the upper Glacio-Lacustrine Aquifer. Below the bedrock, semi-confined by the upper Glacio-Lacustrine Aquifer, is the lower Paleo Beach Sand Aquifer (Envirodyne Engineers, Inc. 1985).

The top 4 feet of soil at DTA can be considered fill material. From 4 to 6 feet bgs, the fill material is often mixed with natural soil of either silty clay loam or clay loam. Glaciolacustrine material consisting of silty and sandy clay, with traces of sand and gravel, is encountered below 6 feet bgs.

2.7 Hydrogeology

A thin, unconfined aquifer is present in the upper glacial lacustrine deposits at DTA and the water table is estimated between 5 and 15 feet bgs (ERT 2017). Primary groundwater flow direction in this surficial aquifer is towards the north-northeast with a low hydraulic gradient and groundwater velocity of approximately 0.17 foot per year (ERT 2017; Envirodyne Engineers, Inc. 1985). This aquifer is not used for human water consumption and could recharge surface water bodies. Water bearing sand deposits are

present below the surficial aquifer at approximately 100 feet bgs. Below bedrock is the lower Paleo Beach Sand Aquifer (Envirodyne Engineers, Inc. 1985).

2.8 Surface Water Hydrology and Relevant Utility Infrastructure

Greater than 70 percent (%) of the land area occupied by the DTA is developed with impervious surfaces (e.g., roadways, buildings). It is in an urban setting and surface water is managed by a stormwater collection system. The stormwater system discharges water to the Warren County Municipal Separate Storm Sewer System and Macomb County Drain Bear Creek. The sanitary sewer system at DTA is separate from the stormwater system and discharges to the City of Warren Wastewater Treatment Plant (WWTP).

DTA lies in the Clinton River drainage basin, and the primary natural surface water drainage is collected in Bear Creek. Bear Creek is a 4.5-mile-long intermittent stream running along the western boundary of DTA. The natural drainage patterns follow the topography of DTA and drain into Bear Creek. Bear Creek flows northward along the western boundary of the installation and drains an area of 17.3 square miles. Bear Creek discharges into Red Run River and then flows into the Clinton River. The Clinton River runs easterly and empties into Lake St. Clair (Envirodyne Engineers, Inc. 1985; USACE 2017).

2.9 Potable Water Supply and Drinking Water Receptors

Drinking water at DTA and the surrounding community is supplied by the City of Warren, which sources its water from the Detroit River, approximately 10 miles to the south (Environmental Data Resources, Inc. [EDR] 2018). Due to citywide restrictions, there are no production or drinking water wells at DTA or within 5 miles of the installation boundary. Groundwater present in the aquifers below DTA is of poor quality and not suitable for human consumption (ERT 2017; ABS Environmental Services, Inc. 1993). The Army implements controls which prevent intrusive work (including drilling for well installation) without directorate of public works approval per the installation's master plan and the dig permitting process. An 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 DTA, which along with state and county GIS provided by the installation identified several off-post public and private wells within 5 miles of the installation boundary (**Figure 2-4**). The EDR report providing well search results provided as **Appendix E**.

2.10 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.

No state or federally endangered or threatened plant species are present at DTA. In addition, no wetlands are located at the DTA, and according to Federal Emergency Management Agency flood insurance maps, the DTA property is not located within the 100-year floodplain of Bear Creek (USACE 2004).

The wildlife at the DTA is limited to rabbits, ducks, seagulls, foxes, pheasants, woodchucks, and other small animals that have adapted to the urbanized environment. Nonpoisonous snakes occasionally are seen in the area (United States Army Toxic and Hazardous Materials Agency 1990). No endangered or

threatened species reside on the DTA, and no endangered or threatened migratory birds use the DTA as a habitat (USACE 2004).

2.11 Previous PFAS Investigations

Previous (i.e., pre-PA) PFAS investigations relative to DTA, including both those conducted and not conducted by the Army, are summarized to provide full context of available PFAS data for DTA. However, only data collected by the Army will be used to make recommendations for further investigation. PFOS and PFOA were sampled for in the DTA potable water supply on four occasions from 2013 to 2014. All samples collected were below detection limits (less than 20 ng/L for PFOA and less than 40 ng/L PFOS). PFAS sampling at DTA also occurred at the City of Warren sanitary sewer discharge point on three separate occasions. The sampling was conducted from a sanitary sewer manhole on the northwest portion of the installation as shown on **Figure 2-2**. The highest detections observed were a PFOA detection of 32 ng/L in February 2020, PFOS detection of 60 ng/L in August 2018, and a PFBS detection of 10 ng/L in August 2018.

In response to the third Unregulated Contaminant Monitoring Rule, samples were collected from drinking water distribution systems from the surrounding zip codes in 2013 and 2014. All PFAS compounds analyzed were below detection limits.

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 DTA, data were collected from three principal sources of information and are described in the subsections below:

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

Preliminary locations of potential use, storage, and/or disposal of PFAS-containing materials were then evaluated in the PA (during records review, personnel interviews, and/or site reconnaissance) and were categorized as AOPIs or as areas not retained for further investigation at this time based on a combination of information collected (e.g., records reviewed, personnel interviews, internet searches). A summary of the observations made, and data collected through records reviews (**Appendix F**), installation personnel interviews (**Appendix G**), and site reconnaissance logs (**Appendix H**) during the PA process for DTA 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, DTA fire department documents, DTA directorate of public works documents, and GIS files. Internet searches were also conducted to identify publicly available and other relevant information. A list of the specific documents reviewed for DTA is provided in **Appendix F**.

3.2 Personnel Interviews

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

- Environmental Protection Specialist
- Public Affairs Chief
- Public Affairs Officer
- Chief, Installation Safety Office
- Chief, Environmental Division
- Army Tank Automotive Research, Development and Engineering Center (TARDEC) Assistant Chief of Staff
- TARDEC Facility Operations Manager
- TARDEC Environmental Manager

- TARDEC Team Supervisor
- TARDEC Senior Project Engineer
- Facility Specialist
- Pesticide Manager
- Engineering Technician
- Director, Logistics Readiness Command
- Chief, Plans and Operations and Supply
- Assistant Fire Chief
- Acting Garrison Manager
- Director of Public Works

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

3.3 Site Reconnaissance

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

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

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

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

4.1 AFFF Use, Storage, and Disposal Areas at DTA

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.

AOPI A, AOPI D, and AOPI E were all areas where vehicle testing had occurred. Vehicles would often catch fire as a result of rigorous training and AFFF could have been used to extinguish the fires.

Various operations occurred at AOPI B, a building which included a fire lab and fire training outside of the southern doors. AFFF use at AOPI B was not confirmed, but common practice suggests its use. AOPI G is located to the west of AOPI H. DTA personnel noted significant releases of AFFF on the parking area of AOPI G. A building located on the north end of AOPI H formerly stored AFFF. AFFF may have been released in the truck bay of this building during truck loading and unloading activities.

Fires occurred at AOPI C, AOPI F, AOPI I, and Gate 38. A car fire occurred at AOPI C and AFFF was used to extinguish the fire. At AOPI F, AFFF was reportedly not used to extinguish the fire, but lines containing AFFF were discharged to a nearby grassy area. A fire burned a third to one half of AOPI I, but no specific evidence was identified confirming AFFF was used to extinguish the fire. An overturned vehicle fire occurred near Gate 38 during fire training exercises and AFFF may have been used to extinguish the fire. DTA personnel could not determine the location of the fire and there has been significant ground disturbance in the area leading to Gate 38.

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

Following document research, personnel interviews, and site reconnaissance at DTA, other PFAS source types like metal plating operations, pesticide areas, laboratories, hazardous materials storage areas,

photo-processing areas, WWTPs, landfills 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**.

The pesticide storage area at DTA contains an interior mixing station with drainage to the sanitary sewer that is rarely used. Another mixing station is located in the garage with a secondary containment with no drain or visible staining. There have been no reported releases at the pesticide storage area. During a telephonic interview with the IMCOM Pest Management Consultant, it was noted that products containing Sulfluramid (i.e., associated with insecticides) may have contained PFAS and were phased out in 1996. During the PA records review, the IMCOM Pest Management Consultant provided records of potentially PFAS-containing pesticides and insecticides used at and/or stored at Army installations, and did not identify DTA as an installation having used or stored PFAS-containing pesticides/insecticides. Additionally, the Army PA team reviewed available pesticide use inventory documentation provided by the installation and did not identify PFAS-containing pesticides use, storage, or disposal.

The TARDEC Oil and Water Laboratory currently uses PFAS-containing compounds in vapor degreasing research applications. All waste produced during activities is properly collected and disposed.

In addition to potential use of AFFF at AOPI B (in the fire lab and during fire training) discussed in **Section 4.1**, this building also had a photo processing facility.

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 DTA) 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. While separated from the main DTA installation, AOPI I is still located on a portion of Army owned property and is therefore listed in **Section 4.1**, instead of this section.

The Chrysler Test Track was located on former DTA property to the east and is now part of the BRAC area. The Chrysler Test Track operated from 1949 to 1997 and it is suspected fire training on vehicle fires occurred here during the 1960s and 1970s.

The Former Tank Plant was located on former DTA property to the east and is now part of the BRAC area. The Former Tank Plant was the main tank assembly plant and contained an X-ray lab. Current operations at the Former Tank Plant may include metal plating and historical metal plating is also suspected. A former WWTP was also located inside this building and tanks that were manufactured here contained fire suppression systems which may have contained AFFF.

5 SUMMARY AND DISCUSSION OF PA RESULTS

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

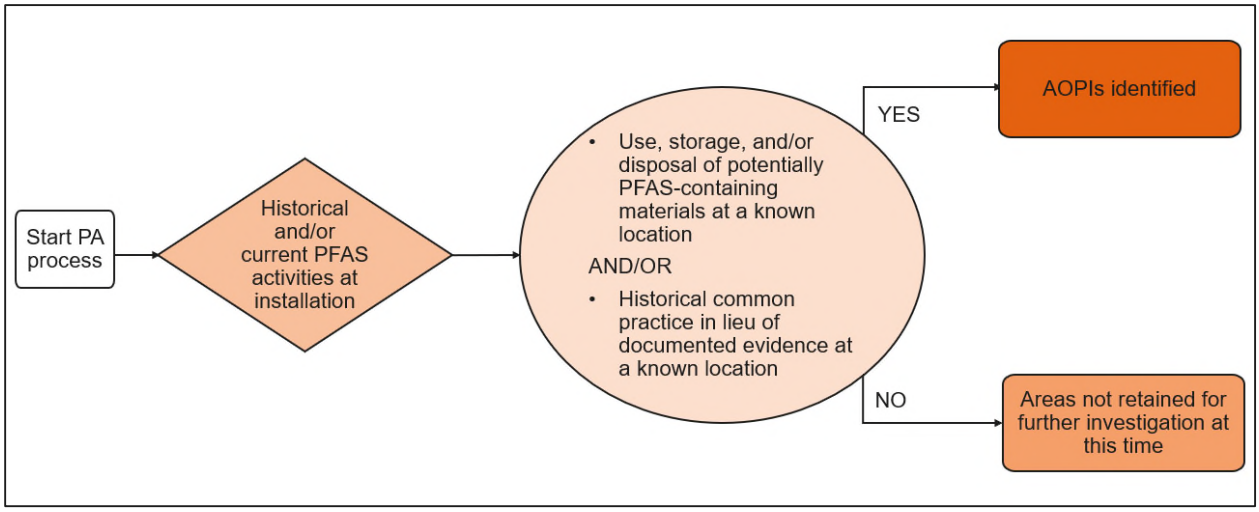


Figure 5-1: AOPI Decision Flowchart

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 DTA 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
Selfridge Air National Guard Base	Current	The only open IRP site associated with DTA is located on Army owned property at Selfridge Air National Guard Base. The site is currently in remediation from two removed underground storage tanks. There is no indication of any fire related activities utilizing PFAS-containing materials conducted here.	No indication of use, storage, or disposal of PFAS containing compounds.
Hazardous Materials Pharmacy	Current	Temporary storage and distribution of various chemicals.	No indication of use, storage, or disposal of PFAS containing compounds.
TARDEC Oil and Water Lab	Current	PFAS-containing compounds are currently used in vapor degreasing research applications. All waste produced during activities is properly collected and disposed.	All activities using PFAS-containing compounds are performed inside of a building in an area without floor drains. Therefore, any PFAS-containing materials potentially spilled could not be released to the environment.
Pesticide Storage Area	Current	The pesticide storage area contains an interior mixing station with drainage to the sanitary sewer that is rarely used. Another mixing station is located in the garage with a secondary containment with no drain or visible staining. Most of the pesticides/herbicides are pre-mixed.	No indication of use, disposal, or storage of PFAS-containing materials.
Gate 38	Unknown	An overturned car fire occurred near the entrance of DTA at Gate 38. AFFF may have been used to extinguish the fire.	DTA personnel are not certain where the fire occurred, other than that it was in the general vicinity of Gate 38. There has also been significant ground disturbance in this area,

Area Description	Dates of Operation	Relevant Site History	Rationale
			increasing the uncertainty of finding PFOS, PFOA, PFBS in site media. Therefore, the site was not retained for further investigation.

5.2 AOPIs

Overviews for each AOPI identified during the PA process are presented in this section. None of the AOPIs overlap with DTA IRP sites and/or Headquarters Army Environmental System sites. At the time of this PA, none of the DTA 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 are presented on **Figures 5-3** through **5-10**.

5.2.1 AOPI A

AOPI A is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to potential AFFF use. Future land use at AOPI A is expected to remain industrial/commercial (**Figure 5-3**). AOPI A was formerly used as a test track where multiple vehicle fires occurred. No specific evidence was identified confirming AFFF was used to extinguish fires; however, interviewees stated the use of AFFF foam on these fires would have been warranted.

5.2.2 AOPI B

AOPI B is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to possible AFFF use and secondary sources. Future land use at AOPI B is expected to remain industrial/commercial (**Figure 5-4**). Various operations occurred at the building located at AOPI B, including a fire lab and photo processing. Personnel also recalled fire training occurring outside the southern doors. AFFF use could not be confirmed at this location, however common practice suggests its use. This building also contained wooden floors. PFAS- containing materials may have been released when penetrating the floors and reached underlying soil. Runoff containing PFOS, PFOA, and PFBS may potentially have migrated to Bear Creek.

5.2.3 AOPI C

AOPI C is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to AFFF use. Future land use at AOPI C is expected to remain industrial/commercial (**Figure 5-5**). AOPI C is the northern portion of a parking lot. A car fire occurred in the northwest corner of AOPI C and was extinguished using an unknown quantity of AFFF. A sanitary sewer line runs just along the western boundary of AOPI C, flowing towards the City of Warren sampling point which has known PFAS

detections. The potential exists that runoff containing PFOS, PFOA, and PFBS may have migrated to Bear Creek.

5.2.4 AOPI D

AOPI D is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to potential AFFF use during tank fording activities. Future land use at AOPI D is expected to remain industrial/commercial (**Figure 5-6**). AOPI D was a former cooling pond constructed in 1953 and decommissioned in 2010. AOPI D is located west of AOPI E, where AFFF may have been used during tank fording activities. If used, AFFF could have been blown into AOPI D via wind or could have entered through an elaborate valve system that connected the two areas.

5.2.5 AOPI E

AOPI E is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to potential AFFF use during tank fording activities. Future land use at AOPI E is expected to remain industrial/commercial (**Figure 5-6**). AOPI E was a former fording pit constructed in 1953 and decommissioned in 2010 when a building was constructed. Tank fording and training activities occurred at AOPI E. Interviewees confirmed that the fire department responded to vehicle fires that resulted from activities at AOPI E, but the method of extinguishing the fires was unknown. AOPI E was unlined and drained directly to Bear Creek. AOPI D is to the west of AOPI E, and AFFF could have blown or flowed via stormwater runoff into AOPI D, if it was used in AOPI E. An elaborate valve system connected the two areas in which water from AOPI D discharged to AOPI E. The valve system has been removed.

5.2.6 AOPI F

AOPI F is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to a response to a building fire. Future land use at AOPI F is expected to remain industrial/commercial (**Figure 5-7**). A fire occurred on the east side of the building located at AOPI F in 2005. AFFF was not used to extinguish the fire; however, AFFF was discharged from the hose lines of the emergency vehicles in the grassy area adjacent to the west access drive.

5.2.7 AOPI G

AOPI G is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to AFFF releases. Future land use at AOPI G is expected to remain industrial/commercial (**Figure 5-8**). Multiple releases of AFFF were noted at AOPI G, which is a parking lot. Interviewees reported several inches of foam covered the parking lot during these releases. The releases were possibly a result of training conducted by the fire department, but the mechanisms and nature of the releases cannot be verified.

5.2.8 AOPI H

Two buildings and a parking lot between the buildings are included in AOPI H. This area is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to AFFF releases

and storage from various operations at these three areas. Future land use at AOPI H is expected to remain industrial/commercial (**Figure 5-9**).

Between 2005 and 2008, there were two confirmed instances of AFFF discharged from valve failures from an emergency response vehicle in the parking lot contained within AOPI H. In both instances, AFFF was observed flowing to the grassy area at the northeast portion of AOPI H. Interviewees also reported witnessing the foam being washed into a storm drain with a fire hose. From here it entered the storm drain and eventually reached Bear Creek off installation. Approximately 70 gallons of concentrate was released in each incident.

The building at the northern end of AOPI H formerly stored AFFF. AFFF may have been released in the truck bay of this building during truck loading and unloading activities.

A valve failure from an emergency response truck carrying AFFF was confirmed inside the truck bay of the current fire station located at the southern end of AOPI H. Nozzle testing using AFFF also occurred inside the truck bay. All releases were reportedly contained inside the building and drained to an oil/water separator connected to the sanitary sewer system.

5.2.9 AOPI I

A fire occurred at the east end of AOPI I in 1986. One-third to one-half of the building located at AOPI I was consumed by the fire and the method used to extinguish the fire is unknown. The area surrounding AOPI I is under active BRAC control, but AOPI I ownership is retained by the Army (**Figure 5-10**).

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at DTA, an SI for PFOS, PFOA, and PFBS was conducted in accordance with CERCLA. SI sampling was completed at DTA at all nine AOPIs to evaluate the presence or absence of PFOS, PFOA, and PFBS in comparison with the OSD risk screening levels. As such, an installation-specific QAPP Addendum (Arcadis 2020) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A preliminary CSM was prepared for each of the installation's AOPIs in accordance with the USACE Engineer Manual on 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 soil, surface water, and sediment pathways as potentially complete, which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on each AOPI's preliminary CSM. The SI scope of work was completed in August 2020 with a remobilization scope completed in December 2021 and January 2022 through the collection of field data and analytical samples.

The SI field work was completed in accordance with the standard operating procedures (SOPs), technical guidance instructions (TGIs), sampling design, and QA/QC requirements as detailed in the QAPP Addendum (Arcadis 2020) and PQAPP (Arcadis 2019). The subsections below summarize the DQOs, sampling design and rationale, sampling activities and methods, and data analyses procedures for the SI phase at DTA. Non-conformances to the prescribed procedures in the PQAPP and QAPP Addendum are described in **Section 6.3.3**. Analytical results obtained through SI field activities are summarized in **Section 7**.

