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

Hawthorne Army Depot, Nevada

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Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

Hawthorne Army Depot, Nevada

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EXECUTIVE SUMMARY

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

HWAD is located in Mineral County, Nevada, approximately 75 miles southeast of Carson City and 90 miles southeast of Reno. The installation occupies 147,236 acres situated on the southern (terminal) shore of Walker Lake, and it nearly wraps around the town of Hawthorne. HWAD has an additional facility ("New Bomb Demilitarization Facility" [New Bomb]) that encompasses 3,000 acres and is located 23 miles south of the installation's southern boundary. This PA/SI focuses on the primary installation. New Bomb is a secondary ordnance area and has never been a location for the use, storage, or disposal of PFAS-containing materials.

The HWAD PA identified 15 AOPIs for investigation during the SI phase. SI sampling results from the 15 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 15 AOPIs; six of the 15 AOPIs had PFOS, PFOA, and/or PFBS present at concentrations greater than the risk-based screening levels. The HWAD 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 HWAD, and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/ND/NS)		Recommendation
	GW	SO	
Fire Station #1 (Building 8): Back Apron, South Main Avenue	No[1]	Yes[2]	Further study in a remedial investigation
Shop Street	No[1]	Yes	Further study in a remedial investigation

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/ND/NS)		Recommendation
	GW	SO	
Fire Truck Steam Cleaning (Building 11 exterior)	No[1]	Yes[2]	Further study in a remedial investigation
Historical Metals Plating Facility (Building 10)	No	No	No action at this time
One-Time Aqueous Film-Forming Foam (AFFF) Training Area (Building 18 exterior)	No	No	No action at this time
Drafting Pit: Fire Truck Pump Testing	ND	No	No action at this time
Conelly Drive	No	No	No action at this time
Fire Training Pit (Solid Waste Management Unit [SWMU] H01)	Yes[3]	No	Further study in a remedial investigation
Northwest (NW) of SWMU H01: Historical AFFF Fire Training Area	Yes	No	Further study in a remedial investigation
Fire Station #2 (Building 94)	Yes	Yes	Further study in a remedial investigation
Former Evaporation Ponds (SWMU E02)	NS	No	No action at this time
Current Sewage Treatment Plant [STP] Ponds (SWMU E03)	No	No	No action at this time
Western Area Demilitarization Facility 117-10: Fire Response	No	No	No action at this time
Vehicle Maintenance (Building 64)	No[1]	No	No action at this time
Vehicle Maintenance (Building 102-52 exterior)	No[2]	No	No action at this time

Notes:
Light gray shading – detection greater than the OSD risk screening level
1. PFOS was detected in groundwater at the Shop Street AOPI at a concentration of 39 nanograms per liter. The Shop Street groundwater sample is a surrogate groundwater sample for three adjacent AOPIs for which a groundwater sampling location was not available: The Fire Station #1 (Building 8): Back Apron, South Main Avenue; Fire Truck Steam Cleaning (Building 11 exterior); and Vehicle Maintenance (Building 64) AOPIs.
2. The Fire Station #1 (Building 8): Back Apron, South Main Avenue, and the Fire Truck Steam Cleaning (Building 11 exterior) AOPIs are located adjacent to the Shop Street AOPI and may have contributed PFOS, PFOA, and PFBS to the Shop Street AOPI soil as follows: the back apron of Fire Station #1 slopes down to Shop Street, and water spray from Fire Truck Steam Cleaning (Building 11 exterior) reportedly went into Shop Street. Therefore, as the PFOS OSD risk screening level exceedance in soil collected at the Shop Street AOPI may be partially attributable to the Fire Station #1 (Building 8): Back Apron, South Main Avenue, and the Fire Truck Steam Cleaning (Building 11 exterior) AOPIs, these two AOPIs are also recommended for further study in a remedial investigation.

3. The NW of SWMU H01: Historical AFFF Fire Training Area AOPI has a groundwater OSD risk screening level exceedance and is located directly downgradient of this AOPI. AFFF historically was used regularly at the Fire Training Pit (SWMU-H01) AOPI for several years; whereas it is likely but not confirmed that fluorosurfactant-containing foams historically were used at the NW of SWMU H01: Historical AFFF Fire Training Area AOPI.
GW – groundwater
ND – non-detect
NS – not sampled
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 Hawthorne Army Depot (HWAD), Nevada 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 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 HWAD 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. An SI includes multi-media sampling at AOPIs to determine whether a release has occurred. An 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 HWAD, 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 HWAD. 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, the 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), HWAD, and Arcadis U.S., Inc. (Arcadis). The teleconference occurred 12 June 2018, approximately 6 weeks before the site visit, to discuss the goals and scope of the PA, project scheduling, installation access, timeline for the site visit, access to installation-specific databases, and to request available records.

Records review was conducted before the site visit to obtain electronically available documents from the installation and external sources for review. The purpose of the records research was to identify any 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 HWAD.

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

- The Army Materiel 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 24 to 26 July 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 HWAD. The interviews focused on confirming information discussed in historical documents, collecting information that may have not been in historical documents, and affirming 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 26 July 2018 with the installation and USACE to discuss preliminary findings of the PA site visit.

1.3.3 Post-Site Visit

Information collected before, during, and after the site visit was reviewed and corroborated by cross-referencing records and reviewing interview details and observations noted during site visit reconnaissance. A site visit trip report was completed and provided to the installation POC, applicable USAEC POCs, and USACE regional POCs following the site visit. The information collected during the pre-site visit and site visit activities was compiled to develop the installation-specific PA portion of the PA/SI report (**Section 3**). Site data obtained during the PA were used to develop preliminary conceptual site models (CSMs) for each AOPI, which serve as the basis for developing the SI scope of work presented in the 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, the SI kickoff teleconference was held between the Army PA team and HWAD on 04 June 2019.

The objectives of the SI kickoff teleconference were to:

- Discuss the AOPIs selected for sampling and reassess whether AOPIs not currently identified for sampling should be sampled (based on a separate discussion with USAEC prior to the SI kickoff teleconference) based on revised decision criteria.
- Gauge regulatory involvement requirements or preferences
- Identify overlapping unexploded ordnance or cultural resource areas
- Confirm the plan for investigation-derived waste (IDW) handling and disposal
- Identify specific installation access requirements, potential schedule conflicts, and seasonal conditions that may impact sampling
- Discuss general SI deliverable and field work schedule information and logistics

Following development of the SI sampling technical approach, the SI scoping teleconference was held on 30 September 2019 to obtain concurrence on the SI sampling plan from USAEC, USACE, and the installation. Additional discussion topics included:

- The expanded scope of AOPIs selected for sampling and the proposed sampling plan for each AOPI
- An updated SI deliverable and field work schedule

The 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, the 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. The Site Safety and Health Plan (SSHP) was 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 (Arcadis 2020a) and SSHP (Arcadis 2020b) 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 HWAD (Arcadis 2020a) in **Sections 6.1** through **6.3**.

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

1.3.5 Data Analysis, Validation, and Reporting

Environmental samples collected during the SI were submitted to a laboratory which is DoD Environmental Laboratory Accreditation Program (ELAP)-accredited for PFOS, PFOA, and PFBS analysis by liquid chromatography with tandem mass spectrometry and compliant with Table B-15 in 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 HWAD, 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

HWAD is located on and is bisected by U.S. Highway 95 in Mineral County, Nevada (**Figure 2-1**). HWAD comprises 147,236 acres of semi-arid land in a high-altitude desert valley and the Wassuk Mountains, and is located 135 miles southeast of Reno, Nevada (driving distance; HWAD 2016, Tetra Tech, Inc. [Tetra Tech] 2013). The main installation is bordered by Walker Lake and the Town of Walker Lake to the north. The southern third of Walker Lake is within the installation boundary. The installation boundary that crosses the lake is marked with a security line of water buoys (Tetra Tech 2013). The main installation is bordered by Bureau of Land Management public grazing lands to the east, south and west, the Gillis Range to the northeast, Garfield Hills to the southeast, the Excelsior Mountains to the south, and the Wassuk Mountains to the west (Tetra Tech 2013). HWAD has an additional facility located 23 miles south of the installation's southern boundary along Highway 359 and it is used as a secondary ordnance area (discussed below in **Section 2.3**).

The main installation surrounds the town of Hawthorne, Nevada (population of 3,269 per the 2010 Census) on three sides (USACE 2016). The town of Walker Lake (population of 275 per the 2010 Census) is located at the northern installation boundary along the western shore of Walker Lake. The installation setting and layout as well as the towns of Hawthorne and Walker Lake, are shown on **Figure 2-2**.

2.2 Mission and Brief Site History

HWAD was commissioned in 1926 as an ammunition storage and manufacturing plant for the U.S. Navy and was constructed in 1928. The early mission of the depot was to store, service, and issue ammunition to the Pacific area, and it was the most important ammunition installation for the Pacific area during World War II (Tetra Tech 2013). Following World War II, the depot was actively involved in the demolition of various types of allied and enemy ammunition. The role of the depot was also expanded to include receiving, renovating, loading, maintaining, storing, and issuing ammunition, explosives, expendable ordnance items, and/or weapons and technical ordnance materials. The depot was also used to test weapons and dispose of unserviceable and/or dangerous ammunition and explosives. The naval facilities at the depot included a chromium metals plating operation in Building 10 and a live-fire firefighting training pit (the live-fire firefighting training pit is no longer present).

In 1977, HWAD was transferred to the U.S. Army and was renamed Hawthorne Army Ammunition Plant (HWAAP). In 1980, HWAAP was converted to a government-owned/contractor-operated (GO/CO) plant and its mission (from 1980 to 1994) was to:

- Receive, produce, assemble, load, issue, store, renovate, inspect, test, demilitarize, and dispose of conventional ammunition

- Operate and/or maintain in operational readiness cast and fuel-air explosive loading plants, rocket assembly plants, and medium/major caliber assembly lines
- Provide special/experimental high explosive casting, extruding, and pressing; fuel air explosive loading and support services to designated research and development activities
- Provide storage facilities for war reserve ammunition, and maintain designated ammunition in a state of readiness for mobilization, including assembling or otherwise providing base unit materials
- Conduct testing of solid propelled munitions, high explosive warheads, mechanical and electronic fuses, cartridge cases, primers, rocket motors, and other ballistic devices

On 01 October 1994, HWAAP was re-designated as HWAD with a primary mission to:

- Store conventional munitions
- Demilitarize and dispose of unserviceable, obsolete, and surplus munitions
- Maintain serviceability through inspection and renovation to ensure munitions readiness (USACE 2016)

HWAD has a secondary mission to provide equipment maintenance, tenant support, and low-impact Special Forces training (Tetra Tech 2013).

HWAD remains a GO/CO facility. The facility was operated by SOC Nevada, LLC (a Day & Zimmermann company) through fiscal year 2021. With the start of fiscal year 2022, the facility is operated by Amentum subsidiary, DynCorp International, LLC, under a 10-year contract (with a phase-in [Amentum]/phase-out [SOC] period that concludes on 01 July 2022). The number of personnel employed by Amentum is unknown (the number of SOC Nevada, LLC staff previously employed at HWAD is also unknown [Joint Munitions Command no date]). The Cantonment area provides housing for the civil servants. HWAD tenants at the time of the PA site visit were the Defense Logistics Agency and the U.S. Naval Underseas Warfare Engineering Station-Keyport Detachment.

2.3 Current and Projected Land Use

The installation is located on federally-owned land with the majority of site access restricted by installation fencing, signage, and security-manned gates. HWAD is divided into four general land use areas: (1) active military areas; (2) the Cantonment Area, which consists of industrial, administration, and housing areas; (3) the Mount Grant watershed; and (4) the area at the south end of Walker Lake (Tetra Tech 2013). HWAD has approximately 25 Department of the Army civil servants. The number of personnel employed by Amentum is unknown (the number of SOC Nevada, LLC staff previously employed at HWAD is also unknown [Joint Munitions Command no date]). The Cantonment area provides housing for the civil servants.

HWAD's mission (ordnance storage and demolition) is carried out across 414 administrative and storage buildings and 2,094 magazines for explosive storage. The total explosives storage capacity is 7,685,000 square feet allocated across a significant portion of the installation. The installation is also used for field training, ordnance testing, and live-fire ranges (USACE 2016).

Areas of HWAD are generally fenced off based on use with separate access points and security measures in place. The Cantonment Area and Walker Lake Golf Course are located northwest of the town of Hawthorne. The magazine and demilitarization facilities are fenced separately east of the Cantonment Area and the town of Hawthorne. Public access to certain portions of the installation located in the Wassuk Mountains is granted on a limited basis for hunting, fishing, and sightseeing.

HWAD has an additional facility located 23 miles south of the installation's southern boundary along Highway 359. The "New Bomb Demilitarization Facility" (New Bomb) encompasses 3,000 acres and is used as a secondary ordnance area. New Bomb is surrounded by U.S. Forest Service lands. Based on interviews with installation personnel during the PA site visit, it was determined that there are no areas at New Bomb where PFAS-containing materials are (or were) used, stored or disposed and, as a result, no further investigation was undertaken. New Bomb is not included in this PA/SI. Given its location, New Bomb is not included in any installation figures.

Land to the north of HWAD is used for ranching, recreation, and a few, small residential communities; land to the south, east, and west of HWAD are principally used for public grazing lands (Bureau of Land Management owned) (Tetra Tech 2013). There is also at least one mine located south of HWAD.

2.4 Climate

The climate is semi-arid, high-altitude desert (USACE 2016). The average annual temperature in Hawthorne ranges between 41.1 (minimum) and 70.7 degrees Fahrenheit (maximum) with large, daily temperature swings. The average annual total precipitation is approximately 4.5 inches (Western Regional Climate Center no date). HWAD experiences average monthly wind speeds of approximately 5 to 8 miles per hour with average gusts of 12 miles per hour; winds are generally strongest in April through May and weakest November through January (Windfinder no date). Wind directions are variable. However, the Walker Valley area sometimes experiences strong winds in excess of 45 miles per hour. As a result of the desert climate, installation soils in Walker Valley are prone to wind and water erosion and the creation of dust. HWAD utilizes irrigated tree-lined windbreaks in the Cantonment Area and a soil stabilizer in the magazine areas where loading and unloading activities occur (Tetra Tech 2013).

2.5 Topography

HWAD is principally located in a basin in the Whiskey Flat-Hawthorne sub-area of the Walker Lake Valley. It is bordered by Walker Lake to the north, Gillis Range to the northeast, Garfield Hills to the southeast, the Excelsior Mountains to the south, and the Wassuk Mountains to the west (USACE 2016). HWAD's elevation ranges from approximately 3,900 to 5,000 feet above mean sea level, with a maximum elevation of 11,329 feet above mean sea level on Mount Grant (Tetra Tech 2013). Most of the main installation's facilities are located within the flat former lakebed of Walker Lake (**Figure 2-3**).

2.6 Geology

HWAD is located in the Walker Lake Valley, which contains mountains composed of Mesozoic- and Cenozoic-age detrital, extrusive, intrusive, metamorphic, and carbonate rocks. Quaternary and Tertiary unconsolidated sedimentary deposits comprise the valley floor, alluvial fans and aprons, and higher elevation weathered parent material. A Holocene (late Quaternary) north-striking fault system runs along

the eastern front of the Wassuk Range (and through HWAD). There is an approximately 2-mile-long gap in the north-striking fault system in the vicinity of the town of Hawthorne and it extends to the HWAD Cantonment Area. In the area of this gap, the north-striking fault is replaced by a zone of northeast-striking Holocene faults extending through the town of Hawthorne and HWAD (Bell and Hinz 2010).

There are three depositional and soil types of surficial deposits at HWAD:

- Overburden occupies the mountains, hills, and canyons. It is shallow and discontinuous, consisting of silty sand, sand-silt mixtures, and gravel in a clay matrix, with cobbles and boulders.
- Deposits that form the alluvial fans and aprons consist of silty sands and gravelly silt-sand. The shallow deposits are mostly sand. Detritus has been transported to lower elevations by fluvial processes. Units are at least 850 feet thick on HWAD.
- Lacustrine deposits consist mostly of clays from the Pleistocene-Age Lake Lahontan (Ecology and Environment, Inc. 1997, Ahtna Engineering Services, LLC [Ahtna] 2018).

2.7 Hydrogeology

HWAD is located almost entirely in the Walker Lake Valley groundwater basin, which is a hydrologically closed basin. Therefore, groundwater loss within the basin is primarily through evapotranspiration and groundwater extraction. Walker Lake is a closed (no natural outlet) and shrinking lake with a very high level of salinity and total dissolved solids. Groundwater quality data for the Walker Lake Valley groundwater basin show consistently high sulfate and total dissolved solids concentrations at various locations. These levels are frequently reported to exceed the USEPA secondary standards for drinking water. The origins of poor water quality in the basin are unknown, but several natural sources are possible. The most important of these sources is evaporite deposits in the valley fill material related to the retreat of Pleistocene-Age Lake Lahontan. Mineralized geothermal water at depth in the basin could contribute to groundwater salinity (Tetra Tech 2013).

Recharge occurs along the mountain front near the apex of the alluvial fans (Ahtna 2018). A small area on Mount Grant at the western border of HWAD is in the East Walker Area groundwater basin (Tetra Tech 2013). Walker Lake is considered the terminus of surface and groundwater flow through Walker Lake Valley groundwater basin (USACE 2016). Groundwater gradients are directed toward the valley axis and Walker Lake, but this gradient might be modified locally by pumping. In general, depth to groundwater decreases from the east-southeast towards Walker Lake, and shallow groundwater generally flows to the northwest towards Walker Lake at approximately 1 foot per day (Ahtna 2018). Depth to groundwater on HWAD ranges from approximately 5 feet below ground surface (bgs) near Walker Lake to approximately 250 feet bgs near the installation's southern boundary.

Groundwater sampling in 2013 as part of a base-wide, annual groundwater monitoring event, determined that the eastern portion of HWAD had a shallow groundwater gradient toward the west from 0.002 to 0.005 foot per foot, while the western portion of HWAD exhibited a northwesterly gradient ranging from 0.003 to 0.005 foot per foot (Ahtna 2018). Local flow impacts from faulting were not considered in the determination of these gradients. Evapotranspiration and groundwater pumping are the major groundwater loss mechanisms because HWAD is predominantly located in a closed hydrogeologic basin (Ahtna 2018).

2.8 Surface Water Hydrology

The valley floor within the Walker Lake Valley groundwater basin consists of a broad alluvial apron that is flanked by alluvial fans with slopes of up to 6 percent (%). The alluvial fans are created by sheet and channel erosion in the mountains, primarily resulting from intense local thunderstorms. Seasonal runoff provides some groundwater recharge within the valley along the mountain front near the apex of alluvial fans (Ahtna 2018). The general direction of flows from the Wassuk Mountain Range (on the west side of the installation) is across the installation to the east and northeast. The Garfield Hills, to the southeast of the installation, also generate water flows across the installation to the northwest toward Walker Lake (Tetra Tech 2013).

There are several creeks and springs in the approximately 45,000 acres of the installation on Mount Grant (Tetra Tech 2013). Surface water from some of the major creeks on Mount Grant (Wassuk Mountains) are captured in three reservoirs located on the eastern slope of Mount Grant: Black Beauty, Cat Dam (also known as Cat Creek), and Rose Creek. There are no perennial surface streams along the valley floor. However, there are approximately 700 acres of wetlands along the southern shore of Walker Lake (Tetra Tech 2013). Dikes and ditches on the installation provide some control of surface water flows during intense local thunderstorms (Tetra Tech 2013).

As noted in **Section 2.7**, Walker Lake Valley groundwater basin is hydrologically closed. Therefore, Walker Lake is the terminus for surface water flow through the Walker Lake Valley groundwater basin that does not evaporate or infiltrate (USACE 2016). Walker Lake is a shrinking lake and has a very high level of salinity and total dissolved solids. The lake no longer supports fish and is not used for drinking water.

2.9 Relevant Utility Infrastructure

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

2.9.1 Stormwater Management System

As noted above, dikes and ditches on the installation provide some degree of control of surface water flows (generally coming off the mountains) during intense local thunderstorms (Tetra Tech 2013). Flash flood events sometimes overwhelm the stormwater management system. Site personnel indicated that flash flooding primarily affects the Southern and Central Magazine areas but, on occasion, the Cantonment Area also experiences flash flooding.

2.9.2 Sewer System

Western Area Demilitarization Facility

There is an active industrial wastewater treatment plant (Installation Restoration Program [IRP] No. HWAAP-E01a) located at the Western Area Demilitarization Facility (WADF) and it has been in operation since 1979. This industrial wastewater treatment plant is designed to treat wastewater generated during the explosives washout processes at the WADF (HWAD 2001). The industrial wastewater treatment plant

can discharge water with concentrations of trinitrotoluene up to 2 parts per million under a National Pollutant Discharge Elimination System permit (HWAD 2001).

There is an active sewage treatment plant (STP; IRP No. HWAAP-E01b) located at the WADF and it has been in operation since 1977 (HWAD 2001). This treatment plant receives sewage from the WADF facilities. The plant is comprised of six polyvinyl chloride-lined evaporation ponds. No mechanical treatment is employed, and the waste does not discharge to groundwater (HWAD 2001). It also receives treated effluent from the WADF industrial wastewater treatment plant. According to the HWAD Environmental Chief during the PA site visit interview, the sewage treatment plant was constructed to avoid having to pump sewage generated at WADF up to the STP operated by Mineral County.

Magazine Areas

Septic tanks with leach fields are utilized in the magazine areas for industrial liquid processing wastes.

Sanitary Sewer System

There is a STP (Solid Waste Management Unit [SWMU] E03, IRP No. HWAAP-E03) encompassing approximately 66 acres and is located on the installation to the southeast of the 112 Magazine Group. Mineral County constructed and operates the STP under an easement issued by the U.S. Army (HWAD 2001, Army 2011). The county-operated plant receives and treats sewage from the town of Hawthorne and the main base area of the installation. HWAD generates approximately 40,000 to 50,000 gallons of sewage per day (Tetra Tech 2013). The most recent easement is for a 50-year term that started on 01 June 2011.

The plant currently consists of the five unlined ponds and three lined ponds. Prior to 2011, the plant consisted of five unlined oxidation-percolation-evaporation ponds (HWAD 2001). According to the HWAD Facilities Manager during the PA site visit interviews, the evaporation/percolation ponds began receiving wastewater in approximately March 2002 when SWMU E02 ceased operation. However, satellite imagery indicates that there were three ponds at this location in December 1985.

During a Phase II investigation conducted by the U.S. Geological Survey (report completed in 1988), it was discovered that contaminants (the 2001 HWAD Installation Action Plan identified the contaminants as “nitrates”) in the ponds had reached groundwater (HWAD 2001). Groundwater under the current STP ponds was approximately 67 to 73 feet bgs during the SI field event conducted in January and February 2021.

The main base feeds into the county system via 8- to 15-inch pipelines. The Army installed these pipelines in the early 2000s and pays the county for sewer services (Tetra Tech 2013). During the PA site visit, the HWAD Environmental Chief noted that they thought the historical sewer lines are still intact. It is unknown whether the historical sewer lines are attached to the existing sewage treatment plant (IRP No. HWAAP-E03) via the new 8- to 15-inch feeder pipelines or if it they were left in place and new pipelines were installed and connected to the feeder pipelines.

The main base was previously connected to the former STP (SWMU E02, IRP No. HWAAP-E02). The former STP began operation in 1930 and ceased operation in approximately 2002. The HWAD Facilities Manager stated during PA site visit interviews that the evaporation/percolation ponds that formed part of the former STP were shut down in March 2002. The former STP was designed to receive and treat 400,000 gallons of sewage a day (HWAD 2001). The former STP included two parallel Imhoff tanks with

bar screens, an open sludge holding tank, two unlined sludge drying beds, and 20 unlined evaporation/percolation ponds (HWAD 2001). The effluent flowed from the sludge settling tank to the unlined evaporation/percolation ponds from which the effluent could percolate to groundwater; sludge from the setting tank was placed in the two, unlined sludge drying beds (HWAD 2001).

2.10 Potable Water Supply and Drinking Water Receptors

HWAD captures surface water flow from the Mount Grant watershed (runoff from the mountains on the west side of the depot) in three reservoirs: Black Beauty (not in use at the time of the PA site visit), Cat Dam (also known as Cat Creek), and Rose Creek. These reservoirs are located on major creeks on the mountain sides above and upgradient of the HWAD Cantonment Area and are used for drinking water. The water captured in these reservoirs generally supplies approximately 90% of the installation's drinking water.

Groundwater in the immediate area beneath HWAD is generally a poor source of potable water because it is high in mineral content, high sulfate, and total dissolved solids content. Mineralized geothermal water at depth in the basin could contribute to groundwater salinity (Tetra Tech 2013). However, from approximately April through September every year, groundwater from two installation production wells (Well 4 and Well 11; see **Table 2-1**) is used to augment the drinking water collected in the reservoirs located above HWAD in the Wasatch Mountains. The screened interval and total depth are not known for these two production wells used for drinking water. According to the HWAD Facilities Manager, the groundwater that is extracted from production wells is approximately 128 degrees Fahrenheit. The installation production (non-drinking) water wells are shown on **Figure 2-2**.

Well 4 is located approximately 4.5 miles from the cantonment area and 2 miles (upgradient) from the town of Hawthorne in the South Magazine Area. Drinking water from Well 4 is treated and has a separate distribution system from that associated with the reservoirs and Well 11.

Well 11 is located approximately 1 mile downgradient/cross-gradient) of the cantonment area. Well 11 provides most of the groundwater used for the installation's drinking and irrigation water. All water from the reservoirs and Well 11 is treated, primarily for arsenic and fluoride, at the drinking water treatment facility.

Groundwater extracted from production wells Well 1 and Well 5 are used for dust suppression. Groundwater from Well 1 is specifically used for dust suppression at the construction and demolition landfill located to the east across U.S. Highway 95.[1] HWAD has four further production wells, none of which are used for drinking water: Wells 2, 3, 7, and 8. Well 7 is located downgradient/cross-gradient of the Fire Station #2 AOPI, and Well 8 is located cross-gradient of the Wastewater Treatment AOPIs, and Well 2, Well 3, and Well 4 are located upgradient of all the AOPIs. It is unknown whether these wells are inactive or active for other installation uses.

[1] According to the HWAD Military Munitions Response Program / IRP Program Manager, groundwater from Well 1 historically was used for drinking water but is no longer connected to the drinking water treatment facility. It is unknown when Well 1 was discontinued as a drinking water source, as well as the current water quality of the associated groundwater.

An Environmental Data Resources, Inc. (EDR) report includes search results from a variety of environmental, state, city, and other publicly available databases for a referenced property. An EDR report was generated for HWAD, 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 HWAD EDR report providing well search results is provided as **Appendix E**.

The wells identified adjacent to the northern installation boundary in and around the Town of Walker Lake are considered to be upgradient because the terminus for all groundwater is Walker Lake. The Town of Walker Lake's wells are also more than 5 miles north of the nearest AOPI.

The town of Hawthorne is almost entirely encircled by HWAD. Hawthorne obtains drinking water from groundwater wells located in the Whiskey Flats area approximately 12 miles south of town and upgradient of HWAD (Ahtna 2018).

2.11 Ecological Receptors

The PA team collected information regarding ecological receptors that was available in the installation documents. The following information is provided for future reference should the Army decide to evaluate exposure pathways relevant to the ecological receptors.

HWAD contains a diverse range of habitats. Plant and animal species vary across the installation due to surface features, elevation, and availability of fresh water. Many of the potential ecological receptors are located in the Mount Grant portion of the installation.

In those portions of the installation within the Walker Lake Valley, the following animal species may be present:

- Mammals: Black-tailed jackrabbits, coyotes, Meriam kangaroo rat, Great Basin kangaroo rat, little pocket mouse, Great Basin pocket mouse, deer mouse, white-tailed antelope ground squirrels, pallid bats, and feral horses (southern shore of Walker Lake; observed during the PA site visit).
- Birds: Numerous birds of prey, terrestrial game, shoreline, water, and other species of birds (e.g., hermit thrush, common raven, horned lark). The white-faced ibis and the western snowy plover are state-listed sensitive species. The common loon and the American white pelican use Walker Lake as a migratory stop.
- Reptiles and amphibians: Two species of amphibians and 16 species of reptiles (eight lizard and eight snake species) are found on HWAD. No sensitive species have been identified at HWAD.
- Plants: Wetland grasses on the southern shore of Walker Lake (Tetra Tech 2013). These grasses are eaten by the feral horses.

Sport fishing is prohibited on Walker Lake until water quality improves sufficiently to support stocked native fish populations. However, it is unlikely that fishing in the southern third of the lake (or from its shoreline), which is within the HWAD installation boundary, will ever be permitted to occur due to the presence of UXO from when HWAD was a Navy installation. The installation boundary that bisects Walker Lake is marked with a security line of water buoys to keep boaters out and identify the beginning of an unexploded ordnance (UXO) area on Army property (Tetra Tech 2013). According to the HWAD Facilities Manager, fishing historically was permissible in at least one of the installation's reservoirs used

for drinking water. It is unknown whether fishing is currently allowed in the reservoir(s) or will be in the future.

Other than Nelson desert bighorn sheep hunting in Lower Cottonwood Canyon on Mount Grant, no hunting or trapping is allowed on the installation (Tetra Tech 2013).

2.12 Previous PFAS Investigations

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

In response to the USEPA's third Unregulated Contaminant Monitoring Rule (UCMR3) and Installation Management Command (IMCOM) Operations Order 16-088, drinking water at HWAD was sampled by installation personnel in November 2016. A total of 12 samples were collected from one of the installation's reservoirs (Black Beauty), the two production wells used for drinking water (Well 4 and Well 11), finished (treated) drinking water (comprised of water from the reservoir[s] and Well 11), and finished water from an off-post municipal well located upgradient of the cantonment that is used by HWAD as a back-up water source. The samples were analyzed for six PFAS compounds: PFOS, PFOA, perfluorononanoic acid, perfluorohexanesulfonic acid, perfluoroheptanoic acid and PFBS using USEPA Method 537. None of the analyzed PFAS compounds were detected above the minimal reportable level (generally 40 ng/L for PFOS, 20 ng/L for PFOA, and 90 ng/L for PFBS). Raw (untreated) water from Well 11 (the other installation production well used for drinking water), located downgradient of several of the AOPIs, was not sampled during the November 2016 sampling event. The laboratory which analyzed samples under UCMR3 met the USEPA's UCMR3 Laboratory Approval Program application and Proficiency Testing criteria for USEPA Method 537 Version 1.1.

Drinking water at HWAD was sampled by installation personnel in October 2020. A total of five primary samples and two duplicate samples were collected from the two production wells used for drinking water (Well 11 and Well 4), the finished (treated) drinking water from Well 4 and Well 11 (separate treatment systems), and from non-drinking water production well 1 (used solely for dust suppression). The samples were analyzed for 30 PFAS compounds, including PFOS, PFOA, and PFBS using USEPA Method 537 Modified in compliance with Table B-15 in the DoD QMS 5.3 (Eurofins Lancaster Laboratories Environmental, LLC 2020). None of the analyzed PFAS compounds were detected above the limit of quantitation (LOQ).

The October 2016 and October 2020 PFAS analytical data are provided in **Table 2-2**.

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 HWAD, data were collected from three principal sources of information:

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**), photo documentation of areas (sites) investigated (**Appendix H**), and site reconnaissance logs (**Appendix I**) during the PA process for HWAD 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 IRP administrative record documents, compliance documents, HWAD fire department documents, HWAD 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 HWAD is provided in **Appendix F**.

3.2 Personnel Interviews

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

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

- Army – Military Munitions Response Program / IRP, Program Manager, Directorate of Public Works
- Army – Environmental Chief, Directorate of Public Works
- Facilities Manager
- Fire Chief, Fire Department
- Risk Management Directorate Supervisor

- Assistant Fire Chief, Fire Department (two Assistant Fire Chiefs)
- Environmental Services Manager, SOC Nevada LLC
- Director, Mineral County Public Works
- Captain, Fire Department
- Naval Sea Systems Command – Inventory Accuracy Officer; Logistics Management Specialist
- Naval Sea Systems Command – Site Manager
- Defense Logistics Agency – Director HWAD Operations; former Fire Chief, HWAD Fire Department
- Former Fire Chief, HWAD Fire Department
- Water Operations Supervisor

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 HWAD during the records review process, the installation in-brief meeting, and/or during the installation personnel interviews. A photo log from the site reconnaissance is provided in **Appendix H**; photos were used to assist in verification of qualitative data collected in the field. The site reconnaissance logs are provided in **Appendix I**.

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

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

HWAD 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 sections.

4.1 AFFF Use, Storage, and Disposal Areas

AFFF was developed in the mid-1960s in response to a need for firefighting foams better suited to extinguish Class B, fuel-based fires. Navy use of AFFF was authorized in 1967; Army use of AFFF was authorized at the start of 1970 (however, instances of DoD use of foams containing perfluorinated surfactants and/or fluoroproteins in firefighter training and fire responses are documented as far back as the early 1950s) (Moody 2003, National Foam no date, Prevedouros et al. 2006, and United Kingdom Home Office 2000). 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.

As identified during site visit interviews with fire department personnel and confirmed during site reconnaissance, AFFF is stored in two locations at HWAD: Fire Station #1 (Building 8) and Fire Station #2 (Building 94). At Fire Station #1, AFFF is stored in the garage bays and in an external shed adjacent to the back apron. HWAD reported, in response to a 2015 Army Materiel Command survey requesting information on AFFF inventory, that HWAD had 25 gallons of AFFF in Engine 2 (CX2915, has a 100-gallon AFFF reservoir) and 30 gallons of AFFF stored in Fire Station #1. Historically, ten to twenty 5-gallon buckets of AFFF concentrate were kept in the chemical storage room. According to the HWAD Assistant Fire Chief during the PA site visit interview, eight or nine buckets of former military specification (MILSPEC) AFFF concentrate were removed from the chemical storage room and five or six buckets of former MILSPEC AFFF concentrate were removed from the garage bays in 2018 and disposed by the installation Directorate of Public Works Environmental Division. During site reconnaissance, six 5-gallon buckets of Ansulite 3% AFFF concentrate and a PRO/pak® portable AFFF foam-injection and application system were observed on the station premises. At Fire Station #2, AFFF is kept in a building located just southeast of the station apron.

For emergency preparedness, installation/fire department personnel were trained on AFFF-containing equipment and performed nozzle testing with AFFF to ensure optimal flow and use of the AFFF mixture. Nozzle testing involved spraying AFFF through fire equipment. Personnel were also trained on how to

use the department's PRO/pak® portable AFFF foam-injection and application systems. These training activities were generally conducted on the back apron of Fire Station #1 and the apron of Fire Station #2. A former HWAD Fire Chief indicated that training with AFFF at Fire Station #1 was conducted in Shop Street for a period of time (the frequency and duration of training is not known) after use at SWMU H01 [the Fire Training Pit (SWMU H01) AOPI] ceased in the mid-1980s. Occasionally, these activities were also carried out on the Fire Station #2 apron or the gravel just beyond the apron. Fire equipment training also included arc training to maximize the arc, reach, and distance covered by AFFF in an emergency response. It is likely that this arc training historically was conducted solely at the Drafting Pit: Fire Truck Pump Testing AOPI, but this was not confirmed during the PA site visit. The drafting pit consists of a concrete pad on top of a below-ground tank or concrete cistern that holds recirculated water.

Historically, there were two locations where large-scale training with AFFF, or other fluorosurfactant-containing foams regularly occurred: the Fire Training Pit (SWMU H01) AOPI and the Northwest (NW) of SWMU H01: Historical AFFF Fire Training Area AOPI. A records review and interviews with a former HWAD Fire Chief and the HWAD Assistant Fire Chief during the PA site visit indicate the Fire Training Pit (SWMU H01) was used for live fire firefighter training by the HWAD Fire Department for approximately four years in the early 1980s (after the installation transferred from the U.S. Navy to the Army in 1977 and became a GO/CO facility in 1980). SWMU H01 was a movie theater, and it is assumed it operated as one until approximately 1977 when the installation transferred to the Army. After the movie theater closed, the structure was removed and only the concrete foundation and lower walls remained. The foundation slab measures approximately 60 feet wide by 120 feet long and slopes down to the southeast. The 3-foot-high foundation wall on the southeast end of the slab, plugged floor drains, and earthen berms in the former doorways were used to contain the flammable fuels during training. The foundation slab was flooded with approximately 1 foot of water and fuel, which was ignited and subsequently extinguished with AFFF sprayed into the area from the exterior of the foundation. The liquid was left to evaporate in place after the fire was extinguished. In the southern portion of the former theater foundation, overspray may have reached approximately 10 feet beyond the eastern, western, and southern foundation walls.

According to a former Army Fire Chief interviewed during the PA site visit, and who worked in the Navy fire department from 1965 until the installation's transfer to the Army in 1977, the Navy fire department used an area located approximately 220 feet to the northwest of the Fire Training Pit (SWMU H01) AOPI for live fire firefighter training. This former Navy fire training area (Northwest [NW] of SWMU H01: Historical AFFF Fire Training Area AOPI) was an earthen pit approximately 30 feet in diameter and 1.5 feet deep. Gas or leftover oil would be put in the pit and lit on fire. The firefighters would enter the pit and use 5-gallon metal pans containing protein foam to spray foam onto the fire in a sweeping motion as the firefighters moved across the pit. The liquid was left in place to evaporate or infiltrate after training was completed. The former Army/Navy firefighter interviewed stated that they recalled training once at this location. However, it is highly likely that other firefighter "platoons" also trained at this location. Use of this training location ceased in or prior to 1977. The pit was later backfilled and converted to a ball field. There was no visual indication of the location of this former fire training area (or former ball field) during the PA site visit.

There are three other locations where fire-department activities that resulted in documented or potential AFFF uses: Shop Street, Conelly Drive, and the locomotive steam cleaning facility located alongside Building 11 (locomotive shed) that is sometimes used for cleaning fire trucks prior to conducting maintenance activities.

The parking lot located on the west side of Building 18 and south of Building 13 was used for a single training event with AFFF in 2007. For this training, a small fire was set in a 3-foot by 3-foot metal pan that was 0.5 foot deep. Each trainee sprayed AFFF into the pan to extinguish the fire. The contents were then dumped onto the pavement and the procedure was repeated six times.

The HWAD fire department fire trucks, including those that carry AFFF, historically and currently are maintained and repaired in Building 64 in the cantonment area and Building 102-52. At least historically, maintenance staff would pressure wash fire trucks in either the wash rack located inside Building 64, the wash rack located outside the door to Building 64, or at the locomotive steam cleaning facility located outside of Building 11. It is not confirmed, but, at least historically, it is likely that fire trucks undergoing maintenance at Building 102-52 were first pressure washed at the wash rack located outside of and behind the building.

There are no known current or historical structures fitted with a fire-suppression system that utilizes AFFF or another PFAS-containing foam.

There is one known on-post firefighting response during which AFFF was used. In the late 1990s, there was an isopropyl alcohol and isopropyl amine fire at the WADF in Building 117-10. AFFF was used to extinguish the fire. AFFF sprayed to the ground outside of the building was left in place to evaporate.

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

Following document research, personnel interviews, and site reconnaissance at HWAD, metal plating operations, photo-processing areas, painting operation areas, vehicle maintenance areas, laundry facilities, wastewater treatment plants, and landfills/dumps were also identified as preliminary locations for use, storage, and/or disposal of PFAS-containing materials. A summary of information gathered in the PA for each of these preliminary locations is described below. Specific discussion regarding areas not retained for further investigation is presented in **Section 5.1** and specific discussion regarding areas retained as AOPIs is presented in **Section 5.2**.

Potential PFAS use associated with metal plating activities may also be relevant to Army installations. During metal plating operations, a metal surface may be treated with a layer of electrochemically deposited metals in an acid bath. PFAS, specifically PFOS, have been used in metal plating operations as surface tension-reducing wetting agents to mitigate the release of aerosolized chemicals into a working environment. Hard chromium plating is one type of metal plating operation where PFAS-containing mist suppressants were commonly used. Historically, it was common for spent plating baths from metal plating operations to be disposed of in a lined or unlined pit or into a sanitary or storm sewer. Therefore, PFAS present in mist suppressants during the metal plating process could be released to the environment. The use of PFAS-containing mist suppressants during plating activities was uncommon before the mid-1990s.