6.1 Data Quality Objectives

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

6.2 Sampling Design and Rationale

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

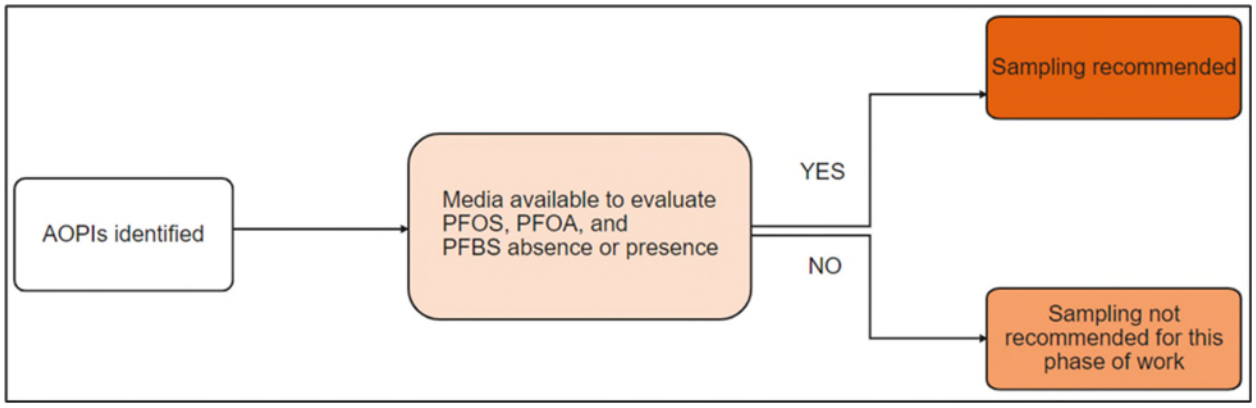


Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at DTA is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2020), and briefly summarized below:

AOPI A

AOPI A (**Figure 5-3**) is located toward the south of the installation. Vehicle fires occurred at AOPI A. The method of extinguishing the fires is unknown, however, interviewees stated the use of AFFF foam on these fires would have been warranted.

At three locations, soil encountered just above the water table was sampled in lieu of surface soil due to the presence of fill material, which was placed after the potential use of AFFF. Soil encountered at the interval directly above the water table was analyzed for presence or absence of PFOS, PFOA, and PFBS. Soil samples were collected in the downgradient direction (west) of groundwater flow since the exact location of AFFF release was not able to be confirmed. One groundwater sample was also intended to be collected at each of the locations at the first encountered groundwater; however, only one groundwater sample was able to be collected due to insufficient volume of water in temporary wells. More details on this field change can be found in **Section 6.3.3**.

AOPI B

AOPI B (**Figure 5-4**) is located in the west-central portion of the installation, where runoff containing PFOS, PFOA, and PFBS may potentially have migrated to Bear Creek. Various operations occurred at AOPI B, including a fire lab, and photo processing. DTA Personnel also recalled fire training occurring outside the southern doors. AFFF use was not confirmed at this location, however common practice suggests its use and potential release at this AOPI. This building also contained wooden floors which could have facilitated PFOS, PFOA, and PFBS compounds seeping into underlying surface soil.

Two shallow soil samples and one co-located shallow soil and shallow groundwater sample were positioned to capture soil outside of the southern doors of AOPI B where fire training occurred. One additional groundwater sample was positioned downgradient, to the west of the building, to capture groundwater downgradient from potential PFOS, PFOA, and PFBS release areas.

AOPI C

AOPI C (**Figure 5-5**) is located in the northwest quadrant of the installation. A car fire occurred in the northwest corner of AOPI C and was extinguished using AFFF. The potential exists that runoff containing PFOS, PFOA, and PFBS may have migrated to Bear Creek.

Three co-located shallow soil and groundwater samples were positioned to the northwest of AOPI C in the area where the AFFF release to the environment occurred, biased towards sewer grates and the underground sewer pipes because it was assumed the sewer lines are compromised.

AOPI D

AOPI D (**Figure 5-6**) is located directly west of AOPI E. PFAS-containing materials could have blown into AOPI D, if it were used in AOPI E. An elaborate valve system, which has since been removed, connected the two areas in which water from the AOPI D discharged to AOPI E.

Three co-located shallow soil and groundwater sampling locations were positioned to capture soil at this AOPI. The location of any potential PFOS, PFOA, and PFBS releases to the environment at this AOPI is unknown; therefore, the sampling locations were spread evenly in the center of the AOPI.

AOPI E

AOPI E (**Figure 5-6**) is located in the northern portion of the installation boundary, where runoff may have migrated to Bear Creek via direct drainage. Tank fording and training activities occurred at AOPI E. Interviewees confirmed that the fire department responded to fires that resulted from activities at AOPI E, but the method of extinguishing the fires was unknown.

Two co-located shallow soil and groundwater sampling locations were positioned to capture soil at this AOPI. A building is now constructed within this AOPI, limiting the possible sampling location to the grassy areas north and south of the building.

AOPI F

A fire occurred on the east side of AOPI F (**Figure 5-7**). PFAS-containing materials were not used to extinguish the fire, however, AFFF was discharged from the hose lines of the emergency vehicles in the grassy area adjacent to the west access drive.

Two co-located shallow soil and groundwater sampling locations were positioned within the known area of AFFF release to the environment north of AOPI F to determine presence/absence.

AOPI G

AOPI G (**Figure 5-8**) is located toward the center of the installation. Significant releases of AFFF were noted at AOPI G. Interviewees reported several inches of foam covered the parking lot during these releases. The mechanisms and nature of the releases is not known.

Five co-located shallow soil and groundwater samples were positioned surrounding AOPI G to the north, northwest, southwest, southeast, and east of the main lot because interviews and reconnaissance noted that AFFF was observed spread across the entire lot at times. The position of these sample locations around the entire periphery of the lot would maximize the potential for detecting potential PFOS, PFOA, and PFBS resulting from these training operations.

AOPI H

AOPI H (**Figure 5-9**) is located along the eastern boundary of the installation. The building at the northern end of the AOPI formerly stored AFFF. AFFF may have been released in the truck bay of this building during truck loading and unloading activities. Several indoor releases of AFFF occurred in the current fire station located at the southern end of AOPI H.

Between 2005 and 2008 there were two confirmed instances of AFFF discharged from an emergency response vehicle valve failure at AOPI H. In both instances, AFFF was observed flowing to the grassy area on the eastern portion of the AOPI. Interviewees also reported witnessing the foam being washed into a storm drain with a fire hose. From here it entered the storm drain and eventually reached Bear Creek off site. Approximately 70 gallons of AFFF concentrate was released in each incident.

Two co-located shallow soil and groundwater sampling locations were positioned at AOPI H to the east where the outdoor PFAS-containing materials releases were flushed. The two buildings and parking area at this AOPI represent different locations with possible AFFF releases to the environment, but their proximity to each other warranted combining into a single AOPI for sampling

AOPI I

AOPI I (**Figure 5-10**) is located to the east of the installation. While the Army currently retains property containing the AOPI footprint, the surrounding property is under BRAC jurisdiction. A fire occurred at the east end of AOPI I in 1986. One-third to one-half of the building was consumed by the fire and the method used to extinguish the fire is unknown.

Seven shallow soil samples and one co-located shallow groundwater sample were positioned to the east of the building footprint within AOPI I. The exact location of any potential PFOS, PFOA, and PFBS releases to the environment at this AOPI is unknown; therefore, the sampling locations were spread evenly across the center of the eastern portion of the AOPI where firefighting activities likely took place.

6.3 Sampling Methods and Procedures

Environmental data were collected and analyzed in accordance with the PQAPP (Arcadis 2019), the SOPs and TGIs included as Appendix A to the PQAPP, the QA/QC requirements identified in Worksheet #20 of the PQAPP, the approved scope and sampling methods outlined in the site-specific QAPP Addendum (Arcadis 2020), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2020). The sampling methods described in the SOPs and TGIs establish equipment requirements, procedures for preparing equipment and containers before sampling, sampling procedures under various conditions, and procedures for storing samples to ensure that sample contamination does not occur during collection, and transport. In general, sampling techniques used in the SI were consistent with conventional sampling techniques used in the environmental industry, but special considerations were made regarding PFAS-containing materials and equipment and cross-contamination potential.

The sampling methods described in the SOPs and TGIs establish equipment requirements, procedures for preparing equipment and containers before sampling, sampling procedures under various conditions, and procedures for storing samples to ensure that sample contamination does not occur during collection, and transport. In general, sampling techniques used in the SI were consistent with conventional sampling

techniques used in the environmental industry, but special considerations were made regarding PFAS-containing materials and equipment and cross-contamination potential.

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

6.3.1 Field Methods

Environmental data were collected and analyzed in accordance with field methods employed from Worksheet #17 of the QAPP Addendum. At sampling locations where boreholes were advanced using direct-push technology (DPT), dual-tube drill casing was advanced using a top-down sampling method to minimize cross-contamination at depth. Soil samples were collected in PFAS-free acetate liners.

A peristaltic pump with PFAS-free disposable high-density polyethylene tubing was used to collect groundwater samples through temporary polyvinyl chloride well screens. Groundwater samples from DPT points were collected in accordance with TGI for PFAS-Specific Drilling and Monitoring Well Installation (P-12 in Appendix A to the PQAPP [Arcadis 2019]). Decontamination procedures for non-dedicated equipment used during sampling are described in **Section 6.3.4**.

6.3.2 Quality Assurance/Quality Control

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

QA/QC samples were collected at the frequencies specified in the QAPP Addendum (Arcadis 2020), typically at a rate of 1 per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicate samples were collected for media sampled for PFOS, PFOA, and PFBS and total organic carbon (TOC) only. Equipment blanks were collected for media sampled for PFOS, PFOA, and PFBS at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2020). The decontaminated reusable equipment from which equipment blanks were collected include tubing, drill rods and cutting shoes, hand augers, water-level meters, and stainless-steel trowels as applicable to the sampled media. Source blanks were collected from the water used to pressure-wash drill tooling. Analytical results for blank samples are discussed in **Section 7.12**.

6.3.3 Field Change Reports

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

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

- No groundwater sample was collected at AOPI A at location DTA-AOPIA-01. A fabric liner was encountered at 2 feet bgs. The fabric was thought to be an insulator for a utility line. There was no room in the utility clearance area to attempt a step out location. Due to concerns in striking a utility, no attempt to drill beyond the fabric liner was made. A water sample was still able to be collected from another location at AOPI A, satisfying the intent of identifying PFOS, PFOA, and/or PFBS presence/absence at this AOPI.
- No groundwater sample was collected at AOPI A at location DTA-AOPIA-03. The temporary well did not contain sufficient water to collect a sample. A water sample was still able to be collected from another location at AOPI A, satisfying the intent of identifying PFOS, PFOA, and PFBS presence/absence at this AOPI.
- An additional SI sampling event was conducted at DTA in December 2021 and January 2022 to evaluate PFOA, PFOS, and/or PFBS presence or absence in groundwater and soil at AOPI I and AOPI G. AOPI I was initially classified as an AOPI but was reclassified and not included in the SI sampling conducted in August 2020 due to its location potentially being on BRAC property. Following discussion with the USACE, USAEC, DTA, and at the direction of BRAC, it was determined that the Army retains property ownership and that a remobilization should occur to sample AOPI I as part of the SI. AOPI G was resampled for groundwater only due to a matrix interference causing the data to be rejected during the first mobilization of the SI sampling event

6.3.4 Decontamination

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

6.3.5 Investigation-Derived Waste

IDW, including soil cuttings, groundwater, equipment, and decontamination fluids were collected. Purged groundwater was discharged back to the point of generation, and decontamination fluids were disposed of in the sanitary sewer at the request and oversight of the installation. Soils were placed in Department of Transportation-approved 55-gallon drums, labeled as non-hazardous, transported to a staging area until waste characterization sampling was completed. The waste was removed from DTA and transported to a permitted non-hazardous landfill on 20 November 2020, by Safety Kleen, a waste removal contractor. Equipment IDW includes disposable personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, Lexan tubes, and high-density polyethylene and silicon tubing) that came in

contact with sampling media. Equipment IDW was disposed of in installation approved disposal bins. Analytical results for IDW samples collected during the SI are discussed in **Section 7.10.**

6.4 Data Analysis

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

6.4.1 Laboratory Analytical Methods

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

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

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

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

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

6.4.2 Data Validation

All analytical data generated during the SI, except grain size 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 5.3 (DoD and Department of Energy 2019). Additionally, 10% of the data underwent Stage 4 data validation. Copies of the data validation

reports for each sample delivery group are included as attachments to the DUSR in **Appendix M**. The Level IV analytical reports are included within **Appendix M** in the final electronic deliverable only.

6.4.3 Data Usability Assessment and Summary

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

Based on the final data usability assessment, the environmental data collected at DTA during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUSR and its associated data validation reports (**Appendix M**), and as indicated in the full analytical tables (**Appendix N**) provided for the SI results, with the exception of several results being qualified as potentially unusable with an “X” qualifier. The “X” qualifiers were due to extracted internal standards exhibiting recoveries less than 20%, which is indicative of matrix interferences. Of the “X” qualifiers, three were PFOS, PFOA, or PFBS. The water sample from DTA-AOPIC-01 contained PFOS of 22 X ng/L. The water sample collected from DTA-AOPIG-01 contained PFOS of 860 X ng/L and PFOA of 150 X ng/L. Following discussion with the USACE chemist in January 2022, “X” qualifiers on results from non-PFOS and PFOA data were changed to an “R” qualifier. “X” qualifiers on PFOS and PFOA results were changed to “J-” with a caveat that they cannot be compared to the OSD risk screening levels or other screening criteria. AOPI G was resampled for groundwater only in January 2022. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and DTA QAPP Addendum (Arcadis 2020). Data qualifiers applied to laboratory analytical results for samples collected during the SI at DTA are provided in the data tables, data validation reports, and the Data Usability Summary Table located at the end of the DUSR. Qualifiers for data shown on figures are defined in the notes of figures.

6.5 Office of the Secretary of Defense Risk Screening Levels

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

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

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

Notes:

1. Risk screening levels for tap water and soil provided by the OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September 15 (**Appendix A**).
2. All soil data will be screened against both the Residential Scenario and Industrial/Commercial risk screening levels (if collected from less than 2 feet bgs), regardless of the current and projected land use of the AOPI. Soil samples collected from greater than 2 feet but less than 15 feet bgs will be compared to the industrial/commercial risk screening levels only, and soil samples collected from greater than 15 feet bgs will not be compared to either risk screening level.

mg/kg = milligram per kilogram
ng/L = nanograms per liter
ppm = parts per million
ppt = parts per trillion

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

7 SUMMARY AND DISCUSSION OF SI RESULTS

This section summarizes the analytical results obtained from samples collected during the SI at DTA (field duplicate results are provided in the associated tables). Sampled media and QA/QC samples were analyzed for the constituents prescribed per Worksheet #18 of the QAPP Addendum (Arcadis 2020) and as noted in **Table 6-1**. The sample results discussion below focuses on the PFOS, PFOA, and PFBS analytical results because they have OSD risk screening levels. The Army will make subsequent investigation decisions based on these constituents' concentrations relative to the OSD risk screening levels.

Tables 7-1 and **7-2** provide a summary of the groundwater and soil analytical results for PFOS, PFOA, and PFBS. **Table 7-3** summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix N** includes the full suite of analytical results for these media, as well as for the QA/QC samples. An overview of AOPIs at DTA with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2** through **7-9** show the PFOS, PFOA, and PFBS analytical results for groundwater and soil for each AOPI. Non-detected results are reported as less than the LOQ. Detections of PFOS, PFOA, and/or PFBS greater than the applicable OSD risk screening levels are highlighted in summary tables and on figures. Final qualifiers applied to the data by the laboratory and the project chemist (as defined in **Section 6.4.3**) are defined and presented on the analytical tables. Groundwater data collected during the SI are reported in ng/L, or parts per trillion, and soil data are reported in mg/kg, or parts per million.

Field parameters measured for groundwater during low-flow purging and sample collection are provided on the field forms in **Appendix J**. Soil descriptions are also provided on the field forms in **Appendix J**. The results of the SI are grouped by AOPI and discussed for each medium as applicable. Groundwater was generally first encountered at depths of approximately 8 to 24 feet bgs at DTA.

Table 7-3 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Yes/No)
AOPI A	No
AOPI B	No
AOPI C	No
AOPI D	No
AOPI E	Yes
AOPI F	Yes
AOPI G	No
AOPI H	Yes
AOPI I	No

7.1 AOPI A

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

7.1.1 Groundwater

One groundwater sample was collected via DPT drilling and temporary well sampling at AOPI A (DTA-AOPIA-02; **Figure 7-2)**. The groundwater sample was collected at the first-encountered groundwater in the boring, which was at approximately 14 feet bgs. Additional groundwater samples were planned at this AOPI; however, as discussed in **Section 6.3.3** groundwater samples were not able to be collected from DTA-AOPIA-01 due to a potential utility preventing further drilling and due to a lack of water at DTA-AOPIA-03. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIA-02 (3.1 ng/L). PFOA was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIA-02 (4.5 ng/L). PFBS was detected below the OSD risk screening level of 600 ng/L at DTA-AOPIA-02 (7.8 ng/L).

7.1.2 Soil

Soil samples were collected from three locations at AOPI A (DTA-AOPIA-01 through DTA-AOPIA-03; **Figure 7-2**). One soil sample was collected from 0 to 2 feet bgs at DTA-AOPIA-01, one from 8 to 10 bgs at DTA-AOPIA-02, and one from 6 to 8 bgs at DTA-AOPIA-03 to capture native soil impacts below fill soil. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

The only detection of PFOS, PFOA, and PFBS was a PFOS detection of 0.0014 mg/kg at DTA-AOPIA-01. This detection was below the industrial OSD risk screening level of 1.6 mg/kg and below the residential OSD risk screening level of 0.13 mg/kg.

7.2 AOPI B

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

7.2.1 Groundwater

Two groundwater samples were collected via DPT drilling and temporary well sampling at AOPI B (DTA-AOPIB-01 and DTA-AOPIB-02; **Figure 7-3**). The groundwater sample was collected at the first-encountered groundwater in the boring, which was at approximately 10 to 12 feet bgs. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIB-01 and DTA-AOPIB-02 (2.6 ng/L and 39 ng/L, respectively). PFOA was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIB-01 and DTA-AOPIB-02 (6.7 ng/L and 26 ng/L, respectively). PFBS was detected below the OSD risk screening level of 600 ng/L at DTA-AOPIB-01 and DTA-AOPIB-02 (3.8 ng/L and 4.6 ng/L, respectively).

7.2.2 Soil

Soil samples were collected from three locations at AOPI B (DTA-AOPIB-01, DTA-AOPIB-02, and DTA-AOPIB-03; **Figure 7-3**). Each boring included one surface soil sample from 0 to 2 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

PFOA and PFBS compounds were not detected. PFOS was detected below the residential OSD risk screening level of 0.13 mg/kg at DTA-AOPIB-02 and DTA-AOPIB-03 (0.0011 mg/kg and 0.00059 mg/kg, respectively).

7.3 AOPI C

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

7.3.1 Groundwater

Three groundwater samples were collected via DPT drilling and temporary well sampling at AOPI C (DTA-AOPIC-01 through DTA-AOPIC-03; **Figure 7-4**). The groundwater sample was collected at the first-encountered groundwater in the boring, which was at approximately 8 to 10 feet bgs. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIC-02 and DTA-AOPIC-03 (14 ng/L and 14 ng/L, respectively). PFOS was detected at DTA-AOPIC-01 at a concentration of 22 J-ng/L; because this result originally had an X qualifier, it is not compared to the OSD risk screening level. PFOA was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIC-01, DTA-AOPIC-02, and DTA-AOPIC-03 (23 ng/L, 6.7 ng/L, and 5.8 ng/L, respectively). PFBS was detected below the OSD risk screening level of 600 ng/L at DTA-AOPIC-01 (10 ng/L). PFBS was not detected at DTA-AOPIC-02, and DTA-AOPIC-03.