Installation personnel interviews indicate that chromium plating was conducted in the west end of Building 10 starting sometime in the 1950s. The Navy performed chromium plating in Building 10 prior to the transfer of HWAD to the Army in 1977. Chromium plating activities may have continued by the Army until 1980 when the installation was converted to a GO/CO installation. However, another interviewee indicated that metal plating activities continued in the 1980s and 1990s. There are no other forms of metal-plating operations known to have been conducted at HWAD. The chromium plating facility within

Building 10 no longer exists and there was no one available to interview who had worked in this facility during its period of operation; therefore, it could not be determined during the PA site visit whether a mist suppressant may have been used during chromium plating activities. Based on historical blueprints, it appears that a pipe coming out of the building's west exterior wall may have been connected to the sewer system via a now non-existent down pipe. However, it is uncertain whether wastes went to the former or current sewage treatment plant, were discharged to the ground, or went somewhere else. Historically, there was a discharge pit (SWMU I13) associated with Building 10 and located at the building's southwest corner (Tetra Tech 1999). Petroleum hydrocarbons, paint residues and solvents were discharged to this pit. Subsurface soil samples collected in August 1994 had total chromium detected in all six samples at concentrations ranging from 4.4 J mg/kg (J indicates an estimated concentration) to 21 mg/kg. While not documented, there is the possibility that waste materials from chromium plating activities were also discharged to this pit.

The current STP (SWMU E03) has been in operation since at least December 1985. The current STP receives (or received) wastewater from Building 8 (Fire Station #1), Building 94 (Fire Station #2), Building 64 (fire truck maintenance), and Building 110-29 (formerly had a washing machine that was used by vehicle maintenance staff to wash coveralls worn during fire truck maintenance). There is no known history of biosolid land applications.

The former STP (SWMU E02) began operation in 1930 and ceased operation in approximately 2002. The former STP received wastewater from Building 8 (Fire Station #1), Building 94 (Fire Station #2), Building 64 (fire truck maintenance), Building 110-29 (formerly had a washing machine that was used to wash coveralls worn during fire truck maintenance), and potentially the H01 former fire training pit. There is no known history of biosolid land applications.

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 HWAD as an installation having used or stored PFAS-containing pesticides/insecticides. Additionally, the PA team reviewed available pesticide use inventory documentation provided by the installation and did not identify PFAS-containing pesticides use, storage, or disposal (HWAD 2018).

Several other facilities and activities that historically could have utilized PFAS-containing materials were identified at HWAD:

- A former explosive munitions x-ray facility that ceased operation in 1996
- An active photo-processing facility; it is unknown when this facility became operational
- Numerous former painting facilities and one active painting facility
- Vehicle maintenance facilities
- Current and historical landfills/dumps and burn pits
- Former laundry facilities
- Historical fire responses

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

There are four instances in which the HWAD fire department provided mutual aid fire-response support with confirmed or likely AFFF use. One of these locations is more than 5 miles away from HWAD.

- In 2008, there was a fire on the east side of Walker Lake, about halfway up the length of the lake, in a railroad culvert of the Southern Pacific railway line. The location of the fire is understood to be on Bureau of Land Management land (government owned). The culvert was constructed with railroad ties. The culvert caught on fire and the HWAD fire department responded. The fire could not be extinguished with only water. The responding HWAD fire truck utilized 300 gallons of AFFF (the entirety of the truck's AFFF reservoir) and an unknown quantity of water to extinguish the fire. The culvert was filled completely with AFFF. AFFF and water flowed down the mountain side towards Walker Lake; however, the runoff flow did not reach the lake.
- Sometime in the 1970s, a twin-engine civilian aircraft ran out of gas and crashed just short of the Hawthorne Industrial Airport runway (southeast end) and just west of the adjacent cemetery. The HWAD fire department responded to the mutual aid request and staged a truck in the road on the west side of the cemetery and sprayed west-northwest onto the crash site. AFFF/film forming fluoroprotein foam was deployed during the crash response. The amount of foam used in the fire response is unknown.
- Sometime between 2007 and 2015, on Corey View Drive, near the Mineral County landfill, a truck caught on fire (magnesium was involved). It is understood from installation personnel interviews that the HWAD fire department provided mutual aid and likely sprayed AFFF to extinguish the vehicle fire. The location of the fire is understood to have been just before Corey View Drive curved to the north (if driving west on Corey View Drive from Nevada Highway 359/E Street).
- In approximately 2016, the HWAD fire department provided mutual aid for a tractor trailer and refrigeration unit fire located approximately 20 miles east-southeast on U.S. Highway 95 just west of the town of Luning (exact location is unknown). An estimated 20 gallons of AFFF were used in the fire response. It is unknown whether any other fire departments participated in the fire response and, if any did, whether they also deployed AFFF.

There is a Mineral County Fire Department fire station located at 418 Mineral Road in Hawthorne. The fire station is approximately 2 miles (downgradient) from HWAD drinking water Well 4 (and 0.2 mile from the upgradient installation boundary) and approximately 3.5 miles (upgradient to cross-gradient) from HWAD drinking water Well 11 (and approximately 2.2 miles from the downgradient installation boundary). It is staffed by volunteer firefighters. According to the HWAD Fire Chief, AFFF is not used during fire training or in fire responses by the Mineral County Hawthorne fire station; however, historical practices may have differed (the Fire Chief who provided information on the Mineral County fire station in Hawthorne joined the HWAD Fire Department in 1996).

Mount Grant General Hospital is located at 200 South A Street in Hawthorne. The hospital is approximately 2 miles (downgradient) from HWAD drinking water Well 4 and approximately 3.6 miles

(upgradient to cross-gradient) from HWAD drinking water Well 11. HWAD wraps around the town of Hawthorne; the hospital is approximately 0.2 mile north of the upgradient installation boundary approximately 2.3 miles south-southeast of the downgradient installation boundary. The hospital has been in existence since at least 1988 and provides x-ray services.

The town of Hawthorne encompasses 1.5 square miles and has a population of 3,269 (USACE 2016). No confirmed historical or current off-post, potential PFAS sources were identified upgradient of the AOPIs identified at HWAD.

5 SUMMARY AND DISCUSSION OF PA RESULTS

The preliminary locations evaluated for potential use, storage, and/or disposal of PFAS-containing materials at HWAD 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, 15 areas have been identified as AOPIs. The process used for refining these areas is presented on **Figure 5-1**, below.

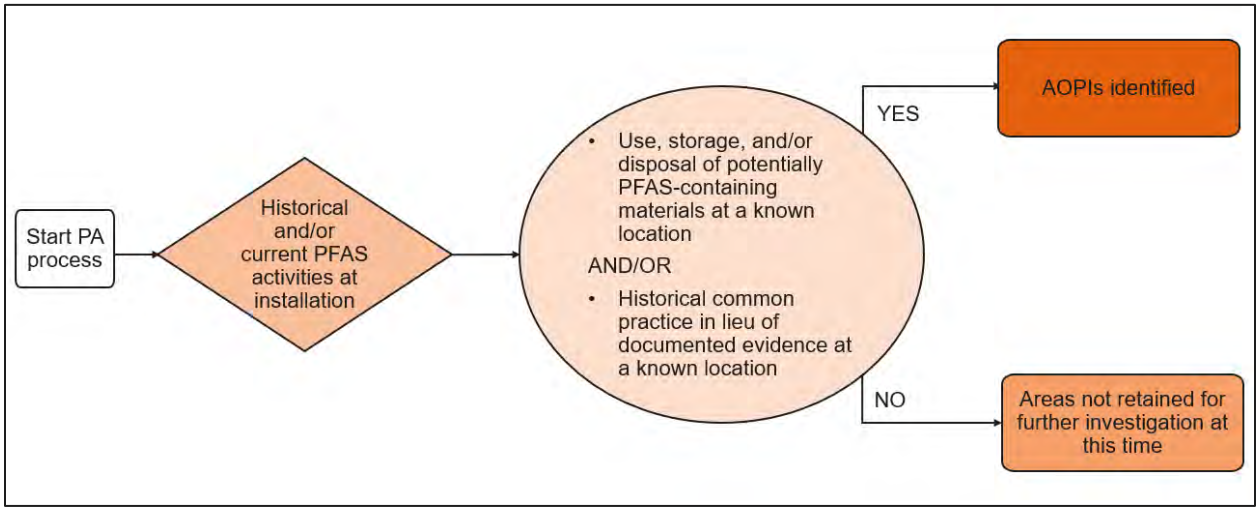

Figure 5-1: AOPI Decision Flowchart

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 HWAD 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
X-ray processing: Building 101-48	1969 to mid-1990s	Building 48 in Group 101 was built as an explosive munitions x-ray facility. Building wastewater, including X-ray film development chemicals, discharged to a sump at the southeast corner of the building and then to a leach field to the west of the building.	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
Photo processing: Building 66	Unknown to present	Used frequently for film development. Processing film liquids were likely disposed down sink which is connected to the sanitary sewer.	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
Painting operations: Buildings 101-41, 101-44, 101-21, 103-16, 103-08/103-10 (associated: CCHWAAP-B27B oxidation ditch), 108-3 (associated: HWAAP-J28 catchment pits), 49-9 (associated: HWAAP-I11 pit/landfill), and 10 (associated: HWAAP-I13 landfill/discharge)	1950s to unknown	Multiple buildings historically used throughout the installation for painting operations, including dumping wastes to exterior open trenches. Painting operations are no longer present.	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
Painting operations: Building 46	Unknown to present	Active painting facility. Likely connected to the sanitary sewer.	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
Vehicle maintenance: Building 63	Unknown to present	Building contains a welding/fabrication shop in which plumbers/pipefitters and boiler operators work. Fire trucks are replumbed here (e.g., conduct repairs	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location. Current and former installation personnel

Area Description	Dates of Operation	Relevant Site History	Rationale
		on a pump removed from a fire truck). No general fire truck maintenance occurred/ occurs in this building. The building does not have a floor drain.	indicated that nothing containing AFFF is repaired in this building.
Waste Lumber Open Burning Pit (HWAAP-H02)	Unknown	Waste lumber was destroyed (burned) in this pit. Fire department staff would be present on standby to ensure the fire did not escape the pit.	No evidence of PFOS, PFOA, or PFBS-containing materials burned, used, stored, and/or disposed of at this location. No indication that the fire department ever deployed AFFF during a burn event.
Road and Grounds Waste Open Burning Pit (HWAAP-H03)	Unknown	Various materials were destroyed (burned) in this pit. Fire department staff would be present on standby to ensure the fire did not escape the pit.	No evidence of PFOS, PFOA, or PFBS-containing materials burned, used, stored, and/or disposed of at this location. No indication that the fire department ever deployed AFFF during a burn event.
Historical Landfills and Burn Pits: **Babbitt (HWAAP-A04), Construction and Debris (HWAAP-A08), Navyside (HWAAP-H04), 33-16 (HWAAP-I05), Building 70 (HWAAP-I08), Building 49-10 Pit (HWAAP-I09/I10), Building 49-9 (HWAAP-I11), 101-44 (HWAAP-I07), 104-10 (HWAAP-I17), 115 Group Burn Area (HWAAP J02), Dock 1 (HWAAP J05), Dock 2 (HWAAP J06), Dock 3 (HWAAP-J07), Dock 4 (HWAAP-J08), Dock 5 (HWAAP-J09), Dock 6 (HWAAP-J10), Building 103-16 (HWAAP-J11/J15), Building 103-5 (HWAAP-J29), WADF South Dump (HWAAP-J13), 111-113**	Various; unknown	Various wastes were disposed in these historical landfills.	No evidence of PFOS, PFOA, or PFBS-containing materials burned, used, stored, and/or disposed of at these locations.

Area Description	Dates of Operation	Relevant Site History	Rationale
Group Burn Area (HWAAP-J16),			
Sanitary Landfill	Unknown to present	Various wastes were disposed in this landfill.	No evidence of PFOS, PFOA, or PFBS-containing materials burned, used, stored, and/or disposed of at this location.
Hazardous Waste Landfill	Unknown	Various wastes were disposed in this landfill.	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location.
WADF Sewage Ponds (HWAAP-E01B)	1977 to present	This treatment plant receives sewage from the WADF facilities. The plant is comprised of six polyvinyl chloride-lined evaporation ponds. It also receives treated effluent from the WADF industrial wastewater treatment plant (HWAD 2001).	No evidence of current or historical PFOS, PFOA, or PFBS-containing materials use, storage, and/or disposal at this location. No indication that these treatment ponds receive PFOS, PFOA, or PFBS-containing liquid wastes. No indication that PFOS, PFOA, or PFBS-containing materials are used in delivery of the WADF mission/activities.
Water Tower Burn	2012	A wooden tower located near the south magazine was set on fire to destroy the structure. The fire department was on standby. According to interviewees, no AFFF was used.	No indication that PFOS, PFOA, or PFBS-containing materials were burned during this intentional fire. No indication that the fire department deployed AFFF during this burn event.
Building 102-70 Fire	1980s	According to the HWAD Environmental Chief, sometime in the 1980s, Building 70 (two-stories) in Group 102 caught fire. According to a former HWAD fire department chief, two MV-5 trucks (which carried AFFF) responded to the fire. However, no AFFF was	No indication that PFOS, PFOA, or PFBS-containing materials were burned during this fire. No indication that the fire department deployed AFFF during this fire response.

Area Description	Dates of Operation	Relevant Site History	Rationale
		deployed because the foam (truck nozzles) did not have a spread wide enough to cover the roof of Building 70. Only water was used. Soil from beneath the former building was later excavated and used as base material for creating Cliff's Road (at least to the south).	
Building 49-8 or 49-9 Battery Fire	Sometime between 1997 and 2000	The fire department responded to a mercury battery fire at Building 8 or 9 in Group 49. No AFFF was used.	No indication that PFOS, PFOA, or PFBS-containing materials were burned during this fire. No indication that the fire department deployed AFFF during this fire response.
Building 110-67 Propellant Fire	Unknown	Propellant fire at Building 67 (bunker) in Group 110. The fire department observes fires in magazine areas from a safe distance and generally does not engage to put out the fire. There is no confirmation that AFFF was used.	No indication that PFOS, PFOA, or PFBS-containing materials were burned during this fire. No indication that the fire department deployed AFFF during this fire response/monitoring.
Highway Wildland Fire	Unknown	A brush fire occurred on the west side of U.S. Highway 95 south of Walker Lake and northwest of the cantonment area. The precise location is unknown. No AFFF was used in this fire response. There have been other brush fires at HWAD over the years. Only water and Class A foam (does not contain AFFF) have been used to respond to brush fires.	No indication that PFOS, PFOA, or PFBS-containing materials were burned during this fire. No indication that the fire department deployed AFFF during this fire response.
Helicopter Crash on Mount Grant	Unknown	A helicopter crashed on Mount Grant (likely military but unconfirmed). There	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored,

Area Description	Dates of Operation	Relevant Site History	Rationale
		was no fire resultant of this crash. No AFFF was used.	and/or disposed of at this location.
Golf Course	Unknown	According to the Assistant Fire Chief, historically, the fire department occasionally would water the golf course greens and surrounding trees with water from the truck water reservoirs. The golf course was never used for training with AFFF.	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location. No indication that the fire department deployed AFFF during this activity.
Dust Control near the South Magazine	Early 1980s (possibly late 1970s as well)	According to the Assistant Fire Chief, in the early 1980s, the fire department used an old 530C military crash truck to provide dust control near the South Magazine. The 530C military crash truck was solely used for dust suppression; only water was used.	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location. No indication that the fire department deployed AFFF during this activity.
Building 110-29	Unknown	Coveralls of worker in Building 64 were laundered in the washing machine present in Building 110-29 when materials were spilled on them, including AFFF, during repairs made on fire trucks. Building 110-29 is connected to the sanitary sewer.	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location. Wastewater would flow to either the former (SWMU E02) or current STP (SWMU E03) – both of which are already AOPIs.
Old depot laundry and dry-cleaning facility	Unknown	This facility operated when the installation was a Navy command. It is not known whether the laundry and dry-cleaning facility continued operation after the installation was transferred to the Army in 1977. It is not known whether the facility was connected to the sanitary sewer (and the former STP). Explosive-contaminated liquids from	No historical information available indicating PFOS, PFOA, or PFBS-containing materials were used in dry-cleaning operations or that items with AFFF/film forming fluoroprotein foam residues were laundered.

Area Description	Dates of Operation	Relevant Site History	Rationale
		the depot laundry went to the Old Depot Laundry Washout (HWAAP-H05), which contains a sump. Trichloroethene was found in the building sump and volatile organic compounds were found in the groundwater associated with this facility (HWAD 2001).	

Note:
No current or historical landfills were retained for further investigation as AOPIs due to the lack of information indicating that PFAS-containing materials were disposed within any of them.

5.2 AOPIs

Overviews for each AOPI identified during the PA process are presented in this section. Three of the AOPIs (Fire Training Pit (SWMU H01), Former Evaporation Ponds (SWMU E02), and Current STP Ponds (SWMU E03)] overlap with HWAD IRP sites and/or Headquarters Army Environmental System (HQAES) sites (**Figure 5-2**). The AOPI, overlapping IRP site identifier, HQAES number, and current site status are discussed within each AOPI subsection presented below. At the time of this PA, none of the HWAD IRP sites have historically been investigated or are currently being investigated for the possible presence of PFAS.

The AOPI locations are shown on **Figure 5-2**. Aerial photographs of each AOPI that also show the approximate extent of AFFF use (if applicable) are presented on **Figures 5-3** through **5-11** and, where present, include active monitoring wells in the vicinity of each AOPI.

5.2.1 Fire Station #1 (Building 8): Back Apron, South Main Avenue

Fire Station #1 (**Figure 5-3**) is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to its storage and use (refilling AFFF reservoirs on trucks and conducting training) of AFFF. Building 8 was constructed as a fire station and became operational in 1930. The front apron slopes down to South Main Avenue and the back apron slopes down to Shop Street.

Fire trucks and equipment (including hoses) are washed on the fire station back apron. Gelled AFFF in the lines, when encountered, was cleaned out and flushed on the back (south) apron. It is assumed that lines are currently flushed on the back apron if necessary. The back apron was used for training new staff on use of the PRO/pak® portable AFFF foam-injection and application system (generally sprayed toward Shop Street). According to the Assistant Fire Chief, the PRO/paks® now typically carry Class A foam. Historically, the back apron was used occasionally for training with AFFF that was about to expire. Drainage flows down the concrete apron and into Shop Street, then, if flow volume is sufficient, through a storm drain in the road that is understood to connect to the sanitary sewer. On one occasion in approximately 2005, a fire truck AFFF reservoir cap was left off during a routine test drive around the

block. Approximately 30 gallons of AFFF concentrate spilled onto Shop Street, South Main Avenue, the street connecting these two streets, and the Fire Station front apron as the fire truck pulled back into the station. Bubbles were visible on the affected streets during several rain events following the incident. An Assistant Fire Chief mentioned during site reconnaissance of Fire Station #1 and Shop Street that during some storm events, flood water and debris would fill Shop Street and rise up the back station apron almost to the garage doors.

Whenever training or a fire response used AFFF, the fire truck staff would flush the pump/hoses at the training/response location to clear the system of residual AFFF.

AFFF is stored in the garage bays and in an external shed adjacent to the back apron. HWAD reported, in response to a 2015 Army Materiel Command survey requesting information on AFFF inventory, that HWAD had 25 gallons of AFFF in Engine 2 (CX2915, has a 100-gallon AFFF reservoir) and 30 gallons of AFFF stored in Fire Station #1. Historically, ten to twenty 5-gallon buckets of AFFF concentrate were kept in the chemical storage room. According to the Assistant Fire Chief, eight or nine buckets of former MILSPEC AFFF concentrate were removed from the chemical storage room and five or six buckets of former MILSPEC AFFF concentrate were removed from the garage bays in 2018 and disposed by the installation Directorate of Public Works Environmental Division. During PA site reconnaissance, six 5-gallon buckets of Ansulite 3% AFFF concentrate and a PRO/pak® portable AFFF foam-injection and application system were observed on the station premises.

5.2.2 Shop Street

Shop Street (**Figure 5-3**) is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to its proximity to Fire Station #1 and its back apron and historical use for training with AFFF. Shop Street regularly receives (or received) surface runoff from the Fire Station #1 back apron (including AFFF from training activities) and was used to conduct activities where AFFF may have been sprayed to the ground surface. Shop Street is adjacent to and receives runoff from the Fire Station #1 back apron; this includes historical, regular inputs of AFFF from fire truck maintenance (e.g., cleaning out congealed AFFF from tank reservoirs, fire truck system flushing) and firefighter training activities. Shop Street is used (currently and historically) for annual fire hose pressure testing where hoses are filled with water and subsequently drained onto the street (hoses likely contain residual AFFF). Gelled AFFF in the lines, when encountered, is cleaned out and flushed from the fire truck on Shop Street. On one occasion in approximately 2005, a fire truck AFFF reservoir cap was left off during a routine test drive around the block. Approximately 30 gallons of AFFF concentrate spilled onto Shop Street, South Main Avenue, the street connecting these two streets, and the Fire Station front apron as the fire truck pulled back into the station. Bubbles were visible on the affected streets during several rain events following the incident. AFFF-containing liquid on Shop Street infiltrated through cracked pavement or surrounding gravel, channeled to the sewer system, or evaporated in place. An Assistant Fire Chief mentioned during the PA site reconnaissance of Fire Station #1 and Shop Street that during some storm events, flood water and debris would fill Shop Street and rise up the back station apron almost to the garage doors.

5.2.3 Fire Truck Steam Cleaning (Building 11 exterior)

The locomotive steam cleaning facility, located alongside Building 11 (locomotive shed) and next to and above Shop Street (**Figure 5-3**), is identified as an AOPI following records review, personnel interviews,

and site reconnaissance due to its use for steam cleaning fire trucks prior to vehicle maintenance or repairs. From the 1980s until approximately 2010, fire trucks were steam cleaned at this location by vehicle maintenance staff prior to conducting scheduled maintenance or repairs on the vehicles. Water flowed to the drain in the middle of the tracks and then to an oil-water separator; it is likely the drain is connected to the sanitary sewer, but this is not confirmed. According to the HWAD Facilities Manager, all oil-water separator solids are removed and disposed offsite at a facility near Las Vegas, Nevada. It was reported that the water spray went in all directions, including into the adjacent Shop Street. The drain located in Shop Street is connected to the sanitary sewer.

5.2.4 Historical Metals Plating Facility (Building 10)

The historical metals plating facility (**Figure 5-3**) is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to the potential use of PFAS-containing mist suppressants during historical metals-plating activities. The western portion of the building was used to conduct chromium metals plating. There are no other forms of metal-plating operations known to have been conducted at Building 10 or elsewhere at HWAD. The Navy began plating operations as early as the 1950s and they continued until the installation was transferred to the Army in 1977. Metals plating activities may have continued until 1980 when the installation converted to a GO/CO facility; however, the Environmental Chief (at HWAD since 1980) indicated that metal plating activities continued into the 1990s. The use of PFAS-containing mist suppressants during plating activities was uncommon before the mid-1990s. The chromium metals-plating facility within Building 10 no longer exists and there was no one available to interview who had worked in this facility during its period of operation. Therefore, there is the potential that PFAS-containing mist suppressants were used in Building 10 chromium metals-plating activities.

Based on historical blueprints, it appears that a pipe coming out of the building's west exterior wall may have been connected to the sewer system via a now non-existent down pipe. However, it is uncertain whether wastes went to the former or current sewage treatment plant, were discharged to the ground, or went somewhere else. One interviewee, the HWAD Environmental Chief, stated that the metals plating drain went to the outside of Building 10 and discharged to the ground. The sewer line runs nearby this location. The Environmental Chief was unsure whether the pipe exiting the side of the building would have been connected to a downpipe and the sanitary sewer system prior to 1980. Historically, there was a discharge pit (SWMU I13, IRP No. HWAAP-I13, HQAES 32225.1085) associated with Building 10 located at the building's southwest corner (Tetra Tech 1999). Petroleum hydrocarbons, paint residues and solvents were discharged to this pit. Subsurface soil samples collected in August 1994 had total chromium detected in all six samples at concentrations ranging from 4.4 J mg/kg (J indicates an estimated concentration) to 21 mg/kg (Tetra Tech 1999). While not documented, there is the possibility that waste materials from chromium plating activities were also discharged to this pit.

5.2.5 One-Time AFFF Training Area (Building 18 exterior)

The paved parking area adjacent to Building 18 (**Figure 5-3**) was identified as an AOPI following records review, personnel interviews, and site reconnaissance because it was used for an AFFF training event. A single AFFF training event was conducted at this location in November 2007. Seven people trained on a 3-feet by 3-feet by 6-inch-deep aluminum tray that contained practice fire. The fire was extinguished

with AFFF, and the foam and liquid in the tray was emptied onto the concrete ground surface. The training process was conducted seven times, once for each participant.

5.2.6 Drafting Pit: Fire Truck Pump Testing

The drafting pit (**Figure 5-4**) is identified as an AOPI following records review, personnel interviews, and site reconnaissance because it was used for equipment testing and arc training with AFFF. The drafting pit consists of a concrete pad on top of a below-ground tank or concrete cistern ("pit") that holds recirculated water. For annual pump testing of each fire truck, a hose would be inserted into the sub-terranean drafting pit; water from the pit would be pulled up and run through the pump; and the water was sprayed back into the drafting pit. The drafting pit also was likely used for annual arc testing. The water in the drafting pit is retained and recirculated for pump and nozzle testing and may contain AFFF from residual AFFF remaining in a truck's system/hoses from previous fire response/training.

Oftentimes, equipment testing following vehicle repairs was conducted at the drafting pit, with the fire department personnel running water through the system with vehicle maintenance personnel underneath the truck checking for leaks.

5.2.7 Conelly Drive

Conelly Drive (**Figure 5-5**) is identified as an AOPI following records review, personnel interviews, and site reconnaissance because it was used occasionally for annual fire hose pressure testing where hoses were filled with water and subsequently drained onto the street (hoses likely contained residual AFFF). Drained liquid infiltrated through cracked pavement, infiltrated through surface material adjacent to the road, or evaporated in place. According to the HWAD Assistant Fire Chief, several years ago, the fire department engines were used to water the rows of trees along Conelly Drive for several months when the sprinkler systems were not functioning.

5.2.8 Fire Training Pit (SWMU H01)

The former Fire Training Pit (SWMU H01, IRP No. HWAAP-H01, HQAES 32225.1071) (**Figure 5-6**) is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to its historical use for training with AFFF.

The southern portion of the concrete foundation slab from the former movie theater was used as the location for most of the historical firefighting training (potentially monthly) with AFFF over an approximately 4-year period in the mid-1980s. However, a former Navy firefighter who continued with the HWAD fire department after the installation's transfer to the Army and retired as the HWAD Fire Department Fire Chief in 2007, indicated that this location was used for firefighting training with AFFF beginning with the installation's transfer to the Army in 1977. Use of the former movie theatre foundation slab ceased in the mid-1980s when the fire department discovered it was classified as a SWMU (SMWU H01). The foundation slab measures approximately 60 feet wide by 120 feet long and slopes down to the southeast. The 3-foot-high foundation wall at the southern end of the slab (where the movie screen would have been), along with plugging the floor drains and blocking the former emergency exit doorways, was used to contain the flammable fuels and water during training. The foundation slab was flooded with approximately 1 foot of water and fuel, which was ignited and subsequently extinguished with AFFF from

the exterior of the foundation, generally approaching the flames from the northern end (or the northeast or northwest) of the foundation slab. The liquid was left to evaporate in place after the fire was extinguished. Interviewees indicated that AFFF overspray may have extended approximately 10 feet beyond the southeastern, southwestern, and southern foundation walls.

5.2.9 NW of SWMU H01: Historical AFFF Fire Training Area

An area NW of SWMU H01 (**Figure 5-6**) was identified as an AOPI following an interview with former U.S. Navy and Army fire department personnel indicated this location was used for firefighter training with protein foam (the interviewee referred to it as “animal blood foam”) by the U.S. Navy prior to 1977. At that time, the U.S. Navy utilized an approximately 30-foot-diameter, 18-inch-deep earthen pit for live-fire firefighting training with protein foam. According to a former HWAD fire chief (worked in the fire department from 1965 to 2007), the U.S. Navy fire department used 5-gallon metal pans filled with protein foam (had to beat/mix it to generate the foam) during these live-fire training exercises. It is likely that the U.S. Navy fire department transitioned to a fluorosurfactant-containing protein foam at some point prior to 1977; however, this is not confirmed. Liquid was left in place to evaporate or infiltrate. The interviewee recalled training at this location once or twice but indicated that other fire department “squadrons” likely trained at this pit as well. The pit was later backfilled. This former pit is located north of the former movie theater foundation/Fire Training Pit AOPI (SWMU H01).

5.2.10 Fire Station #2 (Building 94)

Fire Station #2 (Building 94) is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to its storage and use (refilling AFFF reservoirs on trucks and conducting training) of AFFF (**Figure 5-7**). Building 94 was constructed in 1943. The building has been utilized as a fire station since the 1950s. The fire station has an apron attached to the station’s garage bays. The apron slopes down to a trench drain at the end of the apron. The north end of the trench drain is connected to a pipe that crosses under the railroad tracks immediately north of the station and discharges to a small, vegetated drainage basin (identified as a leach field by the installation). The station apron has cracked asphalt and/or gravel to either side of it and cracked asphalt at the end of the apron on the far side of the trench drain.

The station apron is where fire trucks carrying AFFF and equipment are currently washed. Historically, hoses/pumps were flushed and nozzle testing and hose training were also completed at this location. During PA personnel interviews, it was noted that, historically, congealed AFFF on the apron would be rinsed down the apron and, during hose training, water was sprayed onto the asphalt and gravel beyond the trench drain at the end of the apron. Prior to 2016, the apron was utilized for training new staff on use of the PRO/pak® portable AFFF foam-injection and application system. According to the Assistant Fire Chief, the PRO/paks® now typically carry Class A foam.

A storage building/garage is located approximately 70 feet southeast of the station building. AFFF is stored in this outbuilding.

5.2.11 Former Evaporation Ponds (SWMU E02)

Former evaporation ponds (**Figure 5-8**), associated with the former STP, are identified as an AOPI following records review, personnel interviews, and site reconnaissance due to its use for the disposal of PFAS-containing wastewater. The former evaporation ponds overlap with SWMU E02 (IRP No. HWAAP-E02, HQAES 32225.1065).

The former STP began operation in 1930 and ceased operation in approximately 2001 or 2002 (the former STP was still operational in March 2001 [HWAD 2001]). The former STP received wastewater from the Cantonment Area, including drainage from Fire Station #1, Shop Street, and the former metals plating shop that could have contained AFFF or other PFAS-containing liquids.

This AOPI is comprised of the 20 unlined evaporation/percolation ponds associated with this former STP (HWAD 2001). (Note: The two unlined sludge drying beds would have been included within the boundary of this AOPI, but their location could not be verified.) According to the HWAD Facilities Manager, solids periodically were scooped out of the 20 unlined evaporation ponds via a loader/excavator and dumped on the ground next to the ponds.

During a Phase II investigation conducted by the U.S. Geological Survey (report completed in 1988), it was discovered that contaminants in the ponds (the 2001 HWAD Installation Action Plan identified the contaminants as “sludge”) have reached groundwater (HWAD 2001).

After the former STP ceased operation, a dump station for the current STP (SWMU E03) was constructed in 2002 adjacent to the old evaporation ponds. A gravity-fed line was constructed connecting the dump station to the current STP. It is not known whether this dump station still exists. It was not located/identified during PA site reconnaissance.

5.2.12 Current STP Ponds (SWMU E03)

The current STP ponds (SWMU E03, IRP No. HWAAP-E03, HQAES 32225.1066) (**Figure 5-8**), associated with the current STP, is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to its use for the disposal of PFAS-containing wastewater.

This is an active facility leased and operated by the town of Hawthorne. The plant currently consists of five unlined ponds as well as three lined ponds. According to the HWAD Facilities Manager, the facility began operation around 2002. However, satellite imagery indicates that there were three ponds at this location in December 1985.

The county-operated plant receives and treats wastewater from the town of Hawthorne and the main base area of the installation, including Fire Station #1, Shop Street, and Main Street in the Cantonment Area, and Fire Station #2.

During a Phase II investigation conducted by the U.S. Geological Survey (report completed in 1988), it was discovered that contaminants in the ponds (the 2001 HWAD Installation Action Plan identified the contaminants as “nitrates”) have reached groundwater (HWAD 2001). Groundwater under the current STP ponds was approximately 67 to 73 feet bgs during the SI field event conducted in January and February 2021.

5.2.13 WADF 117-10: Fire Response

The WADF 117-10: Fire Response is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to AFFF being used to extinguish a fire in Building 117-10. The WADF (**Figure 5-9**), located south of Walker Lake and just north of the North Magazine Area, includes a collection of buildings used for demilitarization and disposal of munitions.

In the late 1990s, there was an isopropyl alcohol and isopropyl amine fire in Building 117-10. The fire started indoors in the north-end bay. AFFF was used to extinguish the fire. The fire truck likely was staged on the north side of the building and the AFFF was likely sprayed westward onto the building. The fire truck pump/hoses would have been flushed at WADF 117-10 after extinguishing the fire and before returning to the fire station.

Any AFFF sprayed or that flowed to the building interior would have been directed to floor drains, which are connected to a 10,000-gallon underground storage tank located outside of the building. According to installation personnel, liquid waste stored in this tank periodically is removed and disposed at an appropriate off-post waste facility.

5.2.14 Vehicle Maintenance (Building 64)

Building 64 is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to the use of AFFF. Building 64 (**Figure 5-10**) is in the Cantonment Area and is used for maintenance activities on smaller vehicles (e.g., fire department brush trucks and Hummers). There is a roll-up door at each end of Building 64 and a floor drain connected to the sanitary sewer. Historically, including when HWAD was a Navy installation, all fire trucks (including those carrying AFFF) were repaired/maintained in Building 64. However, as fire trucks have gotten bigger over time, maintenance activities on fire trucks carrying AFFF transitioned from Building 64 to Building 102-52. The HWAD Fire Chief indicated that they were not aware of fire trucks containing AFFF being worked on in Building 64 since 2015. No AFFF was historically stored in Building 64.

When fire truck maintenance activities were required, fire station staff would drain AFFF from the truck reservoir at the fire station prior to maintenance if any maintenance was required related to the truck's AFFF reservoir. Otherwise, AFFF remained in the truck reservoir during maintenance/plumbing servicing. The AFFF reservoir on fire trucks was not handled or emptied by maintenance staff prior to or during maintenance and repair activities. Sometimes maintenance personnel would drain a fire truck's water reservoir into the interior wash rack drain before commencing work. The former vehicle maintenance personnel interviewed does not recall ever seeing bubbles during or after water reservoirs on fire trucks were drained in the interior wash rack.

Historically, vehicle maintenance staff would pressure wash a fire truck at the wash rack located inside Building 64 (or at the Building 11 locomotive shed wash rack, which is a separate AOPI) before working on it in a maintenance bay. If there was any AFFF residue on the fire truck exterior, including the undercarriage, it would be washed off into the wash rack drain.

The interior wash rack is located in the northeast corner of the building, adjacent to the eastern door. It is not known when the interior wash rack was installed, but it likely was present before the installation transferred from the Navy to the Army. According to the HWAD Facilities Manager, a closed-loop system recirculating system was received by HWAD in June 1998 and installed in the interior wash rack sometime after June 1998 and prior to 2009. After installation of the closed-loop recirculating system at

the interior wash rack, water went down the wash rack drain and flowed to an outside water clarifier system. The clarified/treated water returned to the wash rack water holding tank (inside the building). The sludge was removed from the clarifier and went to a bio-remediation tank (inside the building) for treatment. According to the HWAD Facilities Manager, the treated sludge was removed from the bio-remediation tank and dried on newspaper before being picked up by the Directorate of Public Works and disposed in the onsite construction and debris landfill. A former vehicle maintenance employee indicated that the closed-loop recirculating system had never fully worked as intended, and staff periodically had to remove sludge from the sand trap manually. As of August 2021, the interior closed-loop recirculating wash rack is still in place but is not in service.

Prior to installation of the closed-loop recirculating system in the interior wash rack, the wash rack utilized a sand trap under the drain grate to filter out debris before liquid flowed to the sanitary sewer. Periodically the drain would become blocked, and vehicle maintenance staff had to shovel the sludge out of the sand trap. The removed sludge and residual sand were dried on top of newspaper outside of the building (often the newspaper was placed on top of drums that used to be located outside the building's east door). After drying, the removed sludge material and residual sand was dumped at various locations south and east of Building 64 (i.e., near the gun barrels that used to be located east of Building 64 and other nearby locations where there may have been a small depression in the ground) (**Figure 5-10**). This sludge-disposal practice continued for an uncertain period of time after the closed-loop recirculating system was installed in the interior wash rack (sludge and residual sand from the sand trap).

A former vehicle maintenance employee indicated that staff would test a fire truck repair for leaks in the building or would observe fire department staff test the repair at the drafting pit (a separate AOPI). Only water was used to test for leaks. The water used in repair leak tests conducted at Building 64 would be disposed down the drain of the interior wash rack. Historically (at least between 1980 and early 2009), when a water leak was discovered during testing of the repair at Building 64, AFFF occasionally and inadvertently would leak out. Most of the time, leaking AFFF was collected in drain pans under the truck and then emptied into the interior wash rack drain. In those instances where AFFF leaked directly onto the floor and/or the maintenance worker's person, the AFFF would be swept to the interior wash rack drain and the worker's coveralls would be laundered in the washing machine that was present in Building 110-29 with the wastewater going to the sanitary sewer.

There is a second wash rack located outside and adjacent to the eastern roll-up door and the northeast corner of the building. The exterior wash rack was installed sometime after early 2009. The exterior wash rack drain is connected to the sanitary sewer after passing through an oil-water separator and a sand trap. The maintenance activities for this exterior wash rack are unknown. There is no indication that fire trucks carrying AFFF were ever washed prior to maintenance in Building 64 at the exterior wash rack. The exterior wash rack was still in place and operational during the second SI field event conducted in November 2021.

5.2.15 Vehicle Maintenance (Building 102-52 exterior)

The exterior of Building 102-52 is identified as an AOPI following records review, personnel interviews, and site reconnaissance due to the potential use of AFFF. The individual garages in Building 102-52 (**Figure 5-11**) have roll-up doors. Building 102-52 is used for maintenance activities on larger vehicles and heavy equipment (e.g., ladder trucks, forklifts, and semi-truck trailers). The building also has a tire shop, battery washing station for forklifts, and a battery shop. The building has a closed-loop recirculating wash rack located behind the building at the southeast corner. According to the HWAD Facilities

Manager, the closed-loop recirculating system was received by HWAD in June 1998. The system was installed sometime after early 2009. Prior to the installation of the closed-loop recirculating system (and since at least 1980), the wash rack drain was connected to a pipe that transported liquids to an unlined drainage swale or basin located southeast of Building 102-52. The swale/basin is on a northeast-southwest axis with the discharge point at the northeast end.

As fire trucks have gotten bigger over time, maintenances activities on fire trucks carrying AFFF have transitioned from Building 64 to Building 102-52. Since approximately 2015, maintenance on all AFFF-carrying trucks is completed in Building 102-52. Given the known history of incidental and inadvertent uses of AFFF at Building 64, it is likely that Building 102-52 personnel have undertaken maintenance or repair activities on fire trucks that had or resulted in AFFF leaks. Historically, the approach for handling AFFF leaks during repair/maintenance activities or during testing of repairs at this facility is unknown. However, it is reasonable to assume that it is comparable to that historically utilized in Building 64. No AFFF was historically or is currently stored in Building 102-52, and maintenance personnel do not spray water or foam through the system/hoses to test repairs.

Historically, vehicle maintenance staff would pressure wash a fire truck in the wash rack before working on it in a maintenance bay. If there was any AFFF residue on the exterior, including the undercarriage, of the fire truck, it would have been washed off into the drain. (Note: It is unknown whether this is still the practice. The HWAD Facilities Manager stated that they did not recall seeing any fire trucks cleaned at the wash rack because it is a fairly small unit. The HWAD Facilities Manager believed the wash rack was only used for forklifts, heavy equipment, and semi fifth wheel plates.)