7.3.2 Soil

Soil samples were collected from three locations at AOPI C (DTA-AOPIC-01 through DTA-AOPIC-03; **Figure 7-4**). Each boring included one surface soil sample from 0 to 2 feet bgs, in a grassy area just off the asphalt of the lot. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

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

7.4 AOPI D

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

7.4.1 Groundwater

Three groundwater samples were collected via DPT drilling and temporary well sampling at AOPI D (DTA-AOPID-01, DTA-AOPID-02, and DTA-AOPID-03; **Figure 7-5**). The groundwater samples were collected at the first-encountered groundwater in the boring, which was at approximately 20 to 24 feet bgs. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and PFBS were not detected in all groundwater samples at this AOPI.

7.4.2 Soil

Soil samples were collected from three locations at AOPI D (DTA-AOPID-01 through DTA-AOPID-03; **Figure 7-5**). Each boring included one surface soil sample from 0 to 2 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

PFOA and PFBS compounds were not detected in any of the soil samples. PFOS was detected below the residential OSD risk screening level of 0.13 mg/kg at all locations at concentrations ranging from 0.0037 mg/kg (DTA-AOPID-03) to 0.067 mg/kg (DTA-AOPID-01 [0.056 mg/kg in the duplicate]).

7.5 AOPI E

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

7.5.1 Groundwater

Two groundwater samples were collected via DPT drilling and temporary well sampling at AOPI E (DTA-AOPIE-04 and DTA-AOPIE-05; **Figure 7-5**). The groundwater samples were collected at the first-encountered groundwater in the borings, which was at approximately 11 to 18 feet bgs. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIE-04 (12 ng/L). PFOS was detected above the OSD risk screening level at DTA-AOPIE-05 (190 ng/L). PFOA was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIE-04 (7.4 ng/L). PFOA was detected above the OSD risk screening level of 40 ng/L at DTA-AOPIE-05 (47 ng/L). PFBS was not detected at DTA-AOPIE-04. PFBS was detected below the OSD risk screening level of 600 ng/L at DTA-AOPIE-05 (10 ng/L).

7.5.2 Soil

Soil samples were collected from two locations at AOPI E (DTA-AOPIE-04 and DTA-AOPIE-05; **Figure 7-5**). Each boring included one surface soil sample from 0 to 2 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

PFOA and PFBS compounds were not detected in any of the soil samples. PFOS was detected below the residential OSD risk screening level of 0.13 mg/kg at all locations at concentrations ranging from 0.00084 mg/kg (DTA-AOPIE-04) to 0.0048 mg/kg (DTA-AOPIE-05).

7.6 AOPI F

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

7.6.1 Groundwater

Two groundwater samples were collected via DPT drilling and temporary well sampling at AOPI F (DTA-AOPIF-01 and DTA-AOPIF-02; **Figure 7-6**). The groundwater sample was collected at the first-encountered groundwater in the boring, which was at approximately 10 to 16 feet bgs. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIF-01 (6.4 ng/L). PFOS was detected above the OSD risk screening level of 40 ng/L at DTA-AOPIF-02 (67 ng/L). PFOA was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIF-01 (16 ng/L). PFOA was detected above the OSD risk screening level of 40 ng/L at DTA-AOPIF-02 (75 ng/L). PFBS was detected below the OSD risk screening level of 600 ng/L at DTA-AOPIF-01 and DTA-AOPIF-02 (22 ng/L and 2.9 ng/L, respectively).

7.6.2 Soil

Soil samples were collected from two locations at AOPI F (DTA-AOPIF-01 and DTA-AOPIF-02; **Figure 7-6**). Each boring included one surface soil sample from 0 to 2 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

PFOA and PFBS compounds were not detected in either of the soil samples. PFOS was detected below the residential OSD risk screening level of 0.13 mg/kg at DTA-AOPIF-01 and DTA-AOPIF-02 (0.0064 mg/kg and 0.00062 mg/kg, respectively).

7.7 AOPI G

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

7.7.1 Groundwater

Five groundwater samples were collected via DPT drilling and temporary well sampling at AOPI G (DTA-AOPIG-01 through DTA-AOPIG-05; **Figure 7-7**). The groundwater sample was collected at the first-encountered groundwater in the boring, which was at approximately 12 to 18 feet bgs. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

From the initial sampling event, PFOS was detected at DTA-AOPIG-01 (860 J- ng/L). PFOS was not detected in the other AOPI G groundwater samples. PFOA was detected at DTA-EAOPIG-01 (150 J- ng/L). As discussed in **Section 6.4.3**, these data are not suitable for comparison to the OSD risk screening levels. PFOA was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIG-05 (2.2 ng/L). PFOA was non-detect in the other AOPI G groundwater samples. PFBS was detected below

the OSD risk screening level of 600 ng/L at DTA-AOPIG-01 and DTA-EL-03 (22 ng/L and 2.4 ng/L, respectively). PFBS was non-detect in the other AOPI G groundwater samples.

Due to data usability concerns, DTA-AOPIG-01 was resampled in January 2022. PFOA and PFBS were not detected in the sample and PFOS was found below the OSD risk screening level with a concentration of 2.1 J ng/L.

7.7.2 Soil

Soil samples were collected from five locations at AOPI G (DTA-AOPIG-01 through DTA-AOPIG-05; **Figure 7-7**). DTA-AOPIG-01 through DTA-AOPIG-04 included one surface soil sample from 0 to 2 feet bgs. DTA-AOPIG-05 included two samples: one from 0.5 to 2 and one from 2.0 to 3.5 feet bgs. The second, deeper sample was collected due to presence of a shallow water bearing zone observed from 1.5 to 2.5 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

PFOS, PFOA, and PFBS compounds were not detected in any of the soil samples.

7.8 AOPI H

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

7.8.1 Groundwater

Two groundwater samples were collected via DPT drilling and temporary well sampling at AOPI H (DTA-AOPIH-01 and DTA-AOPIH-02; **Figure 7-8**). The groundwater sample was collected at the first-encountered groundwater in the boring, which was at approximately 16 feet bgs. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected below the OSD risk screening level of 40 ng/L at DTA-AOPIH-01 (24 ng/L [20 ng/L in the duplicate]). PFOS was detected above the OSD risk screening level of 40 ng/L at DTA-AOPIH-02 (6,400 ng/L). PFOA was detected above the OSD risk screening level of 40 ng/L at DTA-AOPIH-01 and DTA-AOPIH-02 (42 ng/L and 3,600 ng/L, respectively). PFBS was detected below the OSD risk screening level of 600 ng/L at DTA-AOPIH-01 (400 ng/L) and PFBS was detected above the OSD risk screening level at DTA-AOPIH-02 (5,300 ng/L).

7.8.2 Soil

Soil samples were collected from two locations at AOPI H (DTA-AOPIH-01 and DTA-AOPIH-02; **Figure 7-8**). Each boring included one surface soil sample from 0 to 2 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

PFOS was detected above the residential OSD risk screening level of 0.13 mg/kg at DTA-AOPIH-01 (0.23 mg/kg) and DTA-AOPIH-02 (3.2 mg/kg). The detection at DTA-AOPIH-02 was also above the industrial OSD risk screening level of 1.3 mg/kg. PFOA was detected below the residential and commercial/industrial OSD risk screening levels at DTA-AOPIH-01 and DTA-AOPIH-02 (0.004 mg/kg and

0.028 mg/kg respectfully). PFBS was not detected at DTA-AOPIH-01 but was detected below the residential OSD risk screening level of 1.9 mg/kg at DTA-AOPIH-02 (0.0016 mg/kg).

7.9 AOPI I

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

7.9.1 Groundwater

One groundwater sample was collected via DPT drilling and temporary well sampling at AOPI I (DTA-AOPII-1; **Figure 7-9**). The groundwater sample was collected at the first-encountered groundwater in the boring, which was at approximately 25 feet bgs. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**.

PFOS and PFBS were not detected at DTA-AOPII-01. PFOA was detected below the OSD risk screening level of 40 ng/L at DTA-AOPII-01 (3.9 ng/L [3.6 J ng/L in the duplicate]).

7.9.2 Soil

Soil samples were collected from seven locations at AOPI I (DTA-AOPII-01 through DTA-AOPII-07; **Figure 7-9**). One soil sample was collected from 0 to 2 feet bgs at each location to capture native soil impacts. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

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

7.10 Investigation Derived Waste

A composite sample of the excess soil cuttings was collected from the 55-gallon drum (which contained approximately 55 gallons of soil). The soil results indicated PFOS at 0.00059 J mg/kg and PFBS below detection limits (**Appendix N**). The PFOS, PFOA, and PFBS concentrations observed did not exceed the OSD risk screening levels. The IDW was disposed at an off-post landfill that accepts PFAS-containing waste, as agreed upon by the installation. The full analytical results (i.e., for all constituents analyzed) for IDW samples collected during the SI are included in **Appendix N**.

7.11 TOC, pH, and Grain Size

In addition to sampling soil for PFOS, PFOA, and PFBS, one soil sample per AOPI was analyzed for TOC, pH, moisture content, and grain size data as they may be useful in future fate and transport studies. The soil throughout DTA has been reworked over the years and in some cases could have fill present down to the water table. The soil samples were generally taken from the top 2 feet of soil, so this information is most relevant to the surface soil, which is likely to contain some fill material at DTA. In most cases, this material was sampled instead of going deeper into native soil since any use, storage, and/or disposal of PFAS-containing materials would have impacted the surface. Considering the variability of the glaciolacustrine sediments in native soil in the area, it could be difficult to discern fill from native soil. A wide range of fines (silt and clay) was observed in DTA soil samples which is indicative of the presence of

different types of fill. In general, PFAS constituents tend to be more mobile in soils with less fines and lower TOC. The percent moisture of the soil 11.9% was typical for loam (0 to 12%) or clay (0 to 20%). The pH of the soil was slightly alkaline (average pH 7 through 9). Based on these geochemical data obtained during the SI at DTA, a generalized conclusion cannot be made on PFAS constituents' mobility at DTA. TOC, pH, and grain size analysis can be found in **Appendix N**.

7.12 Blank Samples

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

7.13 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2020) were re-evaluated and updated, if necessary, based on the SI sampling results. The CSMs presented on **Figures 7-10** through **7-13** and in this section therefore represent the current understanding of the potential for human exposure. For some AOPIs, the CSM is the same and thus shown on the same figure.

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

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

Human exposure pathways are shown as "complete", "potentially complete", or "incomplete" on the CSM figures. A complete exposure pathway consists of a constituent source and release mechanism, a transport or retention medium, an exposure point where human contact with the contaminated medium could occur, and an exposure route at the exposure point. If any of these elements is missing, the exposure pathway is incomplete. Pathways are "potentially complete" where data are insufficient to

conclude the pathway is either “complete” or “incomplete”. Additionally, the CSMs do not include ecological receptors and exposure pathways. The potential for ecological exposures to PFOS, PFOA, and PFBS may be evaluated at a future date if those pathways warrant further consideration.

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

- There are no residents or recreational users at DTA. Therefore, potential exposure pathways for these on-installation receptor types are incomplete.
- Except for AOPI I, the AOPIs are wholly located within the installation boundaries, and off-installation receptors are unlikely to access the AOPIs. Therefore, the soil exposure pathways for off-installation receptors are incomplete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at eight of the nine AOPIs where sampling has occurred: 1) AOPI A, 2) AOPI B, 3) AOPI C, 4) AOPI E, 5) AOPI F, 6) AOPI G, 7) AOPI H, and 8) AOPI I. PFOS**,** PFOA, and/or PFBS were not detected in groundwater at AOPI D. Due to citywide restrictions in Warren, there are no production or drinking water wells at DTA or within 5 miles of the installation boundary. Drinking water at DTA and for the surrounding community is supplied by the City of Warren, which sources water from the Detroit River. Additionally, the Army implements controls which prevent intrusive work (including drilling for well installation) without directorate of public works approval per the installation’s master plan and the dig permitting process, and a land use restriction prohibits the use of off-post groundwater in the surrounding area. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for all receptors are incomplete. Additional exposure pathway descriptions for each CSM are listed below by figure.

Figure 7-10 shows the CSM for five AOPIs: 1) AOPI E, 2) AOPI A, 3) AOPI H, 4) AOPI F, and 5) AOPI B. At AOPI E and AOPI A AOPIs, AFFF could have been used during tank fording and testing activities. At AOPI H, AFFF releases were noted in the parking lot. At AOPI F, a fire occurred on the west of side of the building and AFFF was drained in the grassy area adjacent to the building parking lot. At AOPI B, potential PFOS, PFOA, and PFBS sources include photo processing, AFFF training on the southern end of the building, and fire suppression foam in tanks.

- PFOS, PFOA, and PFBS were detected in soil at these AOPIs, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- All surface water runoff at DTA is directed to an on-installation stormwater system, which leads directly to Bear Creek. On-installation site workers could contact constituents in surface water and sediment in the on-installation stormwater system (e.g., while performing maintenance work). Therefore, the surface water and sediment exposure pathways for on-installation site workers are potentially complete.
- PFOS, PFOA, and PFBS were detected in groundwater which could discharge to off-installation surface water. Bear Creek and surface water bodies within 5 miles downstream of the installation are not used and are not likely to be used in the future, as a drinking water source. Therefore, the surface water exposure pathway (via ingestion and dermal contact) for off-installation drinking water receptors

is incomplete. However, recreational users off-post could contact constituents in surface water and sediment through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Figure 7-11 shows the CSM for AOPI D. At AOPI D, AFFF could have been used during tank fording and testing activities.

- PFOS, PFOA, and PFBS were detected in soil at this AOPI, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- All surface water runoff at DTA is directed to an on-installation stormwater system, which leads directly to Bear Creek. On-installation site workers could contact constituents in surface water and sediment in the on-installation stormwater system (e.g., while performing maintenance work). Therefore, the surface water and sediment exposure pathways for on-installation site workers are potentially complete.
- Groundwater at DTA could discharge to off-installation surface water at Bear Creek. However, PFOS, PFOA, and PFBS were not detected in groundwater samples collected at this AOPI; therefore, the surface water and sediment exposure pathways for off-installation receptors are incomplete.

Figure 7-12 shows the CSM for AOPI G and AOPI C. AOPI G was noted by interviewees to have had various AFFF releases during training activities. A car fire at AOPI C was extinguished with AFFF.

- PFOS, PFOA, and PFBS were not detected in soil at AOPI G and AOPI C. Therefore, the soil exposure pathway for on-installation site workers is incomplete at these AOPIs.
- PFOS, PFOA, and PFBS were detected in groundwater which could discharge to off-installation surface water. See **Section 6.4.3** for a data usability discussion surrounding AOPI G and AOPI C sampling. Bear Creek and surface water bodies within 5 miles downstream of the installation are not used and are not likely to be used in the future, as a drinking water source. Therefore, the surface water exposure pathway (via ingestion and dermal contact) for off-installation drinking water receptors is incomplete. However, recreational users off-post could contact constituents in surface water and sediment through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Figure 7-13 shows the CSM for AOPI I. AOPI I was noted by interviewees to have had a fire at the east end of the building. The method to extinguish the fire is not known. The area surrounding this AOPI is under BRAC control.

- PFOS, PFOA, and PFBS were not detected in soil at AOPI I. However, detections of PFOS in groundwater may indicate a soil source that was missed during the initial sampling. Therefore, the soil exposure pathway for on-installation site workers is potentially complete at this AOPI. Although the area is fenced in, it is still surrounded by BRAC property. Therefore, the soil exposure pathway for off-installation receptors is also potentially complete.
- PFOS was detected in groundwater which could discharge to off-installation surface water. Surface water bodies within 5 miles downstream of the installation are not used and are not likely to be used in the future, as a drinking water source. Therefore, the surface water exposure pathway (via

ingestion and dermal contact) for off-installation drinking water receptors is incomplete. However, recreational users off-post could contact constituents in surface water and sediment through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

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

8 CONCLUSIONS AND RECOMMENDATIONS

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

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

All AOPIs were sampled during the SI at DTA to identify presence or absence of PFOS, PFOA, and PFBS at each AOPI. The SI scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the DTA QAPP Addendum (Arcadis 2019).

Potable water samples for PFOS and PFOA were collected from the DTA water supply on four occasions from 2013 to 2014. Also, in response to the third Unregulated Contaminant Monitoring Rule, samples were collected from drinking water distribution systems from the surrounding zip codes in 2013 and 2014. PFOS and PFOA were below detection limits in all samples.

All nine AOPIs had detections of PFOS, PFOA, and PFBS in soil and/or groundwater and four AOPIs exceeded OSD risk screening levels. Groundwater samples were collected at all nine AOPIs. The presence of PFOS, PFOA, and/or PFBS was identified in 16 of 20 samples. PFOS, PFOA, and/or PFBS presence was identified in groundwater at AOPI A, AOPI B, AOPI C, AOPI E, AOPI F, AOPI G, AOPI H, and AOPI I. The highest PFOS, PFOA, and PFBS concentrations in groundwater were observed at AOPI H, at 6,400 ng/L, 3,600 ng/L and 5,300 ng/L, respectively. In total, three AOPIs had groundwater exceedances of PFOS, PFOA and/or PFBS above the OSD risk screening levels of 40 ng/L (PFOS and PFOA) and 600 ng/L (PFBS).

Soil samples were collected at all nine AOPIs. The presence of PFOS, PFOA, and/or PFBS was identified in 12 of 31 soil samples. PFOS, PFOA, and/or PFBS presence were identified in soil at AOPI A, AOPI B, AOPI D, AOPI E, AOPI F, and AOPI H. The highest concentration observed in soil was 3.2 mg/kg of PFOS at AOPI H (above the OSD industrial/commercial risk screening level of 1.6 mg/kg and above the OSD residential risk screening level of 0.13 mg/kg). This is one of two detections in soil above OSD risk screening levels. The second exceedance was also found at AOPI H with a value of 0.23 mg/kg of PFOS (above the OSD residential risk screening level of 0.13 mg/kg). AOPI H was the only AOPI with a soil exceedance of OSD risk screening levels. There were no exceedances of PFOA and PFBS in soil.

Following the SI sampling, nine out of the nine AOPIs with confirmed PFOS, PFOA, and/or PFBS presence were considered to have complete or potentially complete exposure pathways. The soil exposure pathway was considered complete for on-installation site workers at six of the nine AOPIs where PFOS, PFOA, and/or PFBS were detected in soil. PFOS, PFOA, and/or PFBS in soil at those six AOPIs could produce surface water runoff to the on-installation stormwater system where site workers

could contact surface water and sediment. Therefore, the surface water and sediment exposure pathways for on-installation site workers are potentially complete at six of nine AOPIs. Based on the detections of PFOS, PFOA, and/or PFBS in groundwater samples associated with eight of the nine AOPIs, and because groundwater at DTA could discharge to off-installation surface water at Bear Creek, surface water and sediment exposure pathways were potentially complete for off-installation 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, and PFBS to the OSD risk screening levels (**Table 6-2**). **Table 8-1** below summarizes the AOPIs identified at DTA, PFOS, PFOA, and PFBS sampling and recommendations for each AOPI; further investigation is warranted at DTA. In accordance with CERCLA, site-specific risk will be assessed during a future phase to evaluate whether remedial actions are required.