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at HWAD, an SI for PFOS, PFOA, and PFBS was conducted in accordance with CERCLA. SI sampling was completed at HWAD at all 15 AOPIs to evaluate presence or absence of PFOS, PFOA, and PFBS in comparison with the OSD risk screening levels. As such, an installation-specific QAPP Addendum (Arcadis 2020a) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A preliminary CSM was prepared for each of the installation's AOPIs in accordance with the USACE Engineer Manual on Conceptual Site Models, EM 200-1-12 (USACE 2012). The preliminary CSMs identified potential human receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSMs identified soil, groundwater, surface water, and sediment pathways as potentially complete which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on each AOPI's preliminary CSM. The SI scope of work was completed in January and February 2021, and November 2021, through the collection of field data and analytical samples.

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

6.1 Data Quality Objectives

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

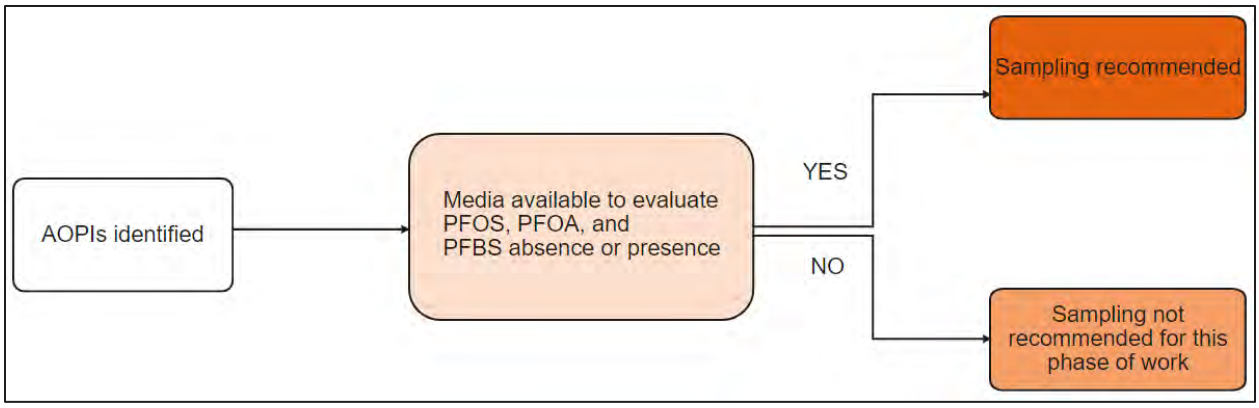

Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at HWAD is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2020a) and Field Change Report No. FCR-HWAD-15. Briefly, the sampling approach was to collect samples from groundwater and soil media at all AOPIs to determine which areas and environmental media are confirmed to have detectable levels of PFOS, PFOA, and/or PFBS and refine the CSMs for each AOPI. For a few AOPIs, no groundwater sampling was included in the approach due to being in close proximity to or upgradient of another AOPI at which a groundwater sample was to be collected. For one AOPI (Former Evaporation Ponds SWMU E02), a groundwater sample was planned to be collected from a downgradient well associated with HWAD's sanitary landfill. However, this well was found to no longer exist during the SI and, therefore, no groundwater sample was collected. In practice, samples were collected from both soil and groundwater media at 10 of the 15 AOPIs, and samples were collected from soil media only at 5 of the 15 AOPIs. No surface water or sediment samples were included in the sampling design because these media were not associated with the identified AOPIs. No soil samples were collected from the current or historical landfills due to the lack of information indicating that PFAS-containing materials were disposed within any of them.

Existing monitoring wells were sampled where wells exist downgradient of historical fire training areas, inadvertent uses (spills), or fire responses in which AFFF was used (no monitoring wells exist within the boundaries of the AOPIs). The sampling depths at existing monitoring wells were at approximately the center of the saturated screened interval. At several AOPIs where no nearby downgradient monitoring well exists, a boring to groundwater was advanced using a sonic drill rig within or immediately downgradient of the AOPI and a grab groundwater sample was collected. **Table 6-1** provides the construction details (if available) for the existing wells and borings/temporary wells sampled during the SI.

Soil sampling was conducted within or downslope of documented AFFF use areas, as well as where surface runoff could have acted as a transport mechanism. One soil sample collected per AOPI was also analyzed for total organic carbon (TOC), pH, and grain size. These additional soil data are collected as they may be useful in future fate and transport studies. The selected, targeted sampling areas are believed to have the potential for the greatest PFOS, PFOA, and/or PFBS concentrations closest to known locations of AFFF use, storage, or disposal.

6.3 Sampling Methods and Procedures

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

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

6.3.1 Field Methods

At existing groundwater monitoring wells, groundwater samples were collected using HydraSleeves® placed in approximately the center of the saturated screened interval. At sampling locations where temporary boreholes were advanced using rotary sonic methods, groundwater samples were collected using bailers via the core barrel of the sonic drill rig. Soil samples were collected using a hand auger or shovel. The soil samples were composited prior to filling the sample jars.

Decontamination procedures for non-dedicated equipment used during sampling are described in **Section 6.3.5**.

6.3.2 Quality Assurance/Quality Control

Worksheets #20 of the PQAPP, QAPP Addendum, and FCR-HWAD-15 provide QA/QC requirements for field duplicates, matrix spike/matrix spike duplicates, equipment blanks (EBs), source blanks for water used in the initial decontamination step for drill tooling, and field blanks for laboratory-supplied water used in the final decontamination step.

QA/QC samples were collected at the frequencies specified in the QAPP Addendum (Arcadis 2020) and FCR-HWAD-15 (**Appendix M**), typically at a rate of 1 per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicate samples were collected for media sampled for PFOS, PFOA, and PFBS, and TOC only. EBs were collected for media sampled for PFOS, PFOA, and PFBS at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2020). The decontaminated reusable equipment from which EBs were collected include HydraSleeves®, drill casing and drilling bit, hand augers and shovels, water-level meter, and bailers as applicable to the sampled media. A source blank was collected from the driller-supplied water used to pressure-wash drill

tooling during the January through February 2021 SI field event. A source blank was collected from the laboratory-supplied water used to clean the hand auger during the November 2021 SI field event. Analytical results for blank samples are discussed in **Section 7.19**.

6.3.3 Dedicated Equipment Background

Dedicated Equipment Background (DEB) samples were collected at a frequency of one DEB per AOPI at AOPIs where groundwater sampling was conducted at existing monitoring wells that contained dedicated, down-hole equipment. The standard process for collecting DEB samples from monitoring wells with dedicated, down-hole equipment, includes collection of two water samples from one monitoring well at each AOPI. One DEB sample is collected from the first water produced through the pump and tubing and is used to evaluate whether the dedicated equipment may be impacting the PFOS, PFOA, and/or PFBS results, as it is unknown if the dedicated equipment was comprised of PFAS-containing components; PFOS, PFOA, and/or PFBS concentrations in the DEBs reflect concentrations of stagnant groundwater, and they may be biased high by contributions from equipment that contains PFOS, PFOA, and/or PFBS components. The parent sample is then collected after the well is purged until the field parameters have stabilized. Although the DEB sample was collected as described, due to anticipated harsh environmental conditions, the decision was made prior to mobilizing for the field event to utilize HydraSleeves® as the primary method of collecting grab groundwater samples. Because the parent sample was collected using a Hydrasleeve®, the well was not purged. Therefore, although a DEB sample was collected, it was not needed based on the sampling method used. DEB analytical data are summarized in **Section 7.16**.

6.3.4 Field Change Reports

No instances of major scope modifications (i.e., those that may have had a significant impact on the project scope and/or data usability/quality, or required stop-work, and warranted discussion with USACE) were encountered during the HWAD 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 (FCRs) included as **Appendix M** and are summarized below:

- Installation wide

  FCR-HWAD-01: Due to anticipated harsh environmental conditions, the decision was made prior to mobilizing for the field event to utilize HydraSleeves® as the primary method of collecting grab groundwater samples (with bailers as the secondary [backup] method) – rather than utilizing bladder pumps and/or bailers as identified in the QAPP Addendum.

  FCR-HWAD-14: Various shallow soil samples were collected using a shovel instead of a hand auger.

- One-Time AFFF Training Area (Building 18 exterior) AOPI

  FCR-HWAD-02: The location for shallow soil sample HWAD-BLDG18-2-SO was moved north (the distance was not documented) of the planned location to avoid a utility.

FCR-HWAD-06: The location for boring to groundwater and collecting shallow soil sample HWAD-BLDG18-1-SO and grab groundwater sample HWAD-BLDG18-1-GW was moved approximately 12 feet south of the planned location to avoid a utility.

- Historical Metals Plating Facility (Building 10) AOPI

  FCR-HWAD-03: The location for boring to groundwater and collecting grab groundwater sample HWAD-BLDG10-1-GW was moved approximately 86 feet north (downgradient) into Shop Street to avoid utilities and allow safe access for the sonic drill rig.

- Fire Station #1 (Building 8): Back Apron, South Main Avenue AOPI

  FCR-HWAD-04: The location for shallow soil sample HWAD-FS1-2-SO in South Main Avenue was moved approximately 20 feet west and 10 feet north and into the middle of the road where four engineered divider cracks between the pavement slabs meet or intersect.

  FCR-HWAD-13: The planned soil sample identifiers for HWAD-FS1-1-SO and HWAD-FS1-2-SO were transposed on the chain-of-custody forms and data collection logs.

- Drafting Pit: Fire Truck Pump Testing AOPI

  FCR-HWAD-05: The planned locations for the two shallow soil samples HWAD-DRAFT-2-SO and HWAD-DRAFT-3-SO were moved approximately 8 feet west and east, respectively, to avoid utilities. The boring to groundwater and associated grab groundwater sample HWAD-DRAFT-1-GW were moved approximately 62 feet north-northeast (generally downgradient) to avoid utilities.

- Fire Training Pit (SWMU H01) AOPI

  FCR-HWAD-07: The boring to groundwater and associated grab groundwater sample HWAD-H01-1-GW were moved approximately 10 feet south of the planned location to allow safe drill rig access.

- Shop Street AOPI

  FCR-HWAD-08: The location for boring to groundwater and the associated grab groundwater sample HWAD-SHOP-1-GW were moved approximately 15 feet north of the planned location. The shallow soil sample HWAD-SHOP-1-SO was moved approximately 12 feet north of the planned location. In both instances, this was to avoid subsurface utilities and minimize potential damage to the paved street surface.

- QA/QC samples

  FCR-HWAD-09: The matrix spike/matrix spike duplicate samples were collected from the WADF 117-10: Fire Response AOPI instead of the planned groundwater sample HWAD-NWH01-1-GW (NW of SWMU H01: Historical AFFF Fire Training Area AOPI) as indicated in the QAPP Addendum, because there was insufficient water in the boring from which HWAD-NWH01-1-GW and HWAD-FD-1-GW were collected to permit the MS/MSD samples to be collected as well.

- Former Evaporation Ponds (SWMU E02) AOPI

  FCR-HWAD-10: The groundwater sample HWAD-IRPMW20 was not collected, since monitoring well IRPMW-20 (downgradient of the AOPI) could not be located.

- Current Ponds (SWMU E03) AOPI

  FCR-HWAD-11: The groundwater sample HWAD-IRPMW18 was not collected, since monitoring well IRPMW-18 (downgradient of the AOPI) could not be located. Alternative groundwater samples were collected from two utility monitoring wells (HWAD-HUMW#2 and HWAD-HUMW#3) that were located downgradient of the current ponds. Additionally, shallow soil samples were collected from two of the Current STP Ponds (SWMU E03) AOPI ponds (HWAD-E03-1-SO and HWAD-E03-2-SO).

- WADF 117-10: Fire Response AOPI

  FCR-HWAD-12: Groundwater sample HWAD-IRPMW57 was not collected due to insufficient water column in the well casing.

- Building 64 and Building 102-52 AOPIs

  FCR-HWAD-15: Two AOPIs were added, both fire truck maintenance facilities, and proposed shallow soil sampling locations at Building 64 and Building 102-52 with the samples to be collected in a second SI mobilization. No boring to groundwater and collecting a grab groundwater sample was proposed for either AOPI. Rather, for each AOPI, the analytical data from a previously collected (SI field event in January and February 2021) downgradient or cross-gradient surrogate groundwater sample(s) would be used. The installation and USAEC approved this approach.

6.3.5 Decontamination

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

6.3.6 Investigation-Derived Waste

IDW, including soil cuttings, groundwater, and decontamination fluids were placed in Department of Transportation-approved 55-gallon drums, labeled as non-hazardous, segregated by medium: waters and soil/sediment, and transported to a staging area pending analysis. HWAD's operating contractor (DynCorp International, LLC, a subsidiary of Amentum, as of the start of fiscal year 2022) is responsible for managing and disposing the IDW generated during the January/February 2021 SI field event.

Given the scope of sampling during the November 2021 SI field event (eight primary soil samples, one duplicate soil sample, and three QC samples), very little IDW (soil and decontamination fluids) was generated. After samples were collected to characterize the soil and liquid IDW, no further soil or decontamination liquid remained requiring disposal.

Equipment IDW was collected in bags and disposed with municipal waste. Equipment IDW includes personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, Lexan™ tubes, and high-density polyethylene and silicon tubing) that may come in contact with sampling media.

Analytical results for IDW samples collected during the SI are discussed in **Section 7.17**.

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 January to February 2021 SI were submitted to Eurofins Lancaster Laboratories Environmental, LLC, and analytical samples collected during the November 2021 SI were submitted to Pace South Carolina (formerly Shealy Environmental Services). Both laboratories are ELAP accredited for PFAS analysis, including PFOS, PFOA, and PFBS, by liquid chromatography with tandem mass spectrometry. Laboratory analyses associated with the SI were completed in accordance with Worksheets #12.1 through #12.5 in the PQAPP (Arcadis 2019). Eighteen PFAS-related compounds, including PFOS, PFOA, and PFBS, were analyzed for in groundwater and soil samples using an analytical method (USEPA Method 537 Modified) that is ELAP-accredited and compliant with QSM 5.3 (DoD and Department of Energy 2019), Table B-15.

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

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

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

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

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 DUSRs in **Appendix N**. The Level IV analytical reports are included within **Appendix N** in the final electronic deliverable only.

6.4.3 Data Usability Assessment and Summary

A data usability assessment was completed for all analytical data associated with SI sampling at HWAD. Documentation generated during the data usability assessments, which were compiled into the DUSRs (**Appendix N**), was prepared in accordance with the USACE Engineer Manual 200-1-10 (USACE 2005), the Final DoD General Data Validation Guidelines (DoD 2019) and the Final DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per-and Polyfluoroalkyl Substances Analysis by QSM Table B-15 (DoD 2020), that reviewed precision, accuracy, completeness, representativeness, comparability, and sensitivity. A statement of overall data usability is included in the DUSR (different laboratories were used for the January through February 2021 and November 2021 SI field events; therefore, there are two DUSRs).

Based on the final data usability assessment, the environmental data collected at HWAD during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUSRs and their associated data validation reports (**Appendix N**), and as indicated in the full analytical tables (**Appendix O**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and HWAD QAPP Addendum (Arcadis 2020a). Data qualifiers applied to laboratory analytical results for samples collected during the SI at HWAD are provided in the data tables, data validation reports, and the Data Usability Summary Table located at the end of DUSR. Qualifiers for data shown on figures are defined in the notes of figures.

6.5 Office of the Secretary of Defense Risk Screening Levels

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

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

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

Notes:
1. Risk screening levels for tap water and soil provided by the OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the 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.
mg/kg = milligram per kilogram
ng/L = nanograms per liter
ppm = parts per million
ppt = parts per trillion

The OSD residential tap water risk screening levels will be used to compare all groundwater data for this Army PFAS PA/SI. While the current and most likely future land uses of the AOPIs at HWAD 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 HWAD (field duplicate results are provided in the associated tables). Sampled media and QA/QC samples were analyzed for the constituents prescribed per Worksheet #18 of the QAPP Addendum (Arcadis 2020a) and Field Change Report No. FCR-HWAD-15. 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** (below) summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix O** includes the full suite of analytical results for these media, as well as for the QA/QC samples. An overview of AOPIs at HWAD with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2** through **7-10** show the PFOS, PFOA, and PFBS analytical results in groundwater and soil for each AOPI. Non-detected results are reported as less than the LOQ. Detections of PFOS, PFOA, and/or PFBS greater than the applicable OSD risk screening levels are highlighted in summary tables and on figures. Final qualifiers applied to the data by the laboratory and the project chemist (as defined in **Section 6.4.3**) are presented on the analytical tables. Groundwater data collected during the SI are reported in ng/L, or parts per trillion, and soil data are reported in mg/kg, or parts per million.

Field parameters measured for groundwater during sample collection are provided on the field forms in **Appendix J**. Soil descriptions are provided on the field forms in **Appendix J**. The results of the SI are grouped by AOPI and discussed for each medium as applicable. Groundwater was generally first encountered at depths of approximately 95 to 134 feet bgs in the Cantonment Area, 118 to 120 feet bgs in the former fire training area, 48 feet bgs at Fire Station #2, 67 to 73 feet bgs in the wastewater treatment area, and 23 feet bgs in the WADF 117 area.

Table 7-3 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Yes/No)
Fire Station # 1 (Building 8): Back Apron, South Main Avenue	Yes
Shop Street	Yes
Fire Truck Steam Cleaning (Building 11 Exterior)	Yes
Historical Metals Plating Facility (Building 10)	No
One-Time AFFF Training Area (Building 18 Exterior)	No
Drafting Pit: Fire Truck Pump Testing	No
Conelly Drive	No
Fire Training Pit (SWMU H01)	Yes
NW of SWMU H01: Historical AFFF Fire Training Area	Yes

AOPI Name	OSD Exceedances (Yes/No)
Fire Station #2 (Building 94)	Yes
Former Evaporation Ponds (SWMU E02)	No
Current STP Ponds (SWMU E03)	No
WADF 117-10: Fire Response	No
Vehicle Maintenance (Building 64)*	No
Vehicle Maintenance (Building 102-52 exterior)*	No

Note:
* Sampled in a second SI field event conducted in November 2021.

7.1 Fire Station #1 (Building 8): Back Apron, South Main Avenue

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Fire Station # 1 (Building 8): Back Apron, South Main Avenue AOPI. The groundwater and soil sampling locations are presented on **Figure 7-2**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.1.1 Groundwater

A groundwater sample was not collected within the AOPI limits because of utility conflicts and because the station's back apron is adjacent to and connects to the Shop Street AOPI. One groundwater sample was collected in Shop Street (for the Shop Street AOPI; see **Section 7.2.1**) approximately 22 feet upgradient of the back apron. The surface drainage from the Fire Station #1 back apron flows towards the Shop Street area where the groundwater sample was collected, and this upgradient groundwater sample is considered a surrogate sample for the Fire Station # 1 (Building 8): Back Apron, South Main Avenue AOPI. The grab groundwater sample (HWAD-SHOP-1-GW-020721) was collected from the boring in Shop Street between Buildings 8 and 11. The groundwater PFOS, PFOA, and PFBS analytical results associated with this upgradient surrogate location are presented below.

- PFOS was detected in the groundwater sample at a concentration of 39 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFOA was detected in the groundwater sample at a concentration of 2.7 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in the groundwater sample at a concentration of 8.3 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

7.1.2 Soil

Two soil samples (HWAD-FS1-1-SO-012621 and HWAD-FS1-2-SO-012221) and one duplicate sample (HWAD-FD-1-SO-012221 / HWAD-FS1-2-SO-012221) were collected from the top 2 feet of native soil at

an interval of 0 to 2 feet bgs at two locations at the Fire Station # 1 (Building 8): Back Apron, South Main Avenue AOPI. The samples were collected using a hand auger.

- PFOS was detected in the two soil samples and the duplicate sample at a concentration of 0.0097 J+ (the result is an estimated quantity; the result may be biased high) mg/kg (HWAD-FD-1-SO-012221 / HWAD-FS1-2-SO-012221) to 0.032 J (the analyte was positively identified; however, the associated numerical value is an estimated concentration only) mg/kg (HWAD-FS1-1-SO-012621). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in the two soil samples and the duplicate sample at a concentration of 0.0008 J mg/kg (HWAD-FS1-1-SO-012621) to 0.0014 J mg/kg (HWAD-FS1-2-SO-012221). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was not detected in the two soil samples or the duplicate sample.