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

AOPI Name	PFOS, PFOA, and/or PFBS Detected Greater than OSD Risk Screening Levels? Yes/No		Recommendation
	GW	SO	
AOPI A	No	No	No action at this time
AOPI B	No	No	No action at this time
AOPI C	No	No	No action at this time
AOPI D	No	No	No action at this time
AOPI E	Yes	No	Further study in a remedial investigation
AOPI F	Yes	No	Further study in a remedial investigation
AOPI G	No	No	No action at this time
AOPI H	Yes	Yes	Further study in a remedial investigation
AOPI I	No	No	No action at this time

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
SO – soil

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, and PFBS at DTA are discussed below.

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

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

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

Finally, the available PFOS, PFOA, and PFBS analytical data is limited to sampling conducted from wells in non-residential areas, and from aquifers other than where drinking water wells are screened. Available data, including PFOS, PFOA, and PFBS, is listed in **Appendix N**, which were analyzed per the selected analytical method.

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

9 REFERENCES

ABS Environmental Services, Inc. 1993. Final Summary Report Data Item A009 Monitoring and Pumping Test Program, Detroit Arsenal, Warren, Michigan. September.

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. 2020. Final UFP QAPP Addendum, Revision 0, USAEC PFAS PA/SI, Detroit Arsenal, Michigan. April.

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

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

DoD. 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. 2019. Consolidated Quality Systems Manual for Environmental Laboratories, Version 5.3. May.

Environmental Data Resources, Inc. (EDR) 2018. Environmental Data Report. Detroit Arsenal. Inquiry Number 5254023.75s. April 23.

Envirodyne Engineers, Inc. 1985. Environmental Contamination Survey of the Detroit Arsenal. August.

ERT. 2017. Final Site Investigation Report – DA-CC-003 Soil and Groundwater Contamination and DA-CC-003, Site Investigation at Former Buildings 7 and 8. December.

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

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

Safford, B., Harold Hassen, Edward B. Jelks, Keith L. Barr, and M. Schroeder. 1985. An Archaeological Overview and Management Plan for the Detroit Arsenal, the Pontiac Storage Facility, and the Keweenaw Field Station, Macomb, Oakland, and Houghton Counties, Michigan. Report No. 40,

Woodward-Clyde Consultants, Walnut Creek, California. Submitted to the National Park Service, Department of the Interior, Atlanta, Georgia.

USACE. 2004. Five-Year Review Report for Detroit Arsenal Tank Plant. Warren, Macomb County, MI. November.

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.

USACE. 2017. Final Site Investigation Report DA-CC-004 Soil and Groundwater Contamination. Detroit Arsenal, MI. December.

United States Army Toxic and Hazardous Materials Agency. 1990. Final Report, 1990 Quarterly Monitoring Program, Detroit Arsenal, Warren, Michigan"; prepared for U.S. Army Toxic and Hazardous Materials Agency. December.

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.

ACRONYMS

°F	degrees Fahrenheit
%	percent
AFFF	aqueous film-forming foam
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	United States Army
bgs	below ground surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	conceptual site model
DoD	Department of Defense
DPT	direct-push technology
DQO	data quality objective
DTA	Detroit Arsenal
DUSR	Data Usability Summary Report
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
GIS	geographic information system
GW	groundwater
IDW	investigation-derived waste
installation	United States Army or Reserve installation
IRP	Installation Restoration Program
LOD	limit of detection
LOQ	limit of quantitation
mg/kg	milligrams per kilogram (parts per million)
ng/L	nanograms per liter (parts per trillion)
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances

PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	parts per million
ppt	parts per trillion
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RSL	Regional Screening Level
SI	site inspection
SO	soil
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
TARDEC	United States Army Tank Automotive Research, Development and Engineering Center
TBD	to be determined
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
WWTP	wastewater treatment plant

TABLES

Table 2-1 - Historical PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Detroit Arsenal, Michigan

Location		City of Warren Discharge Point			DTA Potable Water			
Sample ID		S92650.11	NA	94919-002	359413900 1AM	351055610 01AM	3511608700 1AM	3513263700 1AM
Sample Date		8/3/2018	4/16/2019	2/21/2020	5/20/2013	8/20/2013	11/13/2013	4/1/2013
Units	OSD Risk Screening Level*	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Perfluorooctanoic acid (PFOA)	40	ND	ND	32	<20	<20	<20	<20
Perfluorobutanesulfonic acid (PFBS)	600	10	NA	ND	NA	NA	NA	NA
Perfluorooctane sulfonate (PFOS)	40	60	17	ND	<40	<40	<40	<40

Notes:
* Risk screening level (RSL) for tap water. To be conservative, the OSD tap water RSLs will be used to compare all groundwater and potable-use surface water for this Army PFAS PA/SI program.

Acronyms:
< - less than
am - ante meridiem
DTA - Detroit Arsenal
ID - identification
NA - not available
ND - not detected
ng/L - nanograms per liter
OSD - Office of the Secretary of Defense
PA - preliminary assessment
PFAS - per- and polyfluoroalkyl substances
SI - site inspection

Table 6-1 - Site Inspection Sampling Location Details
USAEC PFAS Preliminary Assessment/Site Inspection
Detroit Arsenal, Michigan

AOPI	Matrix	Sample ID	Depth Interval[1]	Sample Method	Analytes
AOPI B	GW	DTA-AOPIB-01-GW-081820	10	Grab	PFAS[3], field parameters[2]
	SO	DTA-AOPIB-01-SO-081420	0-2	Composite	PFAS, TOC, Grain Size, pH
	GW	DTA-AOPIB-02-GW-081820	12	Grab	PFAS, field parameters
	SO	DTA-AOPIB-02-SO-081420	0-2	Composite	PFAS
	SO	DTA-AOPIB-03-SO-081420	0-2	Composite	PFAS
AOPI H	GW	DTA-AOPIH-01-GW-081720	16	Grab	PFAS, field parameters
	SO	DTA-AOPIH-01-SO-081420	0-2	Composite	PFAS, TOC, Grain Size, pH
	GW	DTA-AOPIH-02-GW-081720	16	Grab	PFAS, field parameters
	SO	DTA-AOPIH-02-SO-081320	0-2	Composite	PFAS
AOPI F	GW	DTA-AOPIF-01-GW-081720	16	Grab	PFAS, field parameters
	SO	DTA-AOPIF-01-SO-081220	0-2	Composite	PFAS, TOC, Grain Size, pH
	GW	DTA-AOPIF-02-GW-081720	10	Grab	PFAS, field parameters
	SO	DTA-AOPIF-02-SO-081320	0-2	Composite	PFAS
AOPI G	GW	DTA-AOPIG-01-GW-081720	14	Grab	PFAS, field parameters
	GW	DTA-AOPIG-01-GW-010422	14	Grab	PFAS, field parameters
	SO	DTA-AOPIG-01-SO-081320	0-2	Composite	PFAS, TOC, Grain Size, pH
	GW	DTA-AOPIG-02-GW-081720	16	Grab	PFAS, field parameters
	SO	DTA-AOPIG-02-SO-081320	0-2	Composite	PFAS
	GW	DTA-AOPIG-03-GW-081720	18	Grab	PFAS, field parameters
	SO	DTA-AOPIG-03-SO-081320	0-2	Composite	PFAS
	GW	DTA-AOPIG-04-GW-081720	12	Grab	PFAS, field parameters
	SO	DTA-AOPIG-04-SO-081320	0-2	Composite	PFAS
	GW	DTA-AOPIG-05-GW-081720	16	Grab	PFAS, field parameters
	SO	DTA-AOPIG-05-SO-081320	0.5-2	Composite	PFAS
	SO	DTA-AOPIG-06-SO-081320	2-3.5	Composite	PFAS
AOPI I	GW	DTA-AOPII-1-GW-010422	30	Grab	PFAS
	SO	DTA-AOPII-1-SO-121621	0-2	Composite	PFAS, TOC, Grain Size, pH
	SO	DTA-AOPII-2-SO-121621	0-2	Composite	PFAS
	SO	DTA-AOPII-3-SO-121621	0-2	Composite	PFAS
	SO	DTA-AOPII-4-SO-121621	0-2	Composite	PFAS
	SO	DTA-AOPII-5-SO-121621	0-2	Composite	PFAS
	SO	DTA-AOPII-6-SO-121621	0-2	Composite	PFAS
	SO	DTA-AOPII-7-SO-121621	0-2	Composite	PFAS
AOPI D	GW	DTA-AOPID-01-GW-081420	20	Grab	PFAS, field parameters
	SO	DTA-AOPID-01-SO-081220	0-2	Composite	PFAS, TOC, Grain Size, pH
	GW	DTA-AOPID-02-GW-081420	24	Grab	PFAS, field parameters
	SO	DTA-AOPID-02-SO-081220	0-2	Composite	PFAS
	GW	DTA-AOPID-03-GW-081420	20	Grab	PFAS, field parameters
	SO	DTA-AOPID-03-SO-081220	0-2	Composite	PFAS
AOPI E	GW	DTA-AOPIE-04-GW-081420	11	Grab	PFAS, field parameters
	SO	DTA-AOPIE-04-SO-081220	0-2	Composite	PFAS
	GW	DTA-AOPIE-05-GW-081720	18	Grab	PFAS, field parameters
	SO	DTA-AOPIE-05-SO-081220	0-2	Composite	PFAS
AOPI A	GW	DTA-AOPIA-02-GW-081820	14	Grab	PFAS, field parameters
	SO	DTA-AOPIA-01-SO-081420	0-2	Composite	PFAS, TOC, Grain Size, pH
	SO	DTA-AOPIA-02-SO-081720	0-2	Composite	PFAS
	SO	DTA-AOPIA-03-SO-081720	0-2	Composite	PFAS
AOPI C	GW	DTA-AOPIC-01-GW-081420	8	Grab	PFAS, field parameters
	SO	DTA-AOPIC-01-SO-081120	0-2	Composite	PFAS, TOC, Grain Size, pH
	GW	DTA-AOPIC-02-GW-081420	10	Grab	PFAS, field parameters
	SO	DTA-AOPIC-02-SO-081120	0-2	Composite	PFAS
	GW	DTA-AOPIC-03-GW-081420	10	Grab	PFAS, field parameters
	SO	DTA-AOPIC-03-SO-081120	0-2	Composite	PFAS

Notes:

1. Depth units are reported in ft bgs unless otherwise noted.

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

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

Acronyms/Abbreviations:

AOPI - area of potential interest
ft bgs - feet below ground surface
GW - groundwater
ID - identification
PFAS - per- and polyfluoroalkyl substances
PFBS - perfluorobutanesulfonic acid
PFOA - perfluorooctanoic acid
PFOS - perfluorooctane sulfonate
SO - soil
TOC - total organic carbon

Table 7-1 - Groundwater PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Detroit Arsenal, Michigan

AOPI	Location	Lab Sample ID / Parent Sample ID	Sample ID / Parent Sample ID	Sample Date	Analyte	PFOS (ng/l)		PFOA (ng/l)		PFBS (ng/L)	
					OSD Tapwater Risk Screening Level	40		40		600	
					Sample Type	Result	Qual	Result	Qual	Result	Qual
AOPI A	DTA-AOPIA-02	DTA-AOPIA-02-GW-081820	DTA-AOPIA-02-GW-081820	08/18/2020	N	**3.1**	J-	**4.5**	J-	**7.8**	J-
AOPI B	DTA-AOPIB-01	DTA-AOPIB-01-GW-081820	DTA-AOPIB-01-GW-081820	08/18/2020	N	**2.6**	J-	**6.7**	J-	**3.8**	J-
AOPI B	DTA-AOPIB-02	DTA-AOPIB-02-GW-081820	DTA-AOPIB-02-GW-081820	08/18/2020	N	**39**	J-	**26**	J-	**4.6**	J-
AOPI C	DTA-AOPIC-01	DTA-AOPIC-01-GW-081420	DTA-AOPIC-01-GW-081420	08/14/2020	N	**22**	J-	**23**	J+	**10**	J+
AOPI C	DTA-AOPIC-02	DTA-AOPIC-02-GW-081420	DTA-AOPIC-02-GW-081420	08/14/2020	N	**14**		**6.7**		3.8	U
AOPI C	DTA-AOPIC-03	DTA-AOPIC-03-GW-081420	DTA-AOPIC-03-GW-081420	08/14/2020	N	**14**		**5.8**		4.3	U
AOPI D	DTA-AOPID-01	DTA-AOPID-01-GW-081420	DTA-AOPID-01-GW-081420	08/14/2020	N	9.7	U	9.7	U	9.7	U
AOPI D	DTA-AOPID-02	DTA-AOPID-02-GW-081420	DTA-AOPID-02-GW-081420	08/14/2020	N	3.7	U	3.7	U	3.7	U
AOPI D	DTA-AOPID-03	DTA-AOPID-03-GW-081420	DTA-AOPID-03-GW-081420	08/14/2020	N	3.8	U	3.8	U	3.8	U
AOPI E	DTA-AOPIE-04	DTA-FD-01-GW-081420 / DTA-AOPIE-04-GW-081420	DTA-FD-01-GW-081420 / DTA-AOPIE-01-GW-081420	08/14/2020	FD	**12**		**6.2**		3.7	U
		DTA-AOPIE-04-GW-081420	DTA-AOPIE-01-GW-081420	08/14/2020	N	**12**		**7.4**		3.7	U
AOPI E	DTA-AOPIE-05	DTA-AOPIE-05-GW-081720	DTA-AOPIE-02-GW-081720	08/17/2020	N	**190**		**47**		**10**	
AOPI F	DTA-AOPIF-01	DTA-AOPIF-01-GW-081720	DTA-AOPIF-01-GW-081720	08/17/2020	N	**6.4**		**16**		**22**	
AOPI F	DTA-AOPIF-02	DTA-AOPIF-02-GW-081720	DTA-AOPIF-02-GW-081720	08/17/2020	N	**67**	J	**75**		**2.9**	J
AOPI G	DTA-AOPIG-01	DTA-AOPIG-01-GW-081720	DTA-AOPIG-01-GW-081720	08/17/2020	N	**860**	J-	**150**	J-	**22**	J-
AOPI G	DTA-AOPIG-01	DTA-AOPIG-01-GW-010422	DTA-AOPIG-01-GW-010422	01/04/2022	N	**2.1**	J	3.7	U	3.7	U
AOPI G	DTA-AOPIG-02	DTA-AOPIG-02-GW-081720	DTA-AOPIG-02-GW-081720	08/17/2020	N	3.7	U	3.7	U	3.7	U
AOPI G	DTA-AOPIG-03	DTA-AOPIG-03-GW-081720	DTA-AOPIG-03-GW-081720	08/17/2020	N	4.8	UJ-	4.8	UJ-	**2.4**	J-
AOPI G	DTA-AOPIG-04	DTA-AOPIG-04-GW-081720	DTA-AOPIG-04-GW-081720	08/17/2020	N	3.8	UJ	3.8	U	3.8	U
AOPI G	DTA-AOPIG-05	DTA-AOPIG-05-GW-081720	DTA-AOPIG-05-GW-081720	08/17/2020	N	3.8	U	**2.2**	J	3.8	U
AOPI H	DTA-AOPIH-01	DTA-FD-02-GW-081720 / DTA-AOPIH-01-GW-081720	DTA-FD-02-GW-081720 / DTA-AOPIH-01-GW-081720	08/17/2020	FD	**20**	J+	**55**		**410**	
		DTA-AOPIH-01-GW-081720	DTA-AOPIH-01-GW-081720	08/17/2020	N	**24**	J+	**42**		**400**	J
AOPI H	DTA-AOPIH-02	DTA-AOPIH-02-GW-081720	DTA-AOPIH-02-GW-081720	08/17/2020	N	**6400**	DJ	**3600**	DJ	**5300**	DJ
AOPI I	DTA-AOPII-1	DTA-FD-1-GW-010422 / DTA-AOPII-1-GW-010422	DTA-FD-1-GW-010422 / DTA-AOPII-1-GW-010422	01/04/2022	FD	3.6	U	**3.9**		3.6	U
		DTA-AOPII-1-GW-010422	DTA-AOPII-1-GW-010422	01/04/2022	N	3.7	U	**3.6**	J	3.7	U

Notes:
1. Bolded values indicate the result was detected greater than the limit of detection (LOD).
2. Grey shaded values indicate the result was detected greater than the 2021 Office of the Secretary of Defense (OSD) risk screening levels for tap water (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. October.)

Acronyms/Abbreviations:
AOPI - area of potential interest
FD - field duplicate sample
HAL - health advisory level
ID - identification
N - primary sample
ng/L - nanograms per liter (parts per trillion)
PFAS - per- and polyfluoroalkyl substances
PFBS - perfluorobutanesulfonic acid
PFOA - perfluorooctanoic acid
PFOS - perfluorooctane sulfonate
Qual - qualifier

Qualifiers:
DJ - The analyte was analyzed at dilution and the result is an estimated quantity.
J - The analyte was positively identified; however the associated numerical value is an estimated concentration only.
J+ - The result is an estimated quantity; the result may be biased high.
J- - The result is an estimated quantity; the result may be biased low.
U - The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
UJ - The analyte was analyzed for but was not detected. The reported LOQ is approximate and may be inaccurate or imprecise.
UJ- - The analyte was analyzed for but was not detected. The reported LOQ is approximate and may be inaccurate or imprecise, biased low.

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Detroit Arsenal, Michigan

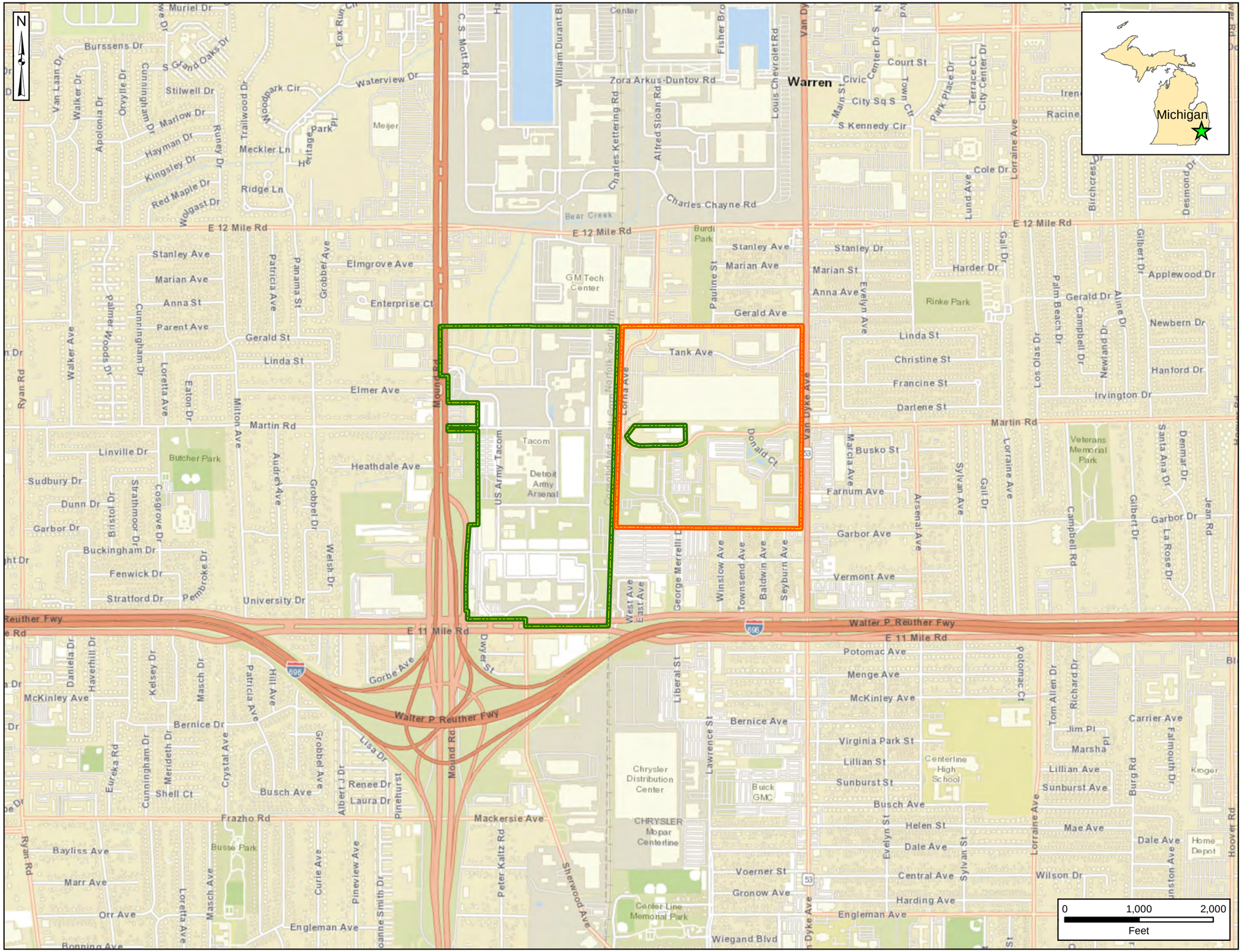
AOPI	Location	Lab Sample ID / Parent Sample ID	Sample ID / Parent Sample ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
					OSD Industrial/Commercial Risk Screening Level	1.6		1.6		25	
					OSD Residential Risk Screening Level	0.13		0.13		1.9	
					Sample Type	Result	Qual	Result	Qual	Result	Qual
AOPI A	DTA-AOPIA-01	DTA-AOPIA-01-SO-081420	DTA-AOPIA-01-SO-081420	08/14/2020	N	**0.0014**		0.00094	U	0.00094	U
AOPI A	DTA-AOPIA-02	DTA-AOPIA-02-SO-081720	DTA-AOPIA-02-SO-081720	08/17/2020	N	0.0012	U	0.0012	U	0.0012	U
AOPI A	DTA-AOPIA-03	DTA-AOPIA-03-SO-081720	DTA-AOPIA-03-SO-081720	08/17/2020	N	0.0012	U	0.0012	U	0.0012	U
AOPI B	DTA-AOPIB-01	DTA-AOPIB-01-SO-081420	DTA-AOPIB-01-SO-081420	08/14/2020	N	0.0010	U	0.0010	U	0.0010	U
AOPI B	DTA-AOPIB-02	DTA-AOPIB-02-SO-081420	DTA-AOPIB-02-SO-081420	08/14/2020	N	**0.0011**		0.0011	U	0.0011	U
AOPI B	DTA-AOPIB-03	DTA-AOPIB-03-SO-081420	DTA-AOPIB-03-SO-081420	08/14/2020	N	**0.00059**	J	0.0011	U	0.0011	U
AOPI C	DTA-AOPIC-01	DTA-AOPIC-01-SO-081120	DTA-AOPIC-01-SO-081120	08/11/2020	N	0.00096	U	0.00096	U	0.00096	U
AOPI C	DTA-AOPIC-02	DTA-AOPIC-02-SO-081120	DTA-AOPIC-02-SO-081120	08/11/2020	N	0.0011	U	0.0011	U	0.0011	U
AOPI C	DTA-AOPIC-03	DTA-AOPIC-03-SO-081120	DTA-AOPIC-03-SO-081120	08/11/2020	N	0.00093	U	0.00093	U	0.00093	U
AOPI D	DTA-AOPID-01	DTA-FD-01-SO-081220 / DTA-AOPID-01-SO-081220	DTA-FD-01-SO-081220 / DTA-AOPIE-01-SO-081220	08/12/2020	FD	**0.056**		0.0011	U	0.0011	U
		DTA-AOPID-01-SO-081220	DTA-AOPID-01-SO-081220	08/12/2020	N	**0.067**		0.0011	U	0.0011	U
AOPI D	DTA-AOPID-02	DTA-AOPID-02-SO-081220	DTA-AOPID-02-SO-081220	08/12/2020	N	**0.004**		0.0010	U	0.0010	U
AOPI D	DTA-AOPID-03	DTA-AOPID-03-SO-081220	DTA-AOPID-03-SO-081220	08/12/2020	N	**0.0037**		0.0011	U	0.0011	U
AOPI E	DTA-AOPID-04	DTA-AOPID-04-SO-081220	DTA-AOPIE-01-SO-081220	08/12/2020	N	**0.00084**	J	0.00098	U	0.00098	U
AOPI E	DTA-AOPID-05	DTA-AOPID-05-SO-081220	DTA-AOPIE-02-SO-081220	08/12/2020	N	**0.0048**		0.0010	U	0.0010	U
AOPI F	DTA-AOPIF-01	DTA-AOPIF-01-SO-081220	DTA-AOPIF-01-SO-081220	08/12/2020	N	**0.0064**		0.0011	U	0.0011	U
AOPI F	DTA-AOPIF-02	DTA-AOPIF-02-SO-081320	DTA-AOPIF-02-SO-081320	08/13/2020	N	**0.00062**	J	0.0011	U	0.0011	U
AOPI G	DTA-AOPIG-01	DTA-AOPIG-01-SO-081320	DTA-AOPIG-01-SO-081320	08/13/2020	N	0.0011	U	0.0011	U	0.0011	U
AOPI G	DTA-AOPIG-02	DTA-AOPIG-02-SO-081320	DTA-AOPIG-02-SO-081320	08/13/2020	N	0.0010	U	0.0010	U	0.0010	U
AOPI G	DTA-AOPIG-03	DTA-AOPIG-03-SO-081320	DTA-AOPIG-03-SO-081320	08/13/2020	N	0.0011	U	0.0011	U	0.0011	U
AOPI G	DTA-AOPIG-04	DTA-AOPIG-04-SO-081320	DTA-AOPIG-04-SO-081320	08/13/2020	N	0.0011	U	0.0011	U	0.0011	U
AOPI G	DTA-AOPIG-05	DTA-AOPIG-05-SO-081320	DTA-AOPIG-05-SO-081320	08/13/2020	N	0.0011	U	0.0011	U	0.0011	U
AOPI G	DTA-AOPIG-06	DTA-AOPIG-06-SO-081320	DTA-AOPIG-06-SO-081320	08/13/2020	N	0.0013	U	0.0013	U	0.0013	U
AOPI H	DTA-AOPIH-01	DTA-FD-02-SO-081420 / DTA-AOPIH-01-SO-081420	DTA-FD-02-SO-081420 / DTA-AOPIH-01-SO-081420	08/14/2020	FD	**0.23**	DJ	**0.0037**		0.0011	U
		DTA-AOPIH-01-SO-081420	DTA-AOPIH-01-SO-081420	08/14/2020	N	**0.23**	DJ	**0.004**		0.0011	U
AOPI H	DTA-AOPIH-02	DTA-AOPIH-02-SO-081320	DTA-AOPIH-02-SO-081320	08/13/2020	N	**3.2**	DJ	**0.028**		**0.0016**	
AOPI I	DTA-AOPII-1	DTA-FD-1-SO-121621 / DTA-AOPII-1-SO-121621	DTA-FD-1-SO-121621 / DTA-AOPII-1-SO-121621	12/16/2021	FD	0.0012	U	0.0012	U	0.0012	U
		DTA-AOPII-1-SO-121621	DTA-AOPII-1-SO-121621	12/16/2021	N	0.0012	U	0.0012	U	0.0012	U
AOPI I	DTA-AOPII-2	DTA-AOPII-2-SO-121621	DTA-AOPII-2-SO-121621	12/16/2021	N	0.0011	U	0.0011	U	0.0011	U
AOPI I	DTA-AOPII-3	DTA-AOPII-3-SO-121621	DTA-AOPII-3-SO-121621	12/16/2021	N	0.0011	U	0.0011	U	0.0011	U
AOPI I	DTA-AOPII-4	DTA-AOPII-4-SO-121621	DTA-AOPII-4-SO-121621	12/16/2021	N	0.0011	U	0.0011	U	0.0011	U
AOPI I	DTA-AOPII-5	DTA-AOPII-5-SO-121621	DTA-AOPII-5-SO-121621	12/16/2021	N	0.0013	U	0.0013	U	0.0013	U
AOPI I	DTA-AOPII-6	DTA-AOPII-6-SO-121621	DTA-AOPII-6-SO-121621	12/16/2021	N	0.00092	U	0.00092	U	0.00092	U
AOPI I	DTA-AOPII-7	DTA-AOPII-7-SO-121621	DTA-AOPII-7-SO-121621	12/16/2021	N	0.0010	U	0.0010	U	0.0010	U

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection
2. Data are compared to the 2021 Office of the Secretary of Defense (OSD) risk screening levels for both the residential as well as the industrial/commercial scenarios (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. October.). No concentrations of PFBS, PFOS, or PFOA exceeded the 2021 OSD risk screening levels.
3. Grey shaded values indicate the result was detected greater than the residential scenario risk screening levels (OSD 2021).
4. Grey 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 2021).

Acronyms/Abbreviations:
AOPI - area of potential interest
FD - field duplicate sample
ID - identification
mg/kg - milligrams per kilogram (parts per million)
N - primary sample
PFAS - per- and polyfluoroalkyl substances
PFBS - perfluorobutanesulfonic acid
PFOA - perfluorooctanoic acid
PFOS - perfluorooctane sulfonate

Qualifiers:
DJ - The analyte was analyzed at dilution and the result is an estimated quantity.
J - The analyte was positively identified; however the associated numerical value is an estimated concentration only.
U - The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).

FIGURES



USAEC PFAS
Preliminary Assessment / Site Inspection
Detroit Arsenal, MI

ARCADIS

Figure 2-1
Site Location

Legend

- Current Army-Owned Property
- East Site (Transferred)

Data Sources:
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 17 North

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Detroit Arsenal, MI

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Figure 2-2
Site Layout

Legend

- Current Army-Owned Property
- East Site (Transferred)
- River/Stream
- Approximate Outfall Location
- City of Warren Sampling Location

Data Sources:
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

0 250 500
Feet

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Detroit Arsenal, MI

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Figure 2-3
Topographic Map

Legend

- Current Army-Owned Property
- East Site (Transferred)

Data Sources:
ESRI, ArcGIS Online, USA Topo Maps

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 2-4
Off-Post Potable Supply Wells

Legend

- Current Army-Owned Property
- East Site (Transferred)
- 5-Mile Radius
- Public Supply Well
- Well Owned by City of Detroit Water
- Domestic Well

Note: Well owner labels are as provided in the Environmental Data Resources (EDR) Report. See Appendix E for further information.

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

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 5-2
AOPI Locations

AOPI E
AOPI D
AOPI F
City of Warren
Sampling Location
AOPI I
AOPI H
AOPI C
AOPI G
AOPI B
AOPI A
Bear Creek

Legend

- Current Army-Owned Property
- East Site (Transferred)
- AOPI
- River/Stream
- Approximate Outfall Location
- City of Warren Sampling Location

AOPI = area of potential interest

0 250 500
Feet

Data Sources:
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

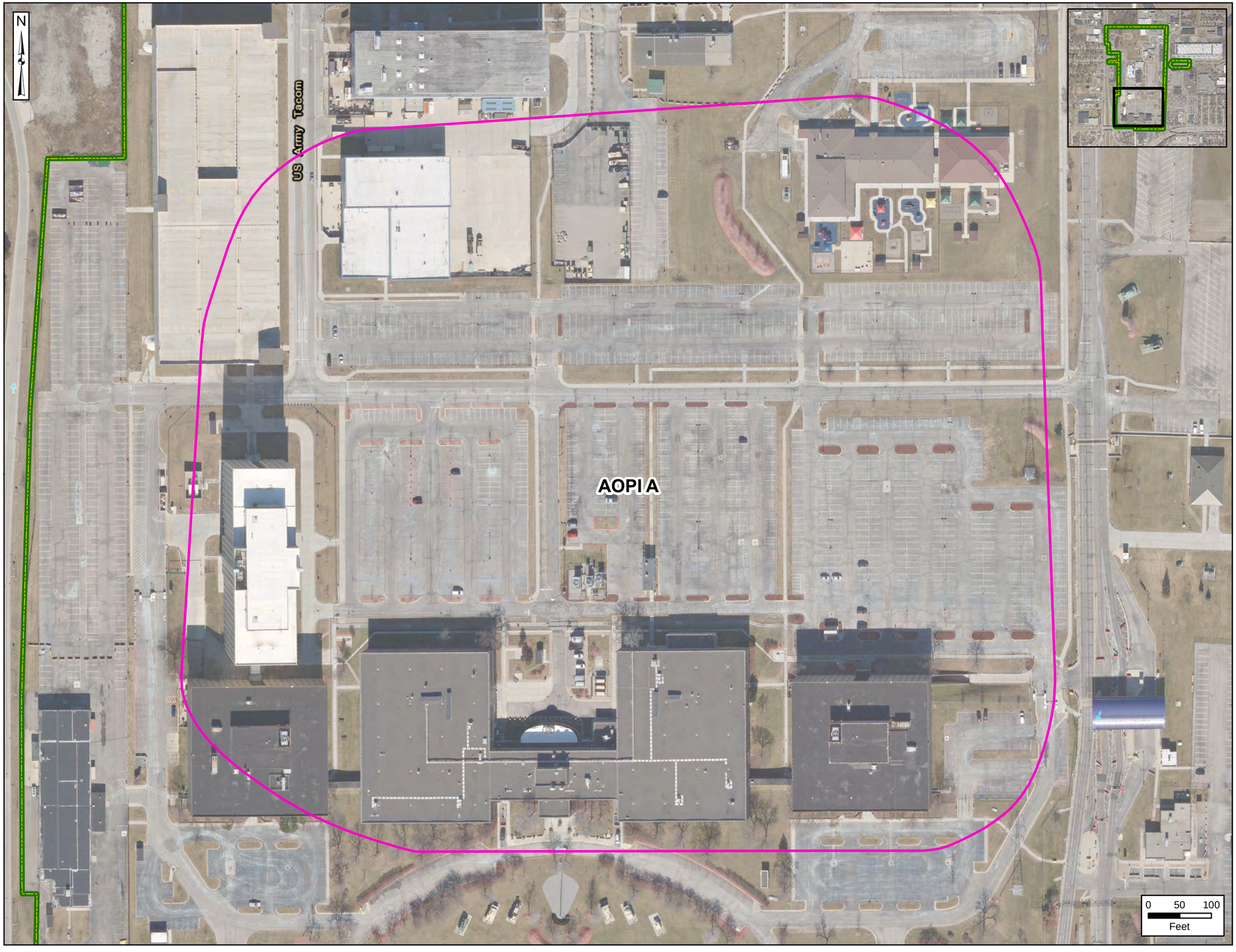

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Figure 5-3
Aerial Photo of AOPI A

Legend

- Current Army-Owned Property
- AOPI

AOPI = area of potential interest

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

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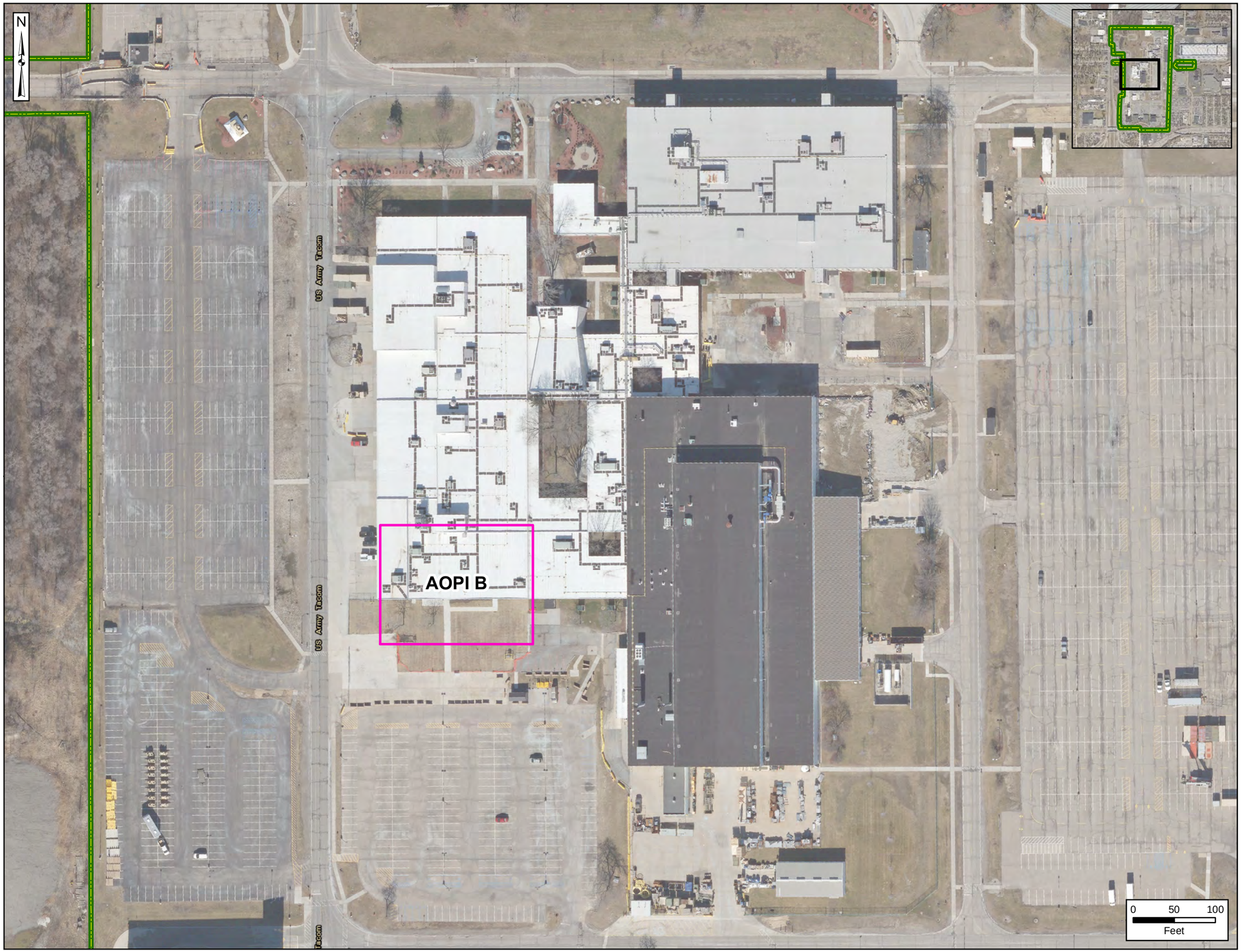
Figure 5-4 Aerial Photo of AOPI B