Additionally, as stated above, the surface drainage from the Fire Station #1 back apron flows towards the Shop Street area where a shallow soil sample was collected. The soil sample collected from this location (see **Section 7.2.2**) contained PFOS at a concentration of 0.22 mg/kg (HWAD-SHOP-1-SO-020421), which exceeds the OSD residential risk screening level (0.13 mg/kg). Because surface runoff from the Fire Station #1 back apron flows to this location, the OSD risk screening level exceedance may also be attributable to the Fire Station # 1 (Building 8): Back Apron, South Main Avenue AOPI.

7.2 Shop Street

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Shop Street AOPI. The groundwater and soil sampling locations are shown on **Figure 7-2**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.2.1 Groundwater

One grab groundwater sample (HWAD-SHOP-1-GW-020721) was collected from the boring in Shop Street between Buildings 8 and 11 using the core barrel of the sonic drill rig. The depth to first encountered groundwater was 132.7 feet bgs. The sample was collected at an interval of 132.7 to 137.5 feet bgs. The surface drainage from the Fire Station #1 back apron flows towards the Shop Street area where this groundwater sample was collected (see **Section 7.1**).

- PFOS was detected in the groundwater sample at a concentration of 39 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFOA was detected in the groundwater sample at a concentration of 2.7 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in the groundwater sample at a concentration of 8.3 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

7.2.2 Soil

Two soil samples were collected from the top 2 feet of native soil at an interval of 0 to 1 foot bgs (HWAD-SHOP-1-SO-020421) and 0 to 2 feet bgs (HWAD-SHOP-2-SO-012621) at two locations within the Shop Street AOPI. The samples were collected using a hand auger.

- PFOS was detected in the two soil samples at concentrations of 0.0035 J mg/kg (HWAD-SHOP-2-SO-012621) and 0.22 mg/kg (HWAD-SHOP-1-SO-020421). One of the two detected concentrations (HWAD-SHOP-1-SO-020421) exceeds the OSD residential risk screening level (0.13 mg/kg) but not the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in one of the two soil samples at a concentration of 0.0068 mg/kg (HWAD-SHOP-1-SO-020421). The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was not detected in either of the two soil samples.

7.3 Fire Truck Steam Cleaning (Building 11 Exterior)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Fire Truck Steam Cleaning (Building 11 Exterior) AOPI. The groundwater (associated with the cross-gradient/downgradient surrogate location) and soil sampling locations are presented on **Figure 7-2**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.3.1 Groundwater

A groundwater sample was not collected from this AOPI as it would require drilling through an elevated train track structure. A groundwater sample was collected in Shop Street (for the Shop Street AOPI; see **Section 7.2.1**) approximately 30 feet cross-gradient/downgradient and several feet below the Fire Truck Steam Cleaning (Building 11 Exterior) AOPI. This cross-gradient/downgradient groundwater sample is considered a surrogate sample for the Fire Truck Steam Cleaning (Building 11 Exterior) AOPI. One grab groundwater sample (HWAD-SHOP-1-GW-020721) was collected from the boring in Shop Street between Buildings 8 and 11. The groundwater PFOS, PFOA, and PFBS analytical results associated with this downgradient surrogate location are presented below.

- PFOS was detected in the groundwater sample at a concentration of 39 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFOA was detected in the groundwater sample at a concentration of 2.7 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in the groundwater sample at a concentration of 8.3 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

7.3.2 Soil

One soil sample was collected from the top 2 feet of native soil at an interval of 0 to 2 feet bgs (HWAD-BLDG11-1-SO-012621) at the Fire Truck Steam Cleaning (Building 11 Exterior) AOPI. The sample was collected using a hand auger. One soil sample is sufficient for this AOPI due to the small area size.

- PFOS was detected in the soil sample at a concentration of 0.0022 J mg/kg. The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in the soil sample at a concentration of 0.00051 J mg/kg. The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was not detected in the soil sample.

Additionally, as discussed in **Section 5.2**, water spray from the Fire Truck Steam Cleaning (Building 11 exterior) AOPI reportedly went into Shop Street. Therefore, soil concentrations in the Shop Street AOPI area may be partly attributable to the Fire Truck Steam Cleaning (Building 11 exterior) AOPI. The shallow soil sample collected near the boring installed at the Shop Street AOPI for collection of a groundwater sample (see **Section 7.2.2**) contained PFOS at a concentration of 0.22 mg/kg (HWAD-SHOP-1-SO-020421) which exceeds the OSD residential risk screening level (0.13 mg/kg). This OSD risk screening level exceedance may be partly attributable to the Fire Truck Steam Cleaning (Building 11 exterior) AOPI.

7.4 Historical Metals Plating Facility (Building 10)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Historical Metals Plating Facility (Building 10) AOPI. The groundwater and soil sampling locations are shown on **Figure 7-2**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.4.1 Groundwater

One grab groundwater sample (HWAD-BLDG10-1-GW-020621) was collected from a boring in Shop Street, near to and downgradient of the Historical Metals Plating Facility (Building 10) AOPI, using the core barrel of the sonic drill rig. The sampling location had to be moved north (downgradient) due to the proximity of utility conflicts and above-ground structures at the planned sampling location. The depth to first encountered groundwater was 133.7 feet bgs. The sample was collected at an interval of 133.7 to 135.0 feet bgs.

- PFOS was not detected in the groundwater sample.
- PFOA was detected in the groundwater sample at a concentration of 2.0 J ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in the groundwater sample at a concentration of 47 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

7.4.2 Soil

One soil sample was collected from the top 2 feet of native soil at an interval of 0 to 2 feet bgs (HWAD-BLDG10-1-SO-012621) at the Historical Metals Plating Facility (Building 10) AOPI. The sample was collected using a hand auger. It was collected in the vicinity of where the drainpipe from the former facility exited the building. One soil sample is sufficient for this AOPI due to the area's small footprint.

- PFOS was detected in the soil sample at a concentration of 0.016 J mg/kg. The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in the soil sample at a concentration of 0.00041 J mg/kg. The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was not detected in the soil sample.

7.5 One-Time AFFF Training Area (Building 18 Exterior)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the One-Time AFFF Training Area (Building 18 Exterior) AOPI. The groundwater and soil sampling locations are shown on **Figure 7-2**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.5.1 Groundwater

One grab groundwater sample (HWAD-BLDG18-1-GW-020421) was collected from a boring at the One-Time AFFF Training Area (Building 18 Exterior) AOPI using the core barrel of a sonic drill rig. The depth to first encountered groundwater was 127.5 feet bgs. The sample was collected at an interval of 127.5 to 135.0 feet bgs.

- PFOS was not detected in the groundwater sample.
- PFOA was detected in the groundwater sample at a concentration of 6.1 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in the groundwater sample at a concentration of 3.4 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

7.5.2 Soil

Two soil samples were collected at the One-Time AFFF Training Area (Building 18 Exterior) AOPI from the top 2 feet of native soil at an interval of 0 to 2 feet bgs (HWAD-BLDG18-1-SO-020321 and HWAD-BLDG18-2-SO-012621). The samples were collected from two locations (one from the sonic drill rig boring and one collected using a hand auger) at the One-Time AFFF Training Area (Building 18 Exterior) AOPI.

- PFOS was detected in the two soil samples at concentrations of 0.0015 J mg/kg (HWAD-BLDG18-2-SO-012621) and 0.0026 mg/kg (HWAD-BLDG18-1-SO-020321). The detected

concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).

- PFOA was not detected in either of the two soil samples.
- PFBS was not detected in either of the two soil samples.

7.6 Drafting Pit: Fire Truck Pump Testing

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Drafting Pit: Fire Truck Pump Testing AOPI. The groundwater and soil sampling locations are shown on **Figure 7-3**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.6.1 Groundwater

One grab groundwater sample (HWAD-DRAFT-1-GW-020321) was collected from a boring downgradient of the Drafting Pit: Fire Truck Pump Testing AOPI using the core barrel of a sonic drill rig. The depth to first encountered groundwater was 116.2 feet bgs. The sample was collected at an interval of 116.2 to 127.5 feet bgs.

- PFOS was not detected in the groundwater sample.
- PFOA was not detected in the groundwater sample.
- PFBS was not detected in the groundwater sample.

7.6.2 Soil

Three soil samples were collected from the top 2 feet of native soil at an interval of 0 to 2 feet bgs (HWAD-DRAFT-1-SO-012721, HWAD-DRAFT-2-SO-012121, and HWAD-DRAFT-3-SO-012121) at three locations at the Drafting Pit: Fire Truck Pump Testing AOPI. The samples were collected using a hand auger or shovel.

- PFOS was detected in the three soil samples at concentrations ranging from 0.0040 mg/kg (HWAD-DRAFT-2-SO-012121) to 0.0088 mg/kg (HWAD-DRAFT-1-SO-012721). None of the three detected concentrations exceeds the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in one of the three soil samples at a concentration of 0.00072 mg/kg (HWAD-DRAFT-2-SO-012121). The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was not detected in any of the three soil samples.

7.7 Conelly Drive

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Conelly Drive AOPI. The groundwater and soil sampling locations are shown on **Figure 7-4**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.7.1 Groundwater

Two grab groundwater samples (HWAD-CON-1-GW-020221 and HWAD-CON-2-GW-012621) were collected from two borings downgradient of the Conelly Drive AOPI using the core barrel of the sonic drill rig. The depths to first encountered groundwater were approximately 116 feet bgs (HWAD-CON-1-GW) and 95 feet bgs (HWAD-CON-2-GW). The samples were collected at an interval of 116.0 to 117.5 feet bgs (HWAD-CON-1-GW-020221) and 94.5 to 95.0 feet bgs (HWAD-CON-2-GW-012621).

- PFOS was detected in one of the two groundwater samples at a concentration of 0.95 J ng/L (HWAD-CON-1-GW-020221). The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFOA was not detected in either of the two groundwater samples.
- PFBS was not detected in either of the two groundwater samples.

7.7.2 Soil

Two soil samples were collected from the top 2 feet of native soil at an interval of 0 to 2 feet bgs (HWAD-CON-1-SO-012721 and HWAD-CON-2-SO-012521) from the location of the two sonic drill rig borings downgradient of the Conelly Drive AOPI. The samples were collected using a hand auger.

- PFOS was detected in one of the two soil samples at a concentration of 0.0010 J mg/kg (HWAD-CON-1-SO-012721). The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was not detected in either of the two soil samples.
- PFBS was not detected in either of the two soil samples.

7.8 Fire Training Pit (SWMU H01)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Fire Training Pit (SWMU H01) AOPI. The groundwater and soil sampling locations are shown on **Figure 7-5**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.8.1 Groundwater

One grab groundwater sample (HWAD-H01-1-GW-020821) was collected from one boring adjacent to and immediately upgradient of the Fire Training Pit AOPI using the core barrel of a sonic drill rig. The selected sampling location is the closest, accessible location to the release area. The depth to first

encountered groundwater was approximately 120.2 feet bgs. The sample was collected at an interval of 120.2 to 127.5 feet bgs.

- PFOS was detected in the groundwater sample at a concentration of 2.1 J ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFOA was detected in the groundwater sample at a concentration of 6.6 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in the groundwater sample at a concentration of 8.5 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

Additionally, one groundwater sample (HWAD-NWH01-1-GW-020921) and a duplicate sample (HWAD-FD-1-GW-020921 / HWAD-NWH01-1-GW-020921) were collected immediately downgradient of the Fire Training Pit at the NW of SWMU H01: Historical AFFF Fire Training Area AOPI (see **Section 7.9.1**), PFOA was detected in the downgradient groundwater sample and duplicate sample at a maximum concentration of 75 ng/L. This PFOA concentration exceeds the OSD tap water risk screening level (40 ng/L). Because AFFF historically was used regularly at the Fire Training Pit (SWMU-H01) AOPI for several years, the concentration in the downgradient groundwater is representative of releases from the Fire Training Pit as well as potential releases from the NW of SWMU H01: Historical AFFF Fire Training Area AOPI.

7.8.2 Soil

Two soil samples (HWAD-H01-1-SO-02012021 and HWAD-H01-2-SO-012121) and one duplicate sample (HWAD-FD-2-SO-02012021 / HWAD-H01-1-SO-02012021) were collected from the top 2 feet of native soil at an interval of 0 to 2 feet bgs at two locations (one near the sonic drill rig boring and the other near the southeast corner of the pit) adjacent to the Fire Training Pit (SWMU H01) AOPI. The samples were collected using a shovel.

- PFOS was detected in the two soil samples and the duplicate sample at a concentration of 0.0055 mg/kg (HWAD-H01-2-SO-012121) to 0.027 mg/kg (HWAD-H01-1-SO-02012021). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in one of the two soil samples and the duplicate sample (same sampling location) at a concentration of 0.0030 mg/kg (HWAD-H01-1-SO-02012021). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg).
- PFBS was not detected in the two soil samples or the duplicate sample.

7.9 NW of SWMU H01: Historical AFFF Fire Training Area

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the NW of SWMU H01: Historical AFFF Fire Training Area AOPI. The groundwater and soil sampling locations are shown on **Figure 7-5**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.9.1 Groundwater

One grab groundwater sample (HWAD-NWH01-1-GW-020921) and a duplicate sample (HWAD-FD-1-GW-020921 / HWAD-NWH01-1-GW-020921) were collected from one boring within the NW of SWMU H01: Historical AFFF Fire Training Area AOPI using the core barrel of the sonic drill rig. The depth to first encountered groundwater was approximately 117.9 feet bgs. The primary groundwater sample and the duplicate sample were collected at an interval of 117.9 to 122.5 feet bgs.

- PFOS was not detected in the groundwater sample or the duplicate sample.
- PFOA was detected in the groundwater sample and the duplicate sample at a maximum concentration of 75 ng/L (HWAD-FD-1-GW-020921 / HWAD-NWH01-1-GW-020921). The detected concentrations exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in the groundwater sample and the duplicate sample at a maximum concentration of 140 ng/L (HWAD-NWH01-1-GW-020921 and HWAD-FD-2-SO-02012021 / HWAD-H01-1-SO-02012021). The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

7.9.2 Soil

Three soil samples were collected from the top 2 feet of native soil at an interval of 0 to 2 feet bgs at three locations (HWAD-NWH01-1-SO-02012021 from the location of the sonic drill rig boring) or 0 to 0.5 foot (HWAD-NWH01-2-SO-012121 and HWAD-NWH01-3-SO-012121) within the NW of SWMU H01: Historical AFFF Fire Training Area AOPI. The samples were collected using a shovel.

- PFOS was detected in two of the three soil samples at concentrations of 0.00046 J mg/kg (HWAD-NWH01-2-SO-012121) and 0.00052 J mg/kg (HWAD-NWH01-3-SO-012121). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was not detected in any of the three soil samples.
- PFBS was not detected in any of the three soil samples.

7.10 Fire Station #2 (Building 94)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Fire Station #2 (Building 94) AOPI. The groundwater and soil sampling locations are shown on **Figure 7-6**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.10.1 Groundwater

One grab groundwater sample (HWAD-FS2-1-GW-021021) was collected from one boring within the Fire Station #2 (Building 94) AOPI using the core barrel of the sonic drill rig. Two grab groundwater samples were collected from downgradient, existing monitoring wells MW-21 (HWAD-MW21-012621) and MW-23 (HWAD-MW23-012621) using Hydrasleeves®. The depth to first encountered groundwater ranged from

approximately 48 feet bgs (HWAD-FS2-1-GW-021021) to 79.3 feet below top of casing (btoc) (HWAD-MW21-012621). HWAD-FS2-1-GW-021021 was collected at an interval of 48.0 to 55.0 feet bgs, HWAD-MW21-012621 was collected at 86 feet btoc, and HWAD-MW23-012621 was collected at 84 feet btoc.

- PFOS was detected in one of the three groundwater samples at a concentration of 11,000 J- (The result is an estimated quantity; the result may be biased low.) ng/L (HWAD-FS2-1-GW-021021). The detected concentration exceeds the OSD tap water risk screening level (40 ng/L).
- PFOA was detected in one of the three groundwater samples at a concentration of 17,000 ng/L (HWAD-FS2-1-GW-021021). The detected concentration exceeds the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in two of the three groundwater samples at concentrations of 2.0 ng/L (HWAD-MW23-012621) and 3.1 ng/L (HWAD-MW21-012621). The detected concentrations do not exceed the OSD tap water risk screening level (600 ng/L).

7.10.2 Soil

Six soil samples were collected from the top 2 feet of native soil at an interval of 0 to 1 foot bgs from two locations (HWAD-FS2-3-SO-012621 and HWAD-FS2-4-SO-012621) or 0 to 2 feet bgs at four locations (HWAD-FS2-1-SO-02012021, HWAD-FS2-2-SO-012221, HWAD-FS2-5-SO-012221, and HWAD-FS2-6-SO-012221) within the Fire Station #2 (Building 94) AOPI. The soil samples were collected using a hand auger or shovel.

- PFOS was detected in all six soil samples at concentrations ranging from 0.0017 mg/kg (HWAD-FS2-6-SO-012221) to 3.2 mg/kg (HWAD-FS2-2-SO-012221). Four of the six detected concentrations exceed the OSD residential risk screening level (0.13 mg/kg), and two of the six detected concentrations exceed the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in five of the six soil samples at concentrations ranging from 0.0032 mg/kg (HWAD-FS2-5-SO-012221) to 0.6 mg/kg (HWAD-FS2-2-SO-012221). One of the six detected concentrations exceeds the OSD residential risk screening level (0.13 mg/kg) but not the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was detected in three of the six soil samples at concentrations ranging from 0.0023 J mg/kg (HWAD-FS2-3-SO-012621) to 0.096 mg/kg (HWAD-FS2-2-SO-012221). The detected concentrations do not exceed the OSD residential risk screening level (1.9 mg/kg) or the OSD industrial/commercial risk screening level (25 mg/kg).

7.11 Former Evaporation Ponds (SWMU E02)

The subsection below summarizes the soil PFOS, PFOA, and PFBS analytical results associated with the Former Evaporation Ponds (SWMU E02) AOPI. No groundwater sample was collected because: (1) the downgradient monitoring well that was planned to be sampled (IRPMW-20) no longer exists; (2) it was determined that the planned soil sampling was sufficient to characterize PFOS, PFOA, and/or PFBS presence/absence at this AOPI; and (3) the PFOS and PFOA concentrations detected in soil samples collected at the Former Evaporation Ponds (SWMU E02) AOPI are similar to the soil concentrations detected at the nearby Current STP Ponds (SWMU E03) AOPI, and PFBS was not detected in soil

samples collected at either AOPI. Because the PFOS, PFOA, and PFBS groundwater concentrations at the Current STP Ponds (SWMU E03) AOPI were below their respective OSD screening levels, it is therefore likely that if PFOS, PFOA, and PFBS are present in groundwater at the Former Evaporation Ponds (SWMU E02) AOPI, their concentrations would also be below the OSD risk screening levels. Additionally, the groundwater flows and discharges to Walker Lake, which is unsuitable for use as drinking water and currently cannot support aquatic life. The soil sampling locations are shown on **Figure 7-7**. The soil analytical results are presented in **Table 7-2**.

7.11.1 Soil

Four soil samples were collected from the top 2 feet of native soil at an interval of 0 to 1 foot bgs (HWAD-E02-2-SO-012121) or 0 to 2 feet bgs (HWAD-E02-1-SO-012121, HWAD-E02-3-SO-012121, and HWAD-E02-4-SO-012121) at four locations within the Former Evaporation Ponds (SWMU E02) AOPI. The soil samples were collected using a hand auger or shovel.

- PFOS was detected in three of the four soil samples at concentrations ranging from 0.00069 mg/kg (HWAD-E02-4-SO-012121) to 0.0055 mg/kg (HWAD-E02-1-SO-012121). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in two of the four soil samples at concentrations of 0.0016 mg/kg (HWAD-E02-3-SO-012121) and 0.0028 mg/kg (HWAD-E02-1-SO-012121). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was not detected in any of the four soil samples.

7.12 Current STP Ponds (SWMU E03)

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Current STP Ponds (SWMU E03) AOPI. The groundwater and soil sampling locations are shown on **Figure 7-7**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.12.1 Groundwater

Two grab groundwater samples were collected from existing Hawthorne Utilities monitoring well (HUMW) #2 (HWAD-HUMW#2-012621) and HUMW #3 (HWAD-HUMW#3-012621) located downgradient of the Current STP Ponds (SWMU E03) AOPI using Hydrasleeves®. The depths to first encountered groundwater were approximately 73.36 feet btoc (HWAD-HMW#2-012621) and 67.17 feet btoc (HWAD-HUMW#3-012621). HWAD-HUMW#2-012621 was collected at 78 feet btoc and HWAD-HUMW#3-012621 was collected at 72 feet btoc.