Legend

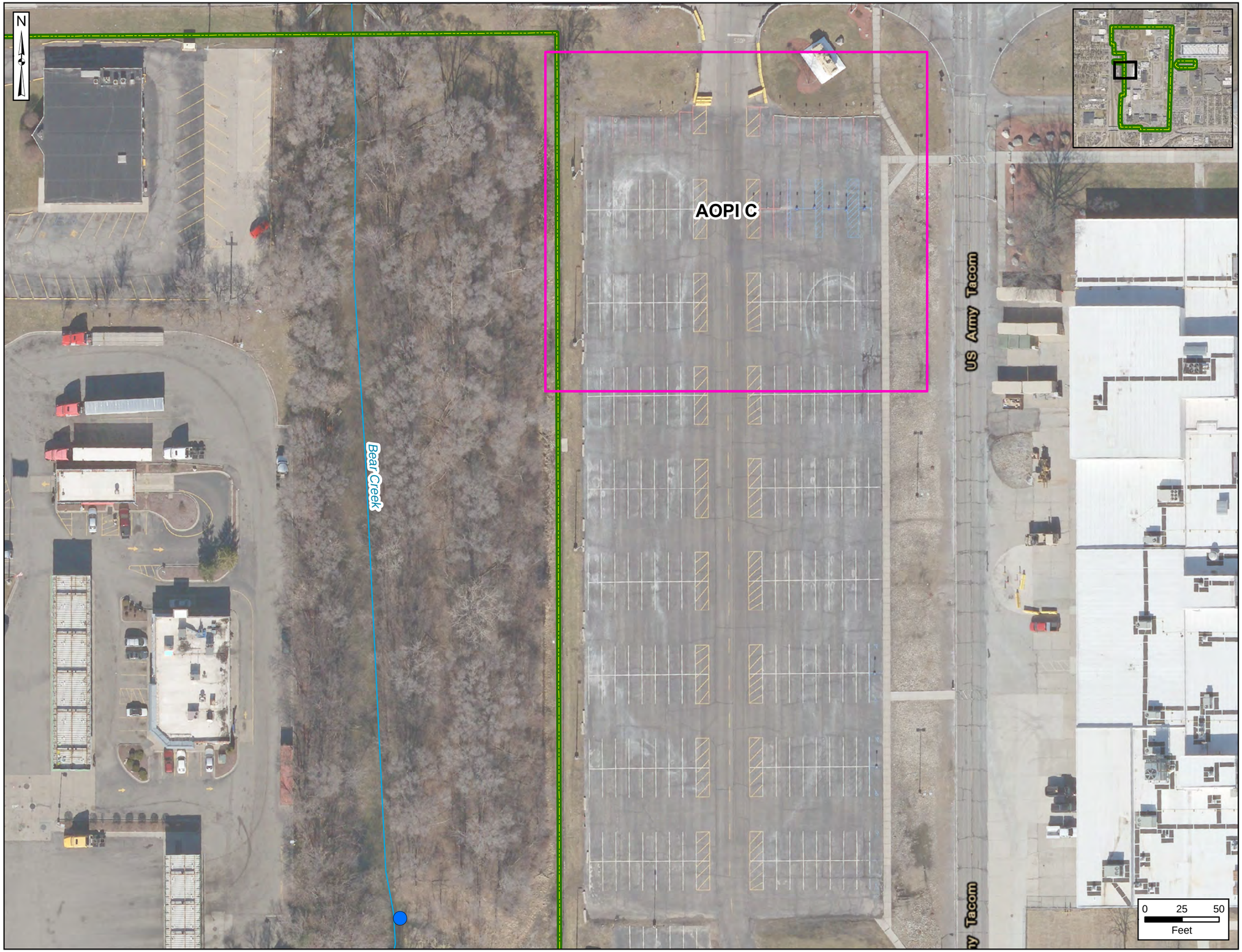
- Current Army-Owned Property
- AOPI

AOPI = area of potential interest



Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



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Detroit Arsenal, MI

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Figure 5-5
Aerial Photo of AOPI C

Legend

- Current Army-Owned Property
- AOPI
- River/Stream
- Approximate Outfall Location

AOPI = area of potential interest

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

N

AOPI D

AOPI E

0 50 100
Feet

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Detroit Arsenal, MI

ARCADIS

Figure 5-6
Aerial Photo of
AOPI D and AOPI E

Legend

- Current Army-Owned Property
- AOPI

AOPI = area of potential interest

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

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Detroit Arsenal, MI

ARCADIS

Figure 5-7
Aerial Photo of
AOPI F

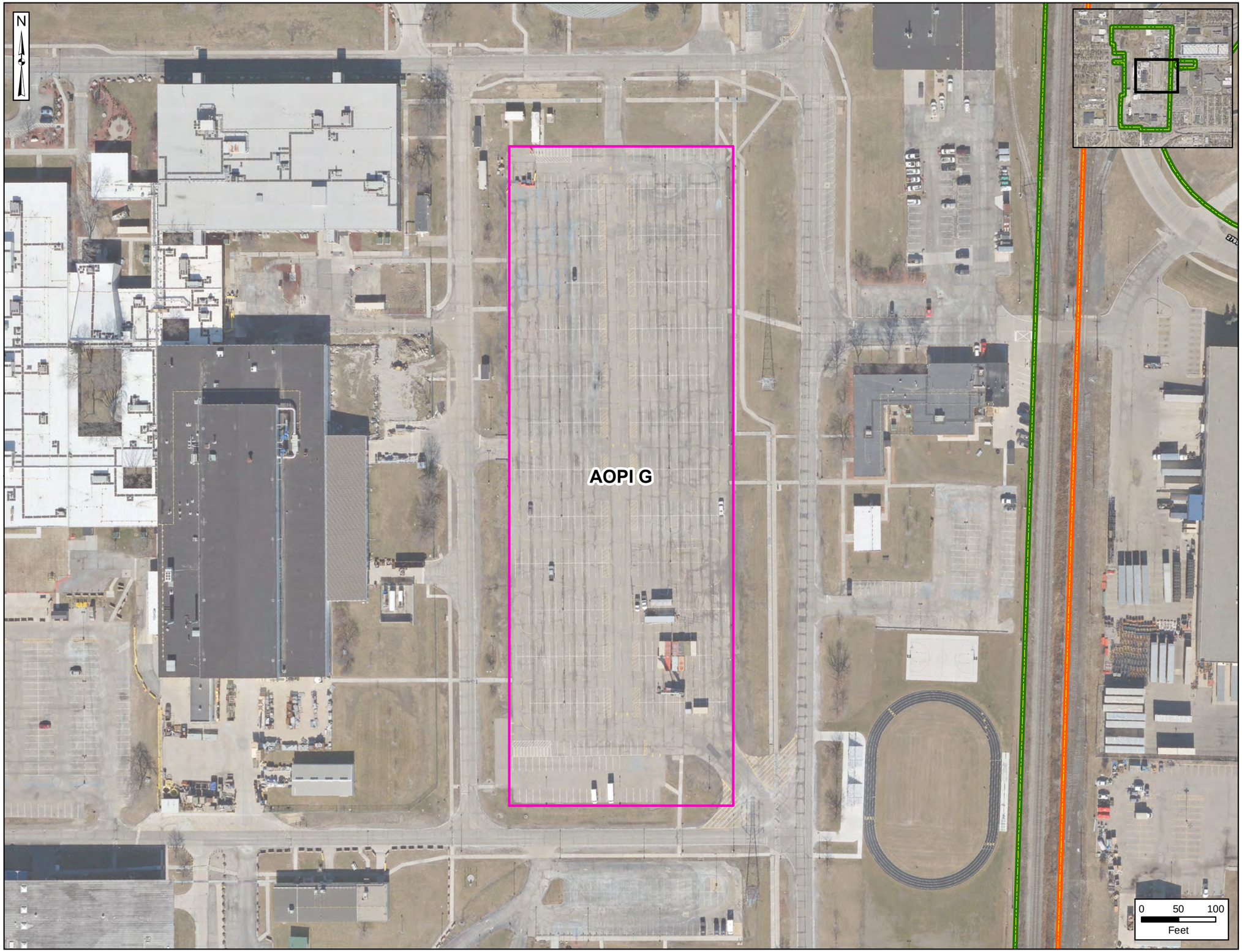
Legend

- Current Army-Owned Property
- AOPI

AOPI = area of potential interest

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



USAEC PFAS
Preliminary Assessment / Site Inspection
Detroit Arsenal, MI

ARCADIS

Figure 5-8
Aerial Photo of AOPI G

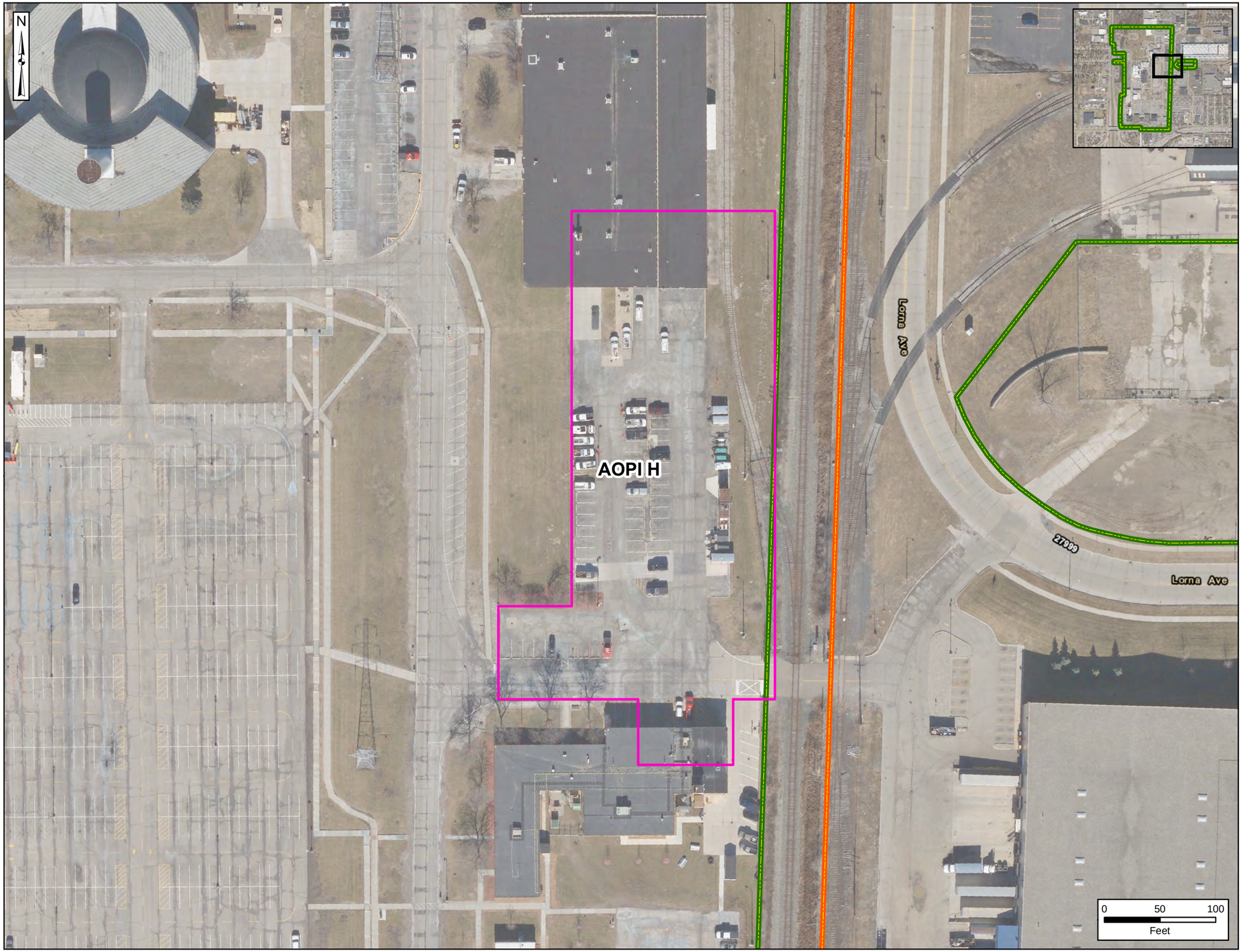
Legend

- Current Army-Owned Property
- East Site (Transferred)
- AOPI

AOPI = area of potential interest

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



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Preliminary Assessment / Site Inspection
Detroit Arsenal, MI

ARCADIS

Figure 5-9
Aerial Photo of
AOPI H

Legend

- Current Army-Owned Property
- East Site (Transferred)
- AOPI

AOPI = area of potential interest

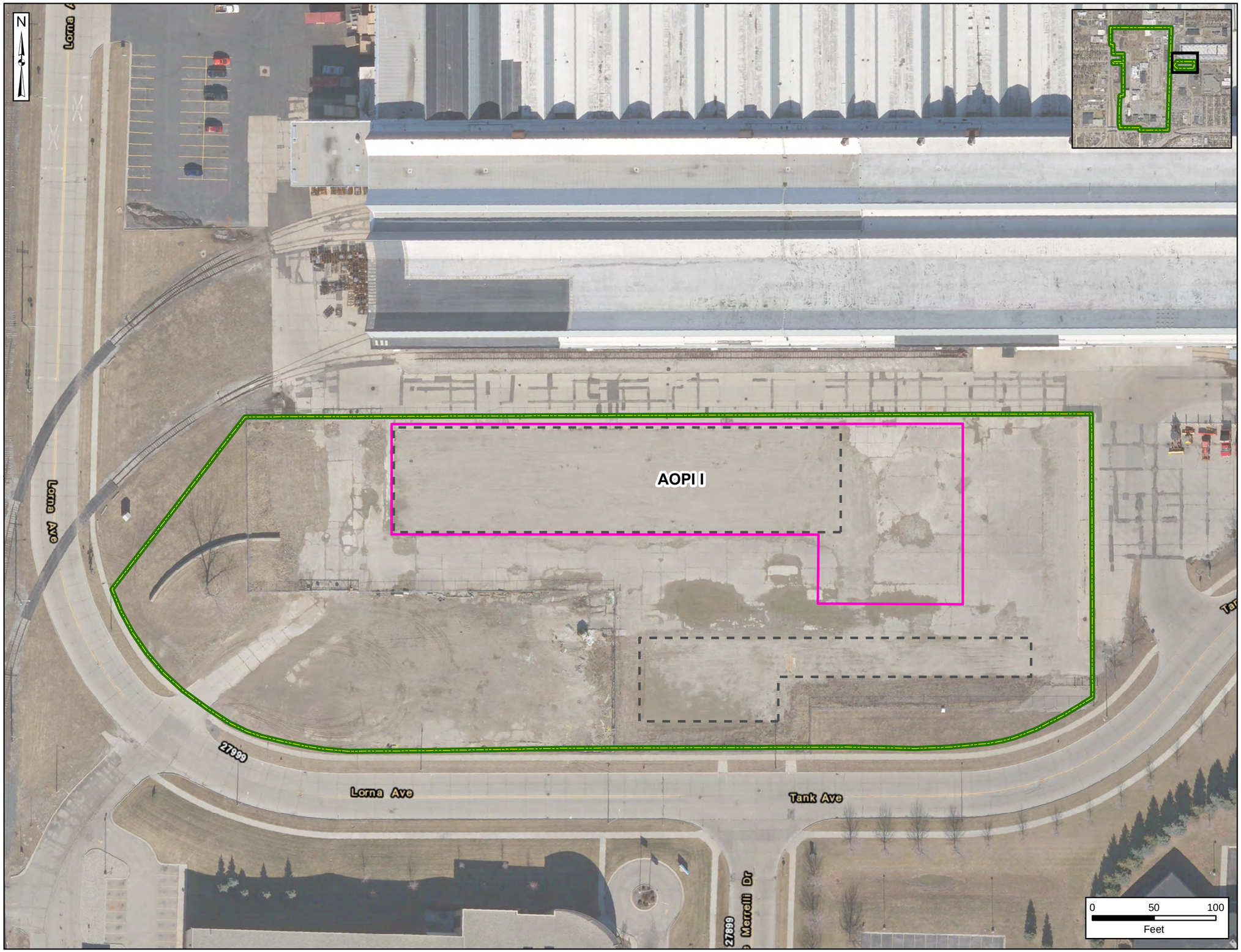
Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

USAEC PFAS Preliminary Assessment / Site Inspection Detroit Arsenal, MI

ARCADIS

Figure 5-10 Aerial Photo of AOPI I



Legend

- Current Army-Owned Property
- AOPI
- Historical Building Footprint

AOPI = area of potential interest

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

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

AOPI E
AOPI D
AOPI F
AOPI I
AOPI H
AOPI G
AOPI C
AOPI B
AOPI A
City of Warren Sampling Location
Bear Creek
Centerline Ditch
Enterprise Ct
Mound Rd
US Army Tacom
Heathdale Ave
Anna Ave
Gerald Ave
Evelyn Ave
Van Dyke Ave
Marden Ave
Manor House Apartments
Francine St
Martin Rd
Tank Ave
Donald Ct
George Merrell Dr
Furnum Ave
Garber Ave
Harsig Ave
Vermont Ave
North St
Railroad St
West Ave
East Ave
Justin St
Winslow Ave
Townsend Ave
Baldwin Ave
Seyburn Ave
Walter P Reuther Fwy
E 11 Mile Rd
Potomac Ave
Albany Ave
Dwyer St
Syracuse Ave

Legend

- Current Army-Owned Property
- East Site (Transferred)
- Sampled AOPI
- AOPI with OSD Risk Screening Level Exceedance
- River/Stream
- Approximate Outfall Location
- City of Warren Sampling Location

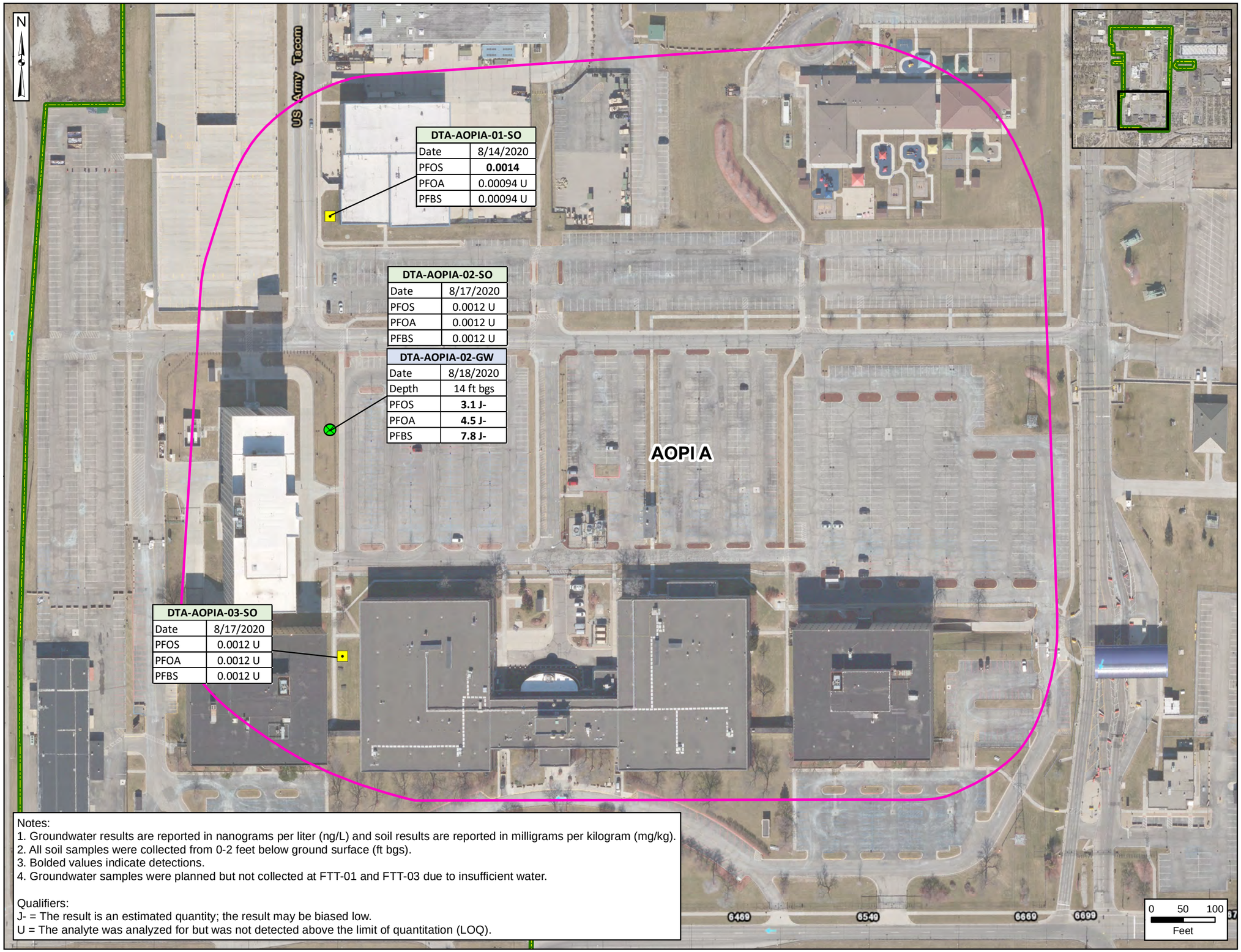
AOPI = area of potential interest
OSD = Office of the Secretary of Defense

Note: E Lot will be resampled due to rejected data.

0 250 500
Feet

Data Sources:
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L) and soil results are reported in milligrams per kilogram (mg/kg).
2. All soil samples were collected from 0-2 feet below ground surface (ft bgs).
3. Bolded values indicate detections.
4. Groundwater samples were planned but not collected at FTT-01 and FTT-03 due to insufficient water.

Qualifiers:
J- = The result is an estimated quantity; the result may be biased low.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

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Figure 7-2
AOPI A
PFOS, PFOA, and PFBS Analytical Results

Legend

- Current Army-Owned Property
- AOPI
- Shallow Soil Sampling Location
- Soil and Groundwater Sampling Location

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

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

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Figure 7-3
AOPI B
PFOS, PFOA, and PFBS Analytical Results

N

US Army Tacom

AOPI B

DTA-AOPIB-02-SO	
Date	8/14/2020
PFOS	**0.0011**
PFOA	0.0011 U
PFBS	0.0011 U

DTA-AOPIB-02-GW	
Date	8/18/2020
Depth	12 ft bgs
PFOS	**39 J-**
PFOA	**26 J-**
PFBS	**4.6 J-**

DTA-AOPIB-01-SO	
Date	8/14/2020
PFOS	0.0010 U
PFOA	0.0010 U
PFBS	0.0010 U

DTA-AOPIB-01-GW	
Date	8/18/2020
Depth	10 ft bgs
PFOS	**2.6 J-**
PFOA	**6.7 J-**
PFBS	**3.8 J-**

DTA-AOPIB-03-SO	
Date	8/14/2020
PFOS	**0.00059 J**
PFOA	0.0011 U
PFBS	0.0011 U

0 50 100
Feet

Legend

- Current Army-Owned Property
- AOPI
- Shallow Soil Sampling Location
- Grab Groundwater Sampling Location
- Soil and Groundwater Sampling Location

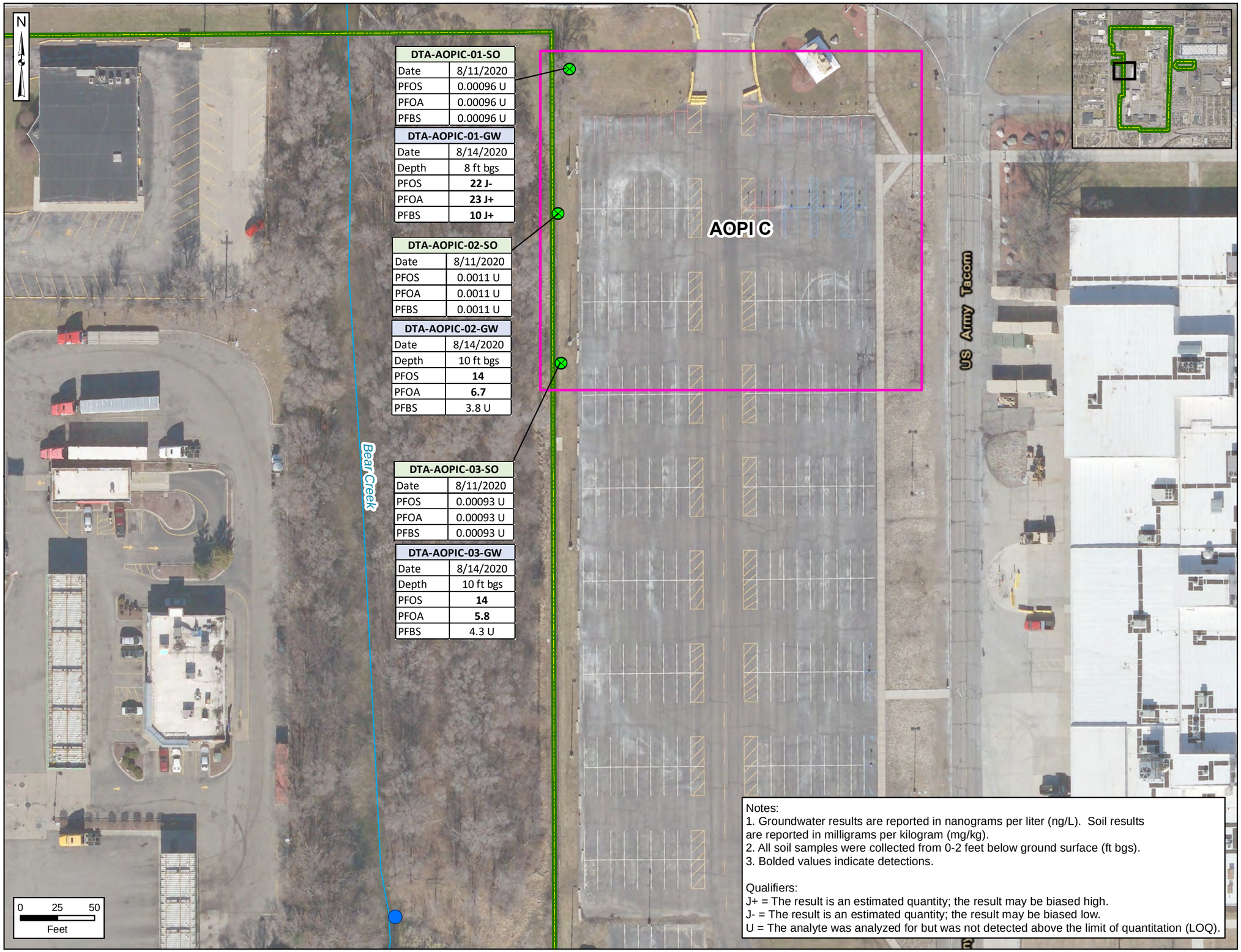
AOPI = area of potential interest
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Notes:
1. Groundwater results are reported in nanograms per liter (ng/L). Soil results are reported in milligrams per kilogram (mg/kg).
2. All soil samples were collected from 0-2 feet below ground surface (ft bgs).
3. Bolded values indicate detections.

Qualifiers:
J = The result is an estimated quantity.
J- = The result is an estimated quantity; the result may be biased low.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L). Soil results are reported in milligrams per kilogram (mg/kg).
2. All soil samples were collected from 0-2 feet below ground surface (ft bgs).
3. Bolded values indicate detections.

Qualifiers:
J+ = The result is an estimated quantity; the result may be biased high.
J- = The result is an estimated quantity; the result may be biased low.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

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Figure 7-4
AOPI C
PFOS, PFOA, and PFBS Analytical Results

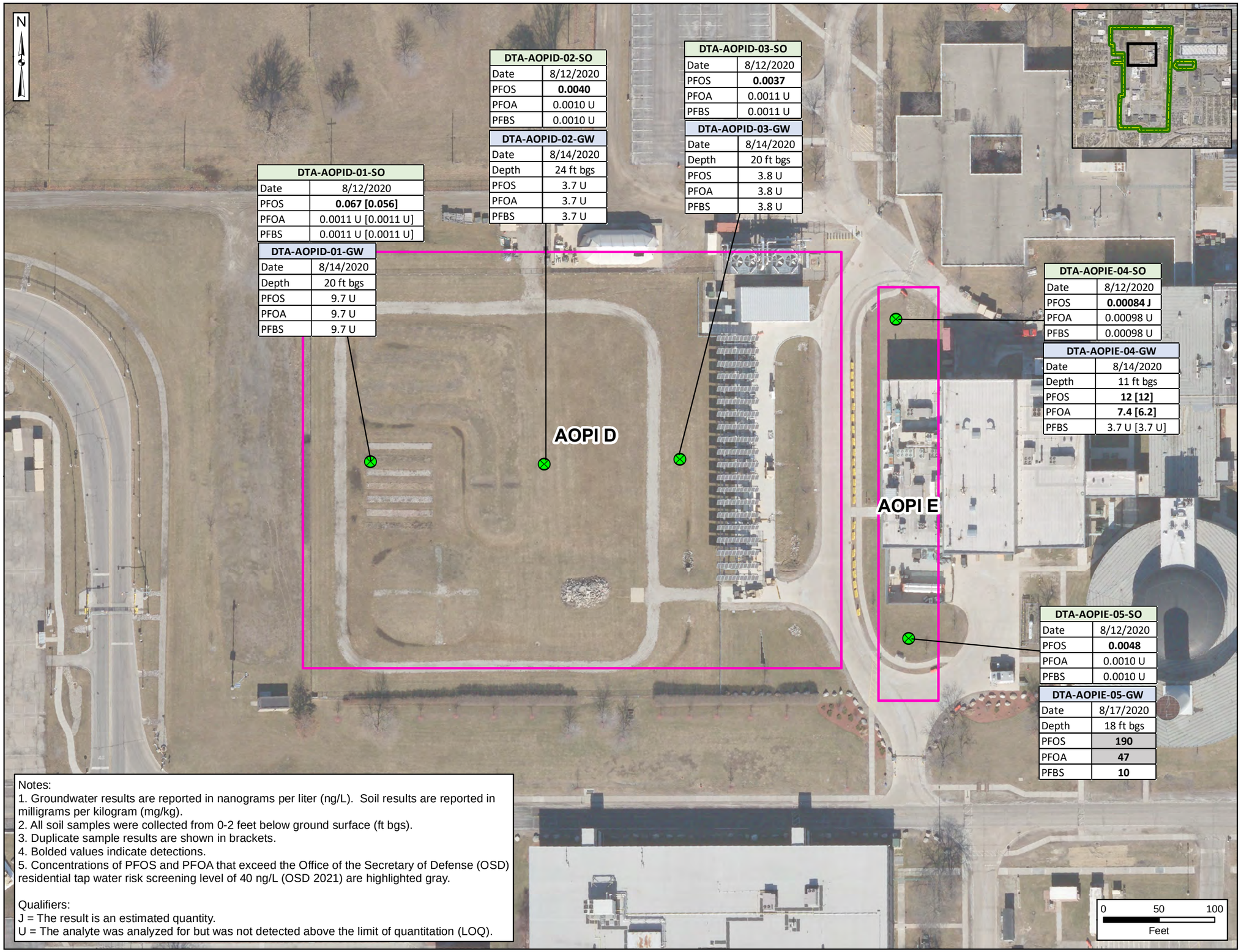
Legend

- Current Army-Owned Property
- AOPI
- River/Stream
- Approximate Outfall Location
- Soil and Groundwater Sampling Location

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

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L). Soil results are reported in milligrams per kilogram (mg/kg).
2. All soil samples were collected from 0-2 feet below ground surface (ft bgs).
3. Duplicate sample results are shown in brackets.
4. Bolded values indicate detections.
5. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.

Qualifiers:
J = The result is an estimated quantity.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

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Figure 7-5
AOPI D and AOPI E
PFOS, PFOA, and PFBS
Analytical Results

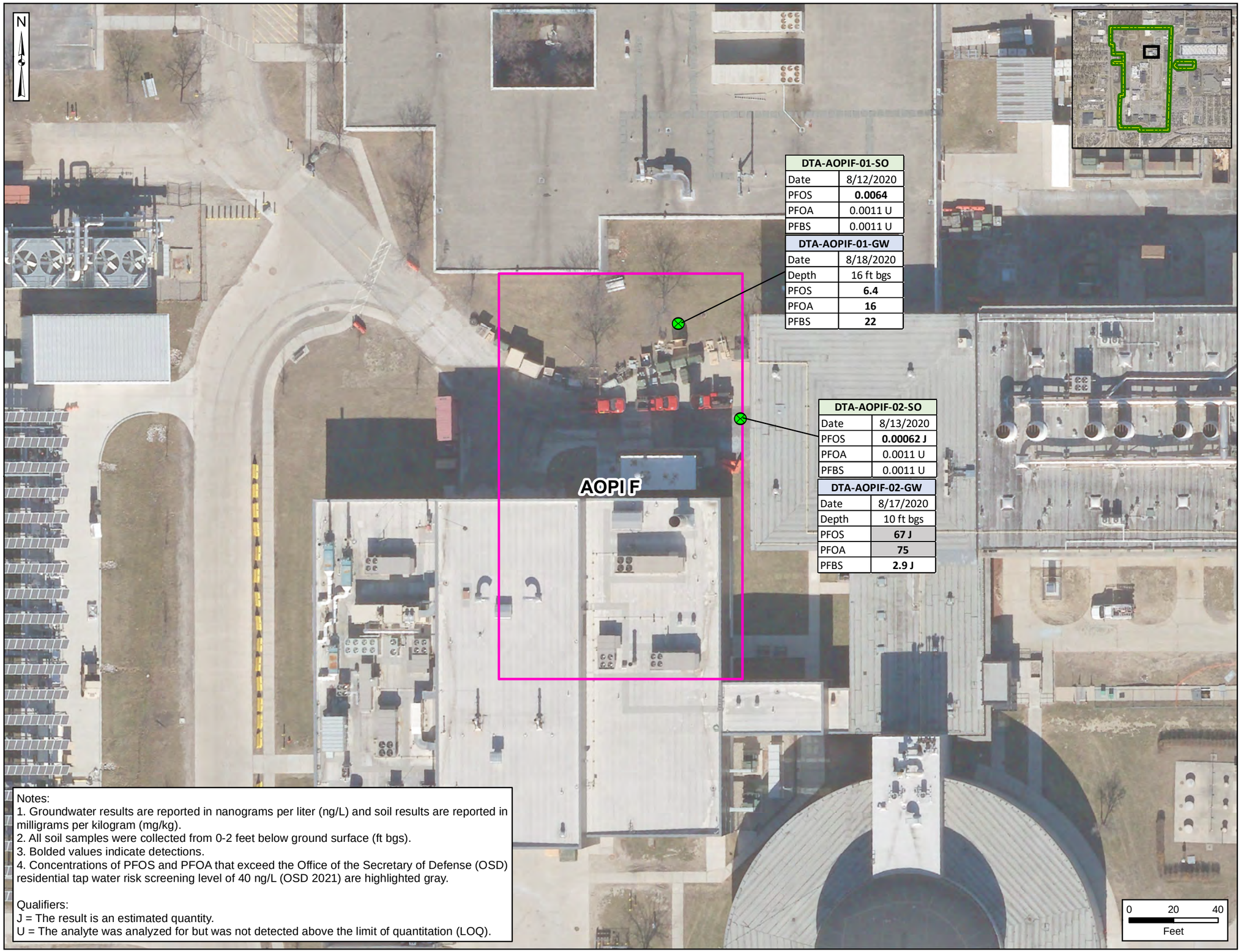
Legend

- Current Army-Owned Property
- AOPI
- Soil and Groundwater Sampling Location

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

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L) and soil results are reported in milligrams per kilogram (mg/kg).
2. All soil samples were collected from 0-2 feet below ground surface (ft bgs).
3. Bolded values indicate detections.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.

Qualifiers:
J = The result is an estimated quantity.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

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Figure 7-6
AOPI F
PFOS, PFOA, and PFBS Analytical Results

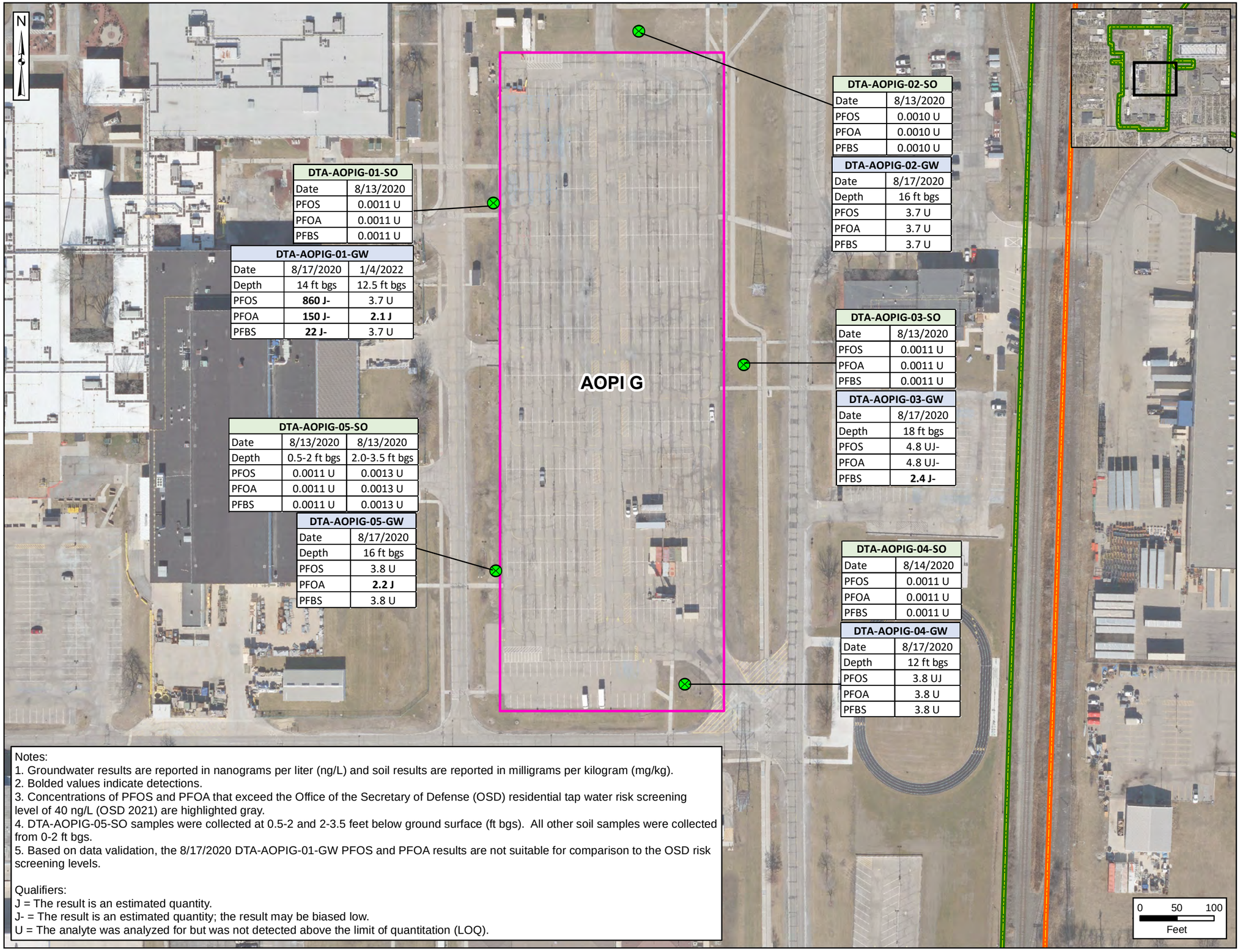
Legend

- Current Army-Owned Property
- AOPI
- Soil and Groundwater Sampling Location

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

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L) and soil results are reported in milligrams per kilogram (mg/kg).
2. Bolded values indicate detections.
3. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.
4. DTA-AOPIG-05-SO samples were collected at 0.5-2 and 2-3.5 feet below ground surface (ft bgs). All other soil samples were collected from 0-2 ft bgs.
5. Based on data validation, the 8/17/2020 DTA-AOPIG-01-GW PFOS and PFOA results are not suitable for comparison to the OSD risk screening levels.