- PFOS was detected in the two groundwater samples at concentrations of 1.9 ng/L (HWAD-HMW#2-012621) and 12 ng/L (HWAD-HUMW#3-012621). The detected concentrations do not exceed the OSD tap water risk screening level (40 ng/L).

- PFOA was detected in the two groundwater samples at concentrations of 4.8 ng/L (HWAD-HMW#2-012621) and 29 ng/L (HWAD-HUMW#3-012621). The detected concentrations do not exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in the two groundwater samples at concentrations of 6.6 ng/L (HWAD-HUMW#3-012621) and 10 ng/L (HWAD-HMW#2-012621). The detected concentrations do not exceed the OSD tap water risk screening level (600 ng/L).

7.12.2 Soil

Two soil samples (HWAD-E03-1-SO-012621 and HWAD-E03-2-SO-012621) were collected from the top 2 feet of native soil at an interval of 0 to 2 feet bgs at two locations within the Current STP Ponds (SWMU E03) AOPI. The soil samples were collected using a hand auger.

- PFOS was detected in one of the two soil samples at a concentration of 0.0075 mg/kg (HWAD-E03-2-SO-012621). The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in one of the two soil samples at a concentration of 0.0030 mg/kg (HWAD-E03-2-SO-012621). The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was not detected in either of the two soil samples.

7.13 WADF 117-10: Fire Response

The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the WADF 117-10: Fire Response AOPI. The groundwater and soil sampling locations are shown on **Figure 7-8**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.13.1 Groundwater

One grab groundwater sample (HWAD-WADF-1-GW-020921) was collected from one boring within the WADF 117-10: Fire Response AOPI using the core barrel of the sonic drill rig. Two grab groundwater samples were collected from downgradient, existing monitoring well IRPMW58 (HWAD-IRPMW58-012621) and downgradient/cross-gradient, existing monitoring well IRPMW59 (HWAD-IRPMW59-012621) using Hydrasleeves®. The depth to first encountered groundwater ranged from approximately 22.8 feet bgs (HWAD-WADF-1-GW-020921) to 25.6 feet btoc (HWAD-IRPMW58-012621). HWAD-WADF-1-GW-020921 was collected at an interval of 22.8 to 35.0 feet bgs. HWAD-IRPMW58-012621 was collected at 32 feet btoc and HWAD-IRPMW59 was collected at 30 feet btoc.

- PFOS was detected in two of the three groundwater samples at concentrations of 2.9 ng/L (HWAD-WADF-1-GW-020921) and 6.5 ng/L (HWAD-IRPMW58-012621). The detected concentrations do not exceed the OSD tap water risk screening level (40 ng/L).

- PFOA was detected in one of the three groundwater samples at a concentration of 2.9 ng/L (HWAD-IRPMW58-012621). The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in one of the three groundwater samples at a concentration of 1.1 J ng/L (HWAD-WADF-1-GW-020921). The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

7.13.2 Soil

Four soil samples (HWAD-WADF-1-SO-020421, HWAD-WADF-2-SO-012221, HWAD-WADF-3-SO-012221, and HWAD-WADF-4-SO-012221) were collected from the top 2 feet of native soil at an interval of 0 to 2 feet bgs at four locations (one location collocated with a sonic drill rig boring, within the WADF 117-10: Fire Response AOPI). The soil samples were collected using a hand auger.

- PFOS was detected in three of the four soil samples at concentrations ranging from 0.0031 mg/kg (HWAD-WADF-2-SO-012221) to 0.011 mg/kg (HWAD-WADF-4-SO-012221). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in one of the four soil samples at a concentration of 0.00048 J mg/kg (HWAD-WADF-4-SO-012221). The detected concentration does not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was not detected in any of the four soil samples.

7.14 Vehicle Maintenance (Building 64)

Vehicle Maintenance (Building 64) was reclassified as an AOPI and sampled in the second SI field event. The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Vehicle Maintenance (Building 64) AOPI. The groundwater (associated with the downgradient surrogate location) and soil sampling locations are shown on **Figure 7-9**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.14.1 Groundwater

One groundwater sample was collected at the Shop Street AOPI (see **Section 7.2.1**), located approximately 0.07 mile downgradient of Vehicle Maintenance (Building 64), during the first SI field event. This downgradient groundwater sample is considered a surrogate sample for the Vehicle Maintenance (Building 64) AOPI. The grab groundwater sample (HWAD-SHOP-1-GW-020721) was collected from the boring in Shop Street between Buildings 8 and 11. The groundwater PFOS, PFOA, and PFBS analytical results associated with this downgradient surrogate location are presented below.

- PFOS was detected in the groundwater sample at a concentration of 39 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).

- PFOA was detected in the groundwater sample at a concentration of 2.7 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (40 ng/L).
- PFBS was detected in the groundwater sample at a concentration of 8.3 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

7.14.2 Soil

Two soil samples (HWAD-BLDG64-2-SO-110421 and HWAD-HWAD-BLDG64-5-SO-110421) and one duplicate sample (HWAD-FD-1-SO-110421 / HWAD-BLDG64-2-SO-110421) were collected from the top foot of native soil at an interval of approximately 0 to 1 foot bgs, and three soil samples (HWAD-BLDG64-1-SO-110421, HWAD-BLDG64-3-SO-110421, and HWAD-BLDG64-4-SO-110421) were collected from the top half foot of native soil at an approximate interval of 0.25 to 0.75 foot bgs at five locations associated with the Vehicle Maintenance (Building 64) AOPI. The soil samples were collected using a hand auger or shovel. The soil sample intervals did not exceed 1 foot bgs because either the soil was too compacted to hand auger any deeper, or the soil was loose such that the surrounding soil started filling the augered hole. Three of the five sampling locations were outside of the AOPI boundary.

- PFOS was detected in all five soil samples and the duplicate sample at concentrations ranging from 0.0014 mg/kg (HWAD-FD-1-SO-110421) to 0.024 mg/kg (HWAD-BLDG64-#-SO-110421). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was detected in two of the five soil samples at concentration of 0.00069 J mg/kg (HWAD-BLDG64-4-SO-110421) and 0.0078 mg/kg (HWAD-BLDG64-1-110421). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFBS was detected in one of the five soil samples at a concentration of 0.00067 J mg/kg (HWAD-BLDG64-1-110421). The detected concentration does not exceed the OSD residential risk screening level (1.9 mg/kg) or the OSD industrial/commercial risk screening level (25 mg/kg).

7.15 Vehicle Maintenance (Building 102-52 exterior)

Vehicle Maintenance (Building 102-52 exterior) was reclassified as an AOPI and sampled in the second SI field event. The subsections below summarize the groundwater and soil PFOS, PFOA, and PFBS analytical results associated with the Vehicle Maintenance (Building 102-52 exterior) AOPI. The groundwater (associated with the downgradient surrogate location) and soil sampling locations are shown on **Figure 7-10**. The groundwater and soil analytical results are presented in **Tables 7-1** and **7-2**, respectively.

7.15.1 Groundwater

A groundwater sample was collected from existing monitoring well MW-21 associated with the Fire Station #2 (Building 94) AOPI (see **Section 7.10.1**), located approximately 0.22 mile cross-gradient/downgradient of Vehicle Maintenance (Building 102-52). This cross-gradient/downgradient groundwater sample is considered a surrogate sample for the Vehicle Maintenance (Building 102-52

exterior) AOPI. The grab groundwater sample (HWAD-MW21-012621) was collected from existing monitoring well MW-21. The groundwater PFOS, PFOA, and PFBS analytical results associated with this cross-gradient/downgradient surrogate location are presented below.

- PFOS was not detected in the groundwater sample.
- PFOA was not detected in the groundwater sample.
- PFBS was detected at a concentration of 3.1 ng/L. The detected concentration does not exceed the OSD tap water risk screening level (600 ng/L).

7.15.2 Soil

Three soil samples (HWAD-BLDG52-1-SO-110321, HWAD-BLDG52-2-SO-110321, and HWAD-BLDG52-3-SO-110321) were collected from the top foot of native soil at an interval of approximately 0 to 1 foot bgs at three locations associated with the Vehicle Maintenance (Building 102-52 exterior) AOPI. The soil samples were collected using a hand auger or shovel. The soil sample intervals did not exceed 1 foot bgs because either the soil was too compacted to hand auger any deeper, or the soil was loose such that the surrounding soil started filling the augered hole. Two of the three sampling locations were outside of the AOPI boundary in the wash rack discharge area.

- PFOS was detected in all three soil samples at concentrations ranging from 0.00063 J mg/kg (HWAD-BLDG52-2-SO-110321) to 0.0012 mg/kg (HWAD-BLDG52-3-SO-110321). The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).
- PFOA was not detected in any of the three soil samples.
- PFBS was not detected in any of the three soil samples.

7.16 Dedicated Equipment Background Samples

A total of two DEB samples were collected from wells that have dedicated down-hole equipment present (one per AOPI). Neither of the parent-DEB sample pairs had detections for PFOS, PFOA, and/or PFBS constituents in both the parent sample and the corresponding DEB sample (**Appendix O**). One primary sample (HWAD-MW23-012621) had a detection of PFBS at 2.0 ng/L; however, PFBS was not detected in the corresponding DEB sample (HWAD-FS2-DEB-1-012521). None of the 18 PFAS compounds were detected above the LOQ in either of the two DEB samples [collected from monitoring well MW-23 for the Fire Station #2 (Building 94) AOPI and monitoring well IRPMW-59 for the WADF 117-10: Fire Response AOPI]. Neither well was purged prior to collecting the primary sample (via a Hydrasleeve®).

7.17 Investigation Derived Waste

A composite sample of the purge and decontamination wastewater was collected from the one 55-gallon stainless-steel drum of generated liquid waste from the January to February 2021 field event and staged in a temporary waste storage area within the Cantonment Area. The results indicated the following concentrations in the wastewater: 2,100 ng/L PFOS, 420 ng/L PFOA, and 130 ng/L PFBS. The PFOS and PFOA concentrations exceed the OSD risk screening levels.

A composite sample of the soil cuttings was collected from the 55-gallon stainless-steel drums from the January to February 2021 field event and staged in a temporary waste storage area. A total of 39 drums of soil cuttings were generated; two of the soil drums also included concrete cores The results indicated the following concentrations in the soil cuttings: 0.0028 mg/kg PFOS and 0.0028 mg/kg PFOA. PFBS was not detected in the composite soil sample. The PFOS and PFOA concentrations in the soil cuttings do not exceed the OSD risk screening levels.

A composite sample of the decontamination wastewater generated during the second SI mobilization in November 2021 was collected. Following collection of the sample, no additional decontamination wastewater remained requiring containerization in a stainless-steel drum and off-installation disposal. The results indicated the following concentration in the wastewater: 77,000 Q (surrogate failure) ng/L PFOS. PFOA and PFBS were not detected in the composite soil sample. The PFOS concentration exceeds the OSD risk screening level.

A composite sample of the soil cuttings generated during the second mobilization in November 2021 was collected. The results indicated the following concentrations in the soil cuttings: 0.0041 S (matrix spike / matrix spike duplicate failure) mg/kg PFOS and 0.00079 J mg/kg PFOA. PFBS was not detected in the composite soil sample. The PFOS and PFOA concentrations do not exceed the OSD risk screening levels. Following collection of the sample, no additional soil cuttings remained requiring containerization in a stainless-steel drum and off-installation disposal. The full analytical results (i.e., for all constituents analyzed) for IDW samples collected during the SI are included in **Appendix O**.

Prior to the January to February 2021 SI field event, the installation indicated that it would take responsibility for disposal of the IDW via its operating contractor. At the time of this report submission, the IDW had not been disposed.

7.18 TOC, pH, and Grain Size

In addition to sampling soil for PFOS, PFOA, and PFBS, one soil sample per AOPI was analyzed for TOC, pH, moisture content, and grain size data as they may be useful in future fate and transport studies. The TOC in the soil samples ranged from 842 to 13,400 mg/kg. The TOC at this installation was within range of what is typically observed [except at three AOPIs (Shop Street, Historical Metals Plating (Building 10), and WADF 117-10: Fire Response) where TOC was higher than what is typically observed] in desert soils (topsoil: 5,000 to 30,000 mg/kg, desert: less than 5,000 mg/kg, organic: greater than 120,000 mg/kg). The combined percentage of fines (i.e., silt and clay) in soils at HWAD ranged from 6.2 to 30.5% with an average of 14.5%. In general, PFAS constituents tend to be more mobile in soils with less than 20% fines (silt and clay) and lower TOC. The percent moisture of the soil (an average of 3.6%) was typical for sandy soil (0 to 10%). The pH of the soil was slightly alkaline (7 to 9) to moderately alkaline (9 to 10) standard units. Based on these geochemical and physical soil characteristics (i.e., low percentage of fines and TOC) observed underlying the installation during the SI, PFAS constituents are expected to be relatively more mobile at HWAD than in soils with greater percentages of fines and TOC.

7.19 Blank Samples

PFOS, PFOA, and/or PFBS were not detected in any of the QA/QC samples collected during the January through February and November 2021 SI work.

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

7.20 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2020a) were re-evaluated and updated, if necessary, based on the SI sampling results. The CSMs presented on **Figures 7-11** through **7-14** 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.

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:

- PFOS, PFOA, and/or PFBS were detected in soil at each AOPI, and site workers (e.g., installation personnel or maintenance workers) could contact constituents in soil or sludge/soil of

the former evaporation ponds and current sewage treatment plant ponds via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.

- The AOPIs are not likely to be regularly accessed by on-installation residents or recreational users, or by off-installation receptors (i.e., off-installation residents, recreational users of nearby streams/parks, and workers whose workplace is near the installation). Therefore, the soil exposure pathways for these receptors are incomplete. Although Conelly Drive is a residential street, all the houses were removed sometime between 2014 and 2021; therefore, the soil exposure pathway for on-installation residents is incomplete for the Conelly Drive AOPI.

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

Figure 7-11 shows the CSM for seven Cantonment Area AOPIs, two Fire Training Area AOPIs, Fire Station #2 (Building 94) AOPI, and Building 102-52 (exterior) AOPI. The seven Cantonment Area AOPIs are Fire Station #1 (Building 8): Back Apron, South Main Avenue; Shop Street; Fire Truck Steam Cleaning (Building 11 exterior); Historical Metals Plating Facility (Building 10); One-Time AFFF Training Area (Building 18 exterior); Conelly Drive; and Building 64. The two Fire Training Area AOPIs are Fire Training Pit (SWMU H01) and NW of SWMU H01: Historical Fire Training Area. These AOPIs have a potential for PFOS, PFOA, and PFBS presence due to chromium plating activities or release of AFFF during fire training, testing, and equipment cleaning activities.

- PFOS, PFOA, and/or PFBS were detected in groundwater samples collected at or associated with these AOPIs. All these AOPIs, except for the Fire Station #2 (Building 94) AOPI, are potentially upgradient of Well 11, which is used to supplement installation drinking water during the summer. Fire Station #2 (Building 94) AOPI is potentially upgradient (under pumping conditions) of Well 7, which is not currently used for drinking water but could be used in the future. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete. Recreational users are not likely to contact groundwater during outdoor recreational activities; therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.
- Shallow groundwater flow is to the northwest towards Walker Lake but may be modified locally by pumping. The Walker Lake Valley groundwater basin is a hydrologically closed basin (no natural outlet). The groundwater quality is poor and generally unsuitable for potable use. However, due to the absence of land-use controls preventing potable use of off-installation groundwater in the area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.
- Walker Lake is not used for drinking water. On-installation access to Walker Lake is strictly controlled and contact with Walker Lake surface water and sediment is not likely within the installation boundary (the installation traverses the southern portion of the lake). Therefore, the surface water and sediment exposure pathways for on-installation receptors are incomplete. Recreational users could contact constituents in Walker Lake through incidental ingestion and dermal contact outside of the installation boundary. Therefore, the surface water and sediment exposure pathways for off-installation receptors (e.g., residents living along the lake or visitors to the lake) are potentially complete.

Figure 7-12 shows the CSM for the Drafting Pit: Fire Truck Pump Testing AOPI. This AOPI has a potential for PFOS, PFOA, and PFBS presence due to release of AFFF during annual pump testing of fire trucks.

- PFOS, PFOA, and PFBS were not detected in the groundwater sample collected from a boring downgradient of the Drafting Pit: Fire Truck Pump Testing AOPI. Therefore, the groundwater exposure pathways for all receptors are incomplete.
- There is no direct pathway for surface water runoff during or following a precipitation event to exit the installation boundary. Considering the only potential constituent migration pathway to Walker Lake is desorption/dissolution from soil to groundwater that discharges to surface water, and PFOS, PFOA, and PFBS were not detected in the groundwater downgradient of this AOPI, the surface water and sediment exposure pathways for all receptors are incomplete.

Figure 7-13 shows the CSM for the Wastewater Treatment Area AOPIs, which consist of the Former Evaporation Ponds (SWMU E02) and the Current STP Ponds (SWMU E03). These AOPIs have a potential for PFOS, PFOA, and PFBS presence due to secondary receipt of wastewater or sludge from the other AOPIs.

- PFOS and PFOA were detected in one of the two groundwater samples collected at the Current STP Ponds (SWMU E03). Groundwater was not sampled at the Former Evaporation Ponds (SWMU E02); however, given the array of soil samples across this AOPI, it was determined that the four soil samples were sufficient for determining absence/presence of PFOS, PFOA, and/or PFBS. These AOPIs are potentially upgradient (under pumping conditions) of Well 8, which is not currently used for drinking water but could be used in the future. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete. Recreational users are not likely to contact groundwater during outdoor recreational activities; therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.
- Shallow groundwater flow is to the northwest towards Walker Lake but may be modified locally by pumping. The Walker Lake Valley groundwater basin is a hydrologically closed basin (no natural outlet). The groundwater quality is poor and generally unsuitable for potable use. However, due to the absence of land-use controls preventing potable use of off-installation groundwater in the area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.
- Walker Lake is not used for drinking water. On-installation access to Walker Lake is strictly controlled and contact with Walker Lake surface water and sediment is not likely within the installation boundary (the installation traverses the southern portion of the lake). Therefore, the surface water and sediment exposure pathways for on-installation receptors are incomplete. Recreational users could contact constituents in Walker Lake through incidental ingestion and dermal contact outside of the installation boundary. Therefore, the surface water and sediment exposure pathways for off-installation receptors (e.g., residents living along the lake or visitors to the lake) are potentially complete.

Figure 7-14 shows the CSM for the WADF 117 Area AOPI (WADF 117-10: Fire Response). The WADF 117-10: Fire Response AOPI has a potential for PFOS, PFOA, and PFBS presence due to the release of AFFF during a fire response.

- PFOS and PFOA were detected in groundwater samples collected at the WADF 117 Area AOPI. This AOPI is downgradient of Well 11 and other existing wells at HWAD. Due to the poor groundwater quality, the potential for future potable well installations downgradient of this AOPI is highly unlikely. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are incomplete. Recreational users are not likely to contact groundwater during outdoor recreational activities; therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.
- Shallow groundwater flow is to the northwest towards Walker Lake but may be modified locally by pumping. The Walker Lake Valley groundwater basin is a hydrologically closed basin (no natural outlet). The groundwater quality is poor and generally unsuitable for potable use. However, due to the absence of land-use controls preventing potable use of off-installation groundwater in the area, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.
- Walker Lake is not used for drinking water. On-installation access to Walker Lake is strictly controlled and contact with Walker Lake surface water and sediment is not likely within the installation boundary (the installation traverses the southern portion of the lake). Therefore, the surface water and sediment exposure pathways for on-installation receptors are incomplete. Recreational users could contact constituents in Walker Lake through incidental ingestion and dermal contact outside of the installation boundary. Therefore, the surface water and sediment exposure pathways for off-installation receptors (e.g., residents living along the lake or visitors to the lake) are potentially complete.

Following the SI sampling, all 15 AOPIs were considered to have complete or potentially complete exposure pathways. Although the CSMs indicate complete or potentially complete exposure pathways may exist, the recommendation for remedial investigation is based on the comparison of analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2).**

8 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA/SI included two distinct efforts. The PA identified AOPIs at HWAD 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 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 HWAD. Following the evaluation, 15 AOPIs were identified.

HWAD receives drinking water form a combination of on-post potable wells (Well 4 [located approximately 4.5 miles from the Cantonment Area and 2 miles and upgradient of the town of Hawthorne] and Well 11 [located approximately 1 mile downgradient/cross-gradient of the Cantonment Area]), and three reservoirs (Black Beauty [not in use at the time of the PA site visit], Cat Dam, and Rose Creek) located on the slopes of Mount Grant above and to the west of the Cantonment Area that capture surface water runoff coming off of Mount Grant. The potable water wells have been sampled for PFOS, PFOA, and PFBS in November 2016 and October 2020 (**Section 2.12** and **Table 2-2**).

All 15 AOPIs were sampled during the SI at HWAD 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), the HWAD QAPP Addendum (Arcadis 2020a), and Field Change Report No. FCR-HWAD-15.

All 15 AOPIs from the January through February 2021 and November 2021 SI sampling events (includes AOPIs for which downgradient, surrogate groundwater samples were utilized) had detections of PFOS, PFOA, and/or PFBS in groundwater and/or soil, and six of these AOPIs exceeded OSD risk screening levels.

Groundwater

Groundwater samples were collected at 10 of the 15 AOPIs. All 10 of these 15 AOPIs had at least one detection of PFOS, PFOA, and/or PFBS in groundwater.

- The PFOS tap water risk screening level (40 ng/L) was exceeded in one groundwater sample collected from the Fire Station #2 (Building 94) AOPI. The maximum detected concentration of PFOS was 11,000 J- ng/L (Fire Station #2 [Building 94] AOPI; HWAD-FS2-1-GW-021021).
- The PFOA tap water risk screening level (40 ng/L) was exceeded in one groundwater sample collected from the Fire Station #2 (Building 94) AOPI and in the two groundwater samples collected from the NW of SWMU H01: Historical AFFF Fire Training Area AOPI. The maximum detected concentration of PFOA was 17,000 ng/L (Fire Station #2 [Building 94] AOPI; HWAD-FS2-1-GW-021021).
- The PFBS tap water risk screening level (600 ng/L) was not exceeded in any of the groundwater samples. The maximum detected concentration of PFBS was 140 ng/L) (NW of Fire Training Pit

[SWMU H01] AOPI; HWAD-NWH01-1-GW-020921 and HWAD-FD-1-GW-020921 / HWAD-NWH01-1-GW-020921).

Soil

Soil samples were collected at all 15 AOPIs from the January to February 2021 SI sampling event and the November 2021 SI sampling event. All 15 AOPIs had at least one detection of PFOS, PFOA, and/or PFBS in soil.

- The PFOS soil residential risk screening level (0.13 mg/kg) was exceeded in one soil sample collected from the Shop Street AOPI and four soil samples collected from the Fire Station #2 (Building 94) AOPI. The PFOS soil industrial/commercial risk screening level (1.6 mg/kg) was exceeded in two soil samples collected from the Fire Station #2 (Building 94) AOPI. The maximum detected concentration of PFOS was 3.2 mg/kg [Fire Station #2 (Building 94) AOPI; HWAD-FS2-2-SO-012221].
- The PFOA soil residential risk screening level (0.13 mg/kg) was exceeded in one soil sample collected from the Fire Station #2 (Building 94) AOPI. The maximum detected concentration of PFOA was 0.6 mg/kg (Fire Station #2 [Building 94] AOPI; HWAD-FS2-2-SO-012221).
- The PFBS soil residential risk screening level (1.9 mg/kg) was not exceeded in any of the soil samples. The maximum detected concentration of PFBS was 0.096 mg/kg (Fire Station #2 [Building 94] AOPI; HWAD-FS2-2-SO-012221).

Following the SI sampling, 15 out of the 15 AOPIs with confirmed PFOS, PFOA, and/or PFBS presence were considered to have complete or potentially complete exposure pathways.

Soil exposure pathways for on-installation site workers are complete at all 15 AOPIs. There are 13 AOPIs at which the groundwater exposure pathways for on-post receptors are potentially complete. Due to a lack of land use controls off installation and downgradient of HWAD, the groundwater exposure pathways for off-installation receptors are also potentially complete for 14 AOPIs. Surface water, other than what is collected in reservoirs in the mountains above the Cantonment Area, is not used for drinking water at HWAD; however, off-installation receptors could contact constituents in surface water and sediment (Walker Lake) via incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways are potentially complete for 14 out of the 15 AOPIs.

Although the CSMs indicate complete or potentially complete exposure pathways may exist, the recommendation for future study in a remedial investigation or no action at this time is based on the comparison of the SI analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2**). **Table 8-1** below summarizes the AOPIs identified at HWAD, PFOS, PFOA, and PFBS sampling and recommendations for each AOPI; further investigation is warranted at HWAD. 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 HWAD, and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/ND/NS)		Recommendation
	GW	SO	
Fire Station #1 (Building 8): Back Apron, South Main Avenue	No[1]	Yes[2]	Further study in a remedial investigation
Shop Street	No[1]	Yes	Further study in a remedial investigation
Fire Truck Steam Cleaning (Building 11 exterior)	No[1]	Yes[2]	Further study in a remedial investigation
Historical Metals Plating Facility (Building 10)	No	No	No action at this time
One-Time Aqueous Film-Forming Foam (AFFF) Training Area (Building 18 exterior)	No	No	No action at this time
Drafting Pit: Fire Truck Pump Testing	ND	No	No action at this time
Conelly Drive	No	No	No action at this time
Fire Training Pit (Solid Waste Management Unit [SWMU] H01)	Yes[3]	No	Further study in a remedial investigation
Northwest (NW) of SWMU H01: Historical AFFF Fire Training Area	Yes	No	Further study in a remedial investigation
Fire Station #2 (Building 94)	Yes	Yes	Further study in a remedial investigation
Former Evaporation Ponds (SWMU E02)	NS	No	No action at this time
Current Sewage Treatment Plant [STP] Ponds (SWMU E03)	No	No	No action at this time
Western Area Demilitarization Facility 117-10: Fire Response	No	No	No action at this time
Vehicle Maintenance (Building 64)	No[1]	No	No action at this time
Vehicle Maintenance (Building 102-52 exterior)	No[2]	No	No action at this time

Notes:
Light gray shading – detection greater than the OSD risk screening level
1. PFOS was detected in groundwater at the Shop Street AOPI at a concentration of 39 ng/L. The Shop Street groundwater sample is a surrogate groundwater sample for three adjacent AOPIs for which a groundwater sampling

location was not available: The Fire Station #1 (Building 8): Back Apron, South Main Avenue; Fire Truck Steam Cleaning (Building 11 exterior); and Vehicle Maintenance (Building 64) AOPIs.
2. The Fire Station #1 (Building 8): Back Apron, South Main Avenue, and the Fire Truck Steam Cleaning (Building 11 exterior) AOPIs are located adjacent to the Shop Street AOPI and may have contributed PFOS, PFOA, and PFBS to the Shop Street AOPI soil as follows: the back apron of Fire Station #1 slopes down to Shop Street, and water spray from Fire Truck Steam Cleaning (Building 11 exterior) reportedly went into Shop Street. Therefore, as the PFOS OSD risk screening level exceedance in soil collected at the Shop Street AOPI may be partially attributable to the Fire Station #1 (Building 8): Back Apron, South Main Avenue, and the Fire Truck Steam Cleaning (Building 11 exterior) AOPIs, these two AOPIs are also recommended for further study in a remedial investigation.
3. The NW of SWMU H01: Historical AFFF Fire Training Area AOPI has a groundwater OSD risk screening level exceedance and is located directly downgradient of this AOPI. AFFF historically was used regularly at the Fire Training Pit (SWMU-H01) AOPI for several years; whereas it is likely but not confirmed that fluorosurfactant-containing foams historically were used at the NW of SWMU H01: Historical AFFF Fire Training Area AOPI.
GW – groundwater
ND – non-detect
NS – not sampled
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 HWAD are discussed below.

Three of the AOPIs are recommended for further study in a remedial investigation based on exceedances of the OSD risk screening levels in groundwater or soil at an adjacent AOPI:

- The Fire Station #1 (Building 8) AOPI and the Fire Truck Steam Cleaning (Building 11 exterior) AOPIs are recommended for further study in a remedial investigation due to the overlap between the areas of known or potential use of AFFF at these two AOPIs with the Shop Street AOPI (the Shop Street AOPI had an exceedance of the PFOS OSD risk screening level in one of the two associated soil samples collected).
- The Fire Training Pit (SWMU-H01) AOPI is recommended for further study in a remedial investigation based on an immediately downgradient groundwater sampling location (at the NW of SWMU H01: Historical AFFF Fire Training Area AOPI) with PFOA concentrations exceeding the OSD tap water risk screening level (40 ng/L). Because AFFF historically was used regularly at the Fire Training Pit (SWMU-H01) AOPI for several years, the concentration in the downgradient groundwater is representative of releases from the Fire Training Pit as well as potential releases from the NW of SWMU H01: Historical AFFF Fire Training Area AOPI.

There is uncertainty about the specific foams used or the volumes of release during historical training activities and fire responses. Similarly, information on the locations of historical firefighting training activities and fire responses with AFFF or other foam suppressant during HWAD's operation as a Navy facility and in its early years as an Army facility is limited and was principally gathered from a single interviewee who worked at HWAD in the fire department from approximately 1965 through 2007. Within this timeframe, there is no information available on whether or where fire department personnel trained with fluorosurfactant-containing foams after the installation transferred to the Army in 1977 and use of the Fire Training Pit (SWMU H01) began in the early to mid-1980s.

Historical information on the metal plating process(es) and the exact plating mist suppressants utilized in Building 10 by the Navy and, subsequently, by the Army was not available.

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 current and former 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 review, installation personnel interviews, and site reconnaissance.

Finally, the available PFOS, PFOA, and PFBS analytical data are limited to samples collected from soil and groundwater collected from within or adjacent to the AOPIs. In a few instances, borings to groundwater had to be relocated downgradient of the release area due to access or utility conflicts. In these cases, the detected concentrations of PFOS, PFOA, and/or PFBS in the groundwater samples may have been lower than if the sample had been collected from within the AOPI boundary, or the detected concentrations may be the result of a release at a nearby AOPI. There are no limitations on the collected data due to cross-contamination impacts from sampling equipment or down-hole dedicated equipment. None of the QA/QC samples (EBs, field blanks, and source blank) had detected concentrations of PFOS, PFOA, and PFBS. Available data, including for PFOS, PFOA, and PFBS, is listed in **Appendix O**, which were analyzed per the selected analytical method.

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

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ACRONYMS

%	percent
AFFF	aqueous film-forming foam
Ahtna	Ahtna Engineering Services, LLC
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	United States Army
bgs	below ground surface
btoc	below top of casing
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	conceptual site model
DEB	dedicated equipment background
DoD	Department of Defense
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
ELLE	Eurofins Lancaster Laboratories Environmental
FCR	Field Change Report
GIS	geographic information system
GO/CO	government-owned, contractor-operated
HQAES	Headquarters Army Environmental System
HUMW	Hawthorne Utilities monitoring well
HWAAP	Hawthorne Army Ammunition Plant
HWAD	Hawthorne Army Depot
IDW	investigation-derived waste
IMCOM	Installation Management Command
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)
MILSPEC	military specification
ng/L	nanograms per liter (parts per trillion)
NW	northwest
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PE	Professional Engineer
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PG	Professional Geologist
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
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
STP	sewage treatment plant
SWMU	Solid Waste Management Unit
TGI	technical guidance instruction
TOC	total organic carbon
UCMR3	third Unregulated Contaminant Monitoring Rule

U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
WADF	Western Area Demilitarization Facility

TABLES

Table 2-1 - On-Post Potable Wells
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

Well ID	Well Type	Well Status
Well 4 (W03)	Drinking Water Supply	Active
Well 11 (W02)	Drinking Water Supply	Active

Acronyms/Abbreviations:
ID = Identification

Table 2-2 - Historical PFAS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

	Location	Well 4 (W03)	Well 11 (W02)	County Backup Water[1]	Black Beauty Reservoir	Surface Water Treatment Plant
	Sample ID	HAAD-GW-W03-RW	HAAD-GW-W02-FW	HAAD-GW-CBW-FW	HAAD-SW-BB-RW	HAAD-SW-SWTP-FW
	Sample Date	11/28/2016	11/28/2016	1/28/2016	1/28/2016	1/28/2016
Chemical name	OSD risk screening level* in ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Perfluorooctanoic acid (PFOA)	40	<20	<20	<19	<20	<20
Perfluorobutanesulfonic acid (PFBS)	600	<91	<88	<88	<90	<91
Perfluorooctane sulfonate (PFOS)	40	<41	<39	<39	<40	<40

	Location	Well 11 (influent)	Well 11 (influent, duplicate)	Well 4 (influent)	Well 4 (post Cl treatment)	County Spigot	Well 1 (effluent)	Well 1 (effluent, duplicate)
	Sample ID	HWAD-S02	HWAD-S11	HWAD-S03	HWAD-E04	HWAD-E05	HWAD-E03	HWAD-E11
	Sample Date	10/5/2020	10/5/2020	10/5/2020	10/5/2020	10/5/2020	10/5/2020	10/5/2020
Chemical name	OSD risk screening level* in ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Perfluorooctanoic acid (PFOA)	40	1.8 U	1.9 U	1.9 U	1.9 U	1.7 U	1.9 U	1.9 U
Perfluorobutanesulfonic acid (PFBS)	600	1.8 U	1.9 U	1.9 U	1.9 U	1.7 U	1.9 U	1.9 U
Perfluorooctane sulfonate (PFOS)	40	1.8 U	1.9 U	1.9 U	1.9 U	1.7 U	1.9 U	1.9 U

Table 2-2 - Historical PFAS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

Notes:

*Risk screening level for tap water. To be conservative, the OSD tap water risk screening levels will be used to compare all groundwater and potable-use surface water for this Army PFAS PA/SI program. (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.)

1. Finished water sampled at the Whiskey Flats RV park sample port (Hawthorne Utilities well).

Acronyms/Abbreviations:

< = indicates the sample concentration was less than the minimal reportable level
CBW = county backup water
Cl = chlorine
FW = finished water
GW = groundwater
HAAD = Hawthorne Army Ammunition Depot
HWAD = Hawthorne Army Depot
ID = Identification
ng/L = nanograms per liter
OSD = Office of the Secretary of Defense
RW = raw water
SW = surface water

Qualifier Description:

U = the analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ)

Table 6-1 - Monitoring Well Construction Details
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

Area of Potential Interest	Sampling Location ID	Total Well Depth	Measuring Point Elevation	Measuring Point	Well Completion Method	January 2021 Depth to Groundwater from MP	Screened Interval	Casing Diameter	Dedicated Bladder Pump
		(ft bTOC/bgs)	(ft amsl)			(ft)	(ft bgs)	(in)	(Yes/No)
Historical Metals Plating Facility (Building 10)	BLDG10-1[1]	135	NM	GS	NA	133.70	133.7-135.0	6.625	No
One-Time AFFF Training Area (Building 18 exterior)	BLDG18-1[1]	135	NM	GS	NA	127.50	127.5-135.0	6.625	No
Shop Street	SHOP-1[1]	137.5	NM	GS	NA	132.70	132.7-137.5	6.625	No
Conelly Drive	CON-1[1]	117.5	NM	GS	NA	116.00	116.0-117.5	6.625	No
	CON-2[1]	95	NM	GS	NA	95.00	94.5-95.0	6.625	No
Drafting Pit: Fire Truck Pump Testing	DRAFT-1[1]	127.5	NM	GS	NA	116.20	116.2-127.5	6.625	No
Fire Training Pit (SWMU H01)	H01-1[1]	127.5	NM	GS	NA	120.20	120.2-127.5	6.625	No
NW of SWMU H01: Historical AFFF Fire Training Area	NWH01-1[1]	122.5	NM	GS	NA	117.90	117.9-122.5	6.625	No
Fire Station #2 (Building 94)	FS2-1[1]	55	NM	GS	NA	48.00	48.0-55.0	6.625	No
	MW-21	91.75	NM	TOC	Stick up	79.29	NA	4	No
	MW-23	89.25	NM	TOC	Stick up	78.42	NA	4	No

Table 6-1 - Monitoring Well Construction Details
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

Area of Potential Interest	Sampling Location ID	Total Well Depth	Measuring Point Elevation	Measuring Point	Well Completion Method	January 2021 Depth to Groundwater from MP	Screened Interval	Casing Diameter	Dedicated Bladder Pump
		(ft bTOC/bgs)	(ft amsl)			(ft)	(ft bgs)	(in)	(Yes/No)
Current STP Ponds (SWMU E03)	HUMW#2	82.7	NM	TOC	Stick up	73.4	NA	2	No
	HUMW#3	76.1	NM	TOC	Stick up	67.2	NA	2	No
WADF 117-10: Fire Response	WADF-1[1]	35	NM	GS	NA	22.80	22.8-35.0	6.625	No
	IRPMW-58	38.41	4003.43	TOC	Stick up	25.64	17.91 - 37.91	4	No
	IRPMW-59	34.16	4002.25	TOC	Stick up	25.21	13.66 - 33.66	4	No

Notes:
1. Permanent wells were not installed at the rotosonic drill rig sampling locations. The total depth listed indicates the total depth of the temporary borehole; the screened interval listed for rotosonic drill rig sampling points indicates the interval at which the drill casing was retracted for collection of a grab groundwater sample through a decontaminated screen-point sampler.

Acronyms/Abreviations:
AFFF = aqueous film-forming foam
amsl = above mean sea level
bgs = below ground surface
bTOC = below top of casing
ft = feet
GS = ground surface
ID = identification
in = inches
MP = measuring point
NA = not available/not applicable
NC = not calculated
NM = not measured (not surveyed)
NW = northwest
STP = sewage treatment plant
SWMU = solid waste management unit
TOC = top of casing
WADF = Western Area Demilitarization Facility

Source:
Hawthorne Army Depot. 2008. Draft Basewide Groundwater Monitoring Annual Report 2008, Appendix B. December.

Table 7-1 - Groundwater PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

AOPI	Location	Sample/ Parent ID	Sample Date	Analyte	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
				OSD Tapwater RiskScreening Level	40		40		600	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Shop Street	HWAD-SHOP-1	HWAD-SHOP-1-GW-020721	02/07/2021	N	**39**		**2.7**		**8.3**	
Historical Metals Plating (Building10)	HWAD-BLDG10-1	HWAD-BLDG10-1-GW-020621	02/06/2021	N	2.5	U	**2.0**	J	**47**	
One-Time AFFF Training Area (Building18 exterior)	HWAD-BLDG18-1	HWAD-BLDG18-1-GW-020421	02/04/2021	N	2.1	U	**6.1**		**3.4**	
Drafting Pit: Fire Truck Pump Testing	HWAD-DRAFT-1	HWAD-DRAFT-1-GW-020321	02/03/2021	N	1.8	U	1.8	U	1.8	U
Conelly Drive	HWAD-CON-1	HWAD-CON-1-GW-020221	02/02/2021	N	**0.95**	J	1.8	U	1.8	U
Conelly Drive	HWAD-CON-2	HWAD-CON-2-GW-012621	01/26/2021	N	1.6	U	1.6	U	1.6	U
Fire Training Pit (SWMU H01)	HWAD-H01-1	HWAD-H01-1-GW-020821	02/08/2021	N	**2.1**	J	**6.6**		**8.5**	
NW of SWMU H01: Historical AFFF Fire Training Area	HWAD-NWH01-1	HWAD-FD-2-SO-02012021 / HWAD-H01-1-SO-02012021	02/09/2021	FD	1.9	U	**75**		**140**	
		HWAD-NWH01-1-GW-020921	02/09/2021	N	2.1	U	**69**		**140**	
Fire Station #2 (Building 94)	HWAD-FS2-1	HWAD-FS2-1-GW-021021	02/10/2021	N	**11,000**	J-	**17,000**		22	U
Fire Station #2 (Building 94)	HWAD-MW21	HWAD-MW21-012621	01/26/2021	N	1.8	U	1.8	U	**3.1**	
Fire Station #2 (Building 94)	HWAD-MW23	HWAD-MW23-012621	01/26/2021	N	1.9	U	1.9	U	**2.0**	
Current STP Ponds (SWMU E03)	HWAD-HUMW#2	HWAD-HUMW