Qualifiers:
J = The result is an estimated quantity.
J- = The result is an estimated quantity; the result may be biased low.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

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Figure 7-7
AOPI G
PFOS, PFOA, and PFBS Analytical Results

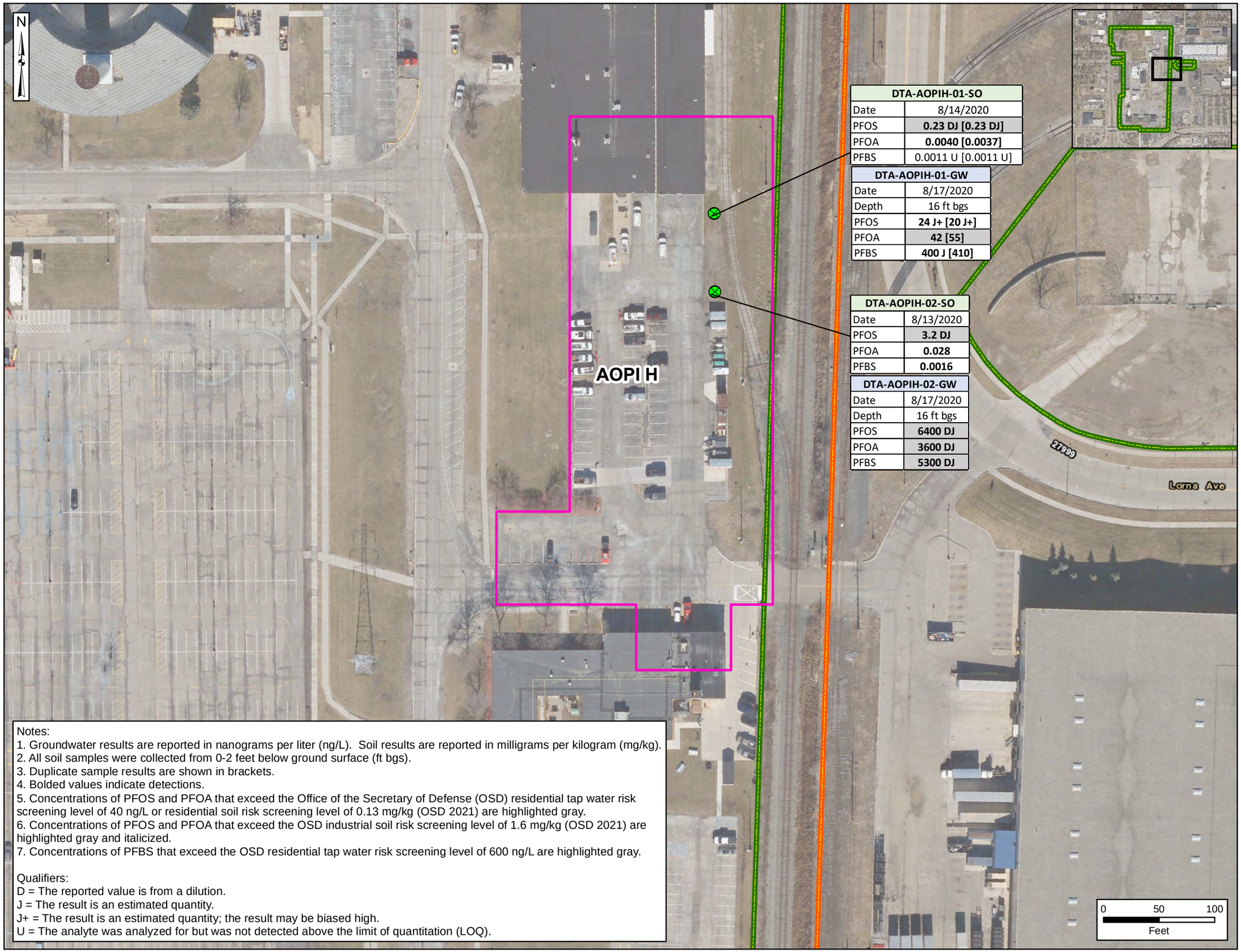
Legend

- Current Army-Owned Property
- East Site (Transferred)
- AOPI
- Soil and Groundwater Sampling Location

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

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L). Soil results are reported in milligrams per kilogram (mg/kg).
2. All soil samples were collected from 0-2 feet below ground surface (ft bgs).
3. Duplicate sample results are shown in brackets.
4. Bolded values indicate detections.
5. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L or residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
6. Concentrations of PFOS and PFOA that exceed the OSD industrial soil risk screening level of 1.6 mg/kg (OSD 2021) are highlighted gray and italicized.
7. Concentrations of PFBS that exceed the OSD residential tap water risk screening level of 600 ng/L are highlighted gray.

Qualifiers:
D = The reported value is from a dilution.
J = The result is an estimated quantity.
J+ = The result is an estimated quantity; the result may be biased high.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

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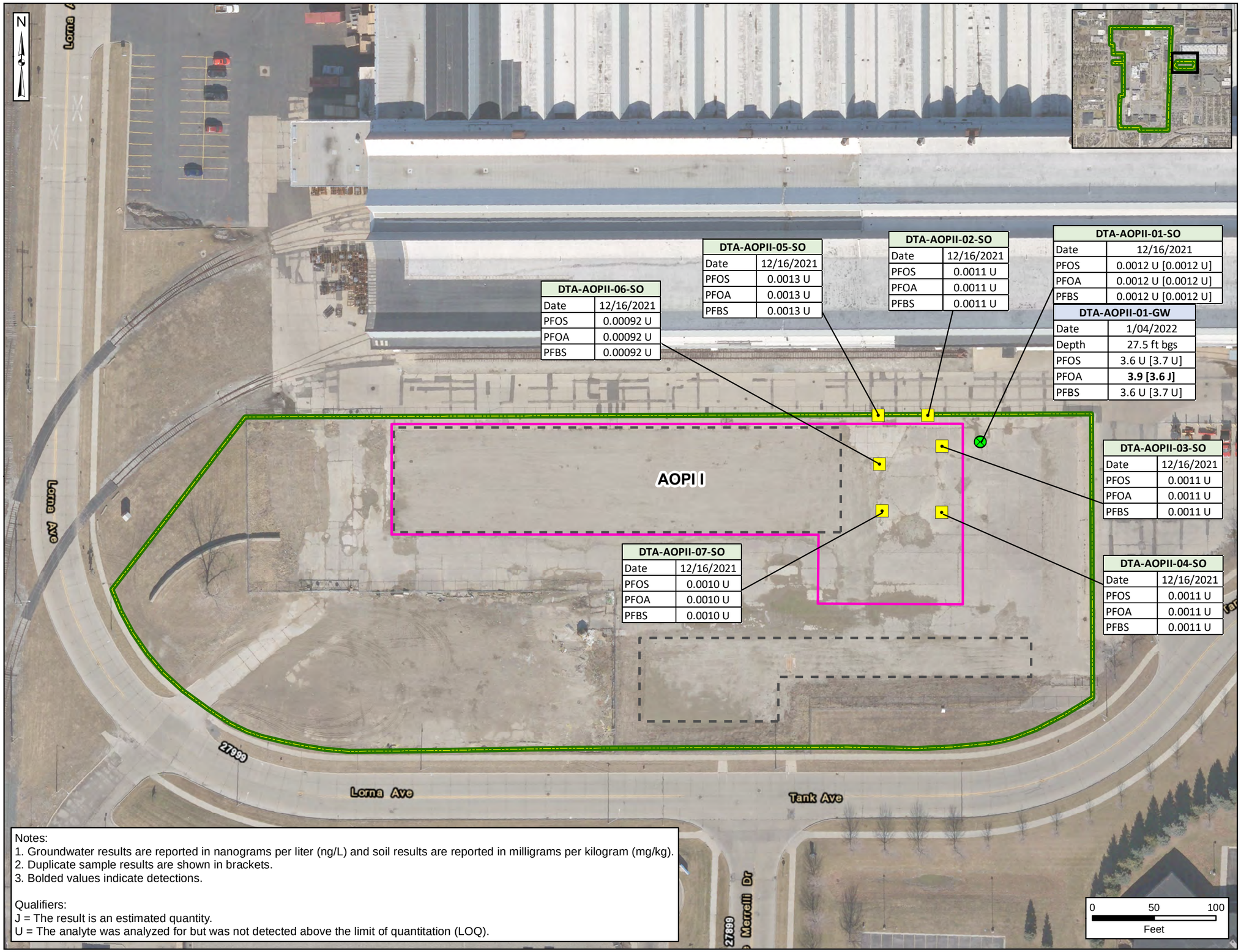
Figure 7-8
AOPI H
PFOS, PFOA, and PFBS Analytical Results

Legend
- Current Army-Owned Property
- East Site (Transferred)
- AOPI
- Soil and Groundwater Sampling Location

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

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North



DTA-AOPII-06-SO	
Date	12/16/2021
PFOS	0.00092 U
PFOA	0.00092 U
PFBS	0.00092 U

DTA-AOPII-05-SO	
Date	12/16/2021
PFOS	0.0013 U
PFOA	0.0013 U
PFBS	0.0013 U

DTA-AOPII-02-SO	
Date	12/16/2021
PFOS	0.0011 U
PFOA	0.0011 U
PFBS	0.0011 U

DTA-AOPII-01-SO	
Date	12/16/2021
PFOS	0.0012 U [0.0012 U]
PFOA	0.0012 U [0.0012 U]
PFBS	0.0012 U [0.0012 U]

DTA-AOPII-01-GW	
Date	1/04/2022
Depth	27.5 ft bgs
PFOS	3.6 U [3.7 U]
PFOA	**3.9 [3.6 J]**
PFBS	3.6 U [3.7 U]

DTA-AOPII-03-SO	
Date	12/16/2021
PFOS	0.0011 U
PFOA	0.0011 U
PFBS	0.0011 U

DTA-AOPII-07-SO	
Date	12/16/2021
PFOS	0.0010 U
PFOA	0.0010 U
PFBS	0.0010 U

DTA-AOPII-04-SO	
Date	12/16/2021
PFOS	0.0011 U
PFOA	0.0011 U
PFBS	0.0011 U

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

Qualifiers:
J = The result is an estimated quantity.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

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Figure 7-9
AOPI I
PFOS, PFOA, and PFBS Analytical Results

Legend

- Current Army-Owned Property
- AOPI
- Historical Building Footprint
- Shallow Soil Sampling Location
- Soil and Groundwater Sampling Location

AOPI = area of potential interest

Data Sources:
Detroit Arsenal, GIS Data, 2018
Detroit Arsenal, Aerial Imagery, 2018

Coordinate System:
WGS 1984, UTM Zone 17 North

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

Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Notes:

[1] At Detroit Arsenal, the surface water and sediment exposure pathways describe incidental ingestion and dermal contact during work activities or outdoor recreational activities.

[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model - AOPI E, AOPI A, AOPI H, AOPI F, and AOPI B

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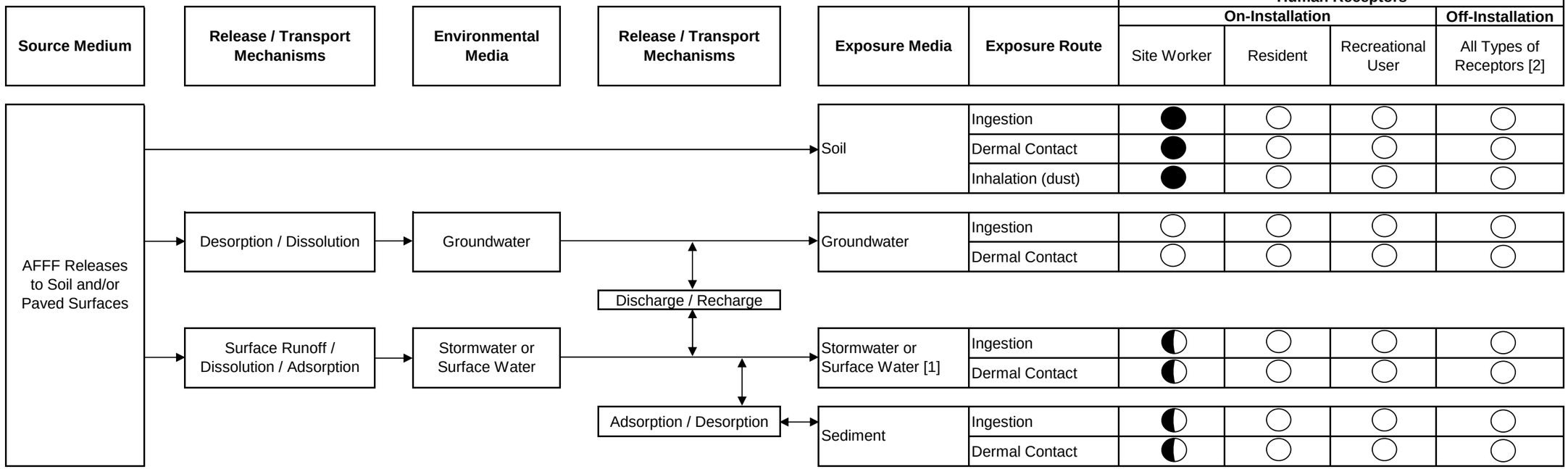
Figure 7-10



Legend:

- = Complete Exposure Pathway
- = Potentially Complete Exposure Pathway
- = Incomplete Exposure Pathway

Notes:
[1] At Detroit Arsenal, the surface water and sediment exposure pathways describe incidental ingestion and dermal contact during work activities or outdoor recreational activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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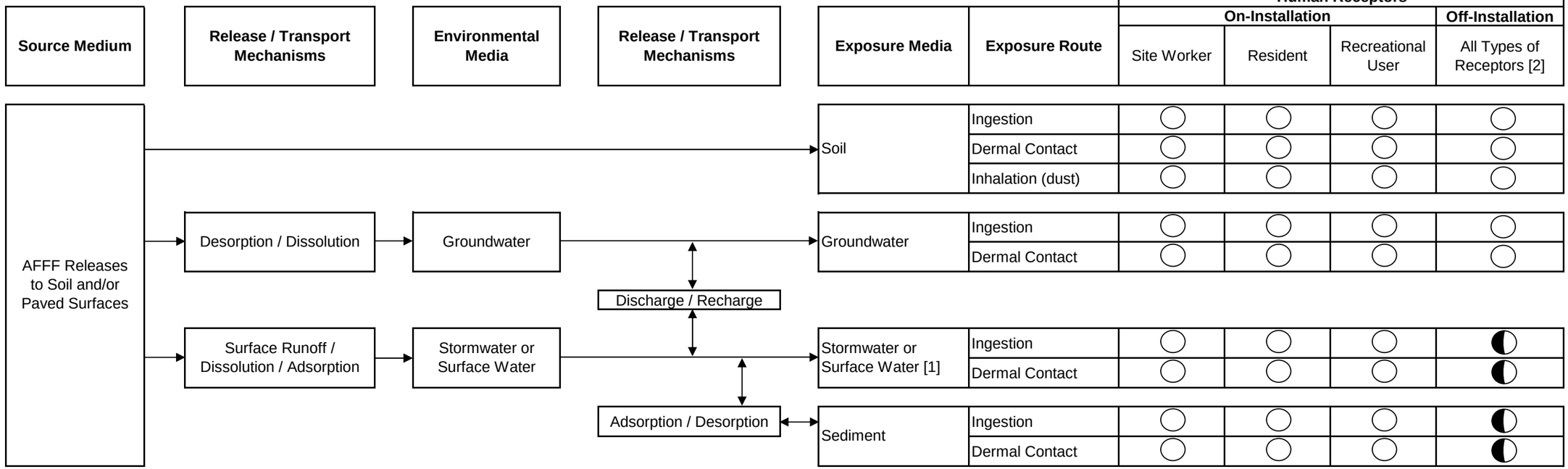
Conceptual Site Model - AOPI D
USAEC PFAS Preliminary Assessment / Site Inspection
Detroit Arsenal, Michigan

Figure 7-11



Legend:

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

Notes:
[1] At Detroit Arsenal, the surface water and sediment exposure pathways describe incidental ingestion and dermal contact during work activities or outdoor recreational activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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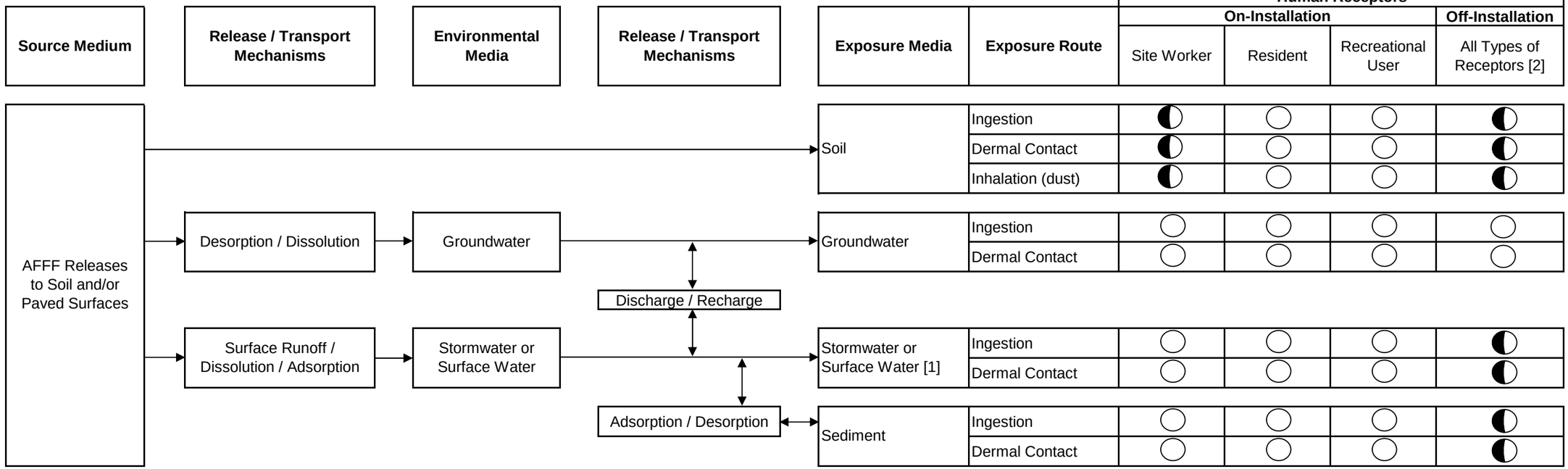
Conceptual Site Model - AOPI C and AOPI E
USAEC PFAS Preliminary Assessment / Site Inspection
Detroit Arsenal, Michigan

Figure 7-12



Legend:

- = Complete Exposure Pathway
- = Potentially Complete Exposure Pathway
- = Incomplete Exposure Pathway

Notes:
[1] At Detroit Arsenal, the surface water and sediment exposure pathways describe incidental ingestion and dermal contact during work activities or outdoor recreational activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model - AOPI I
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Detroit Arsenal, Michigan

Figure 7-13

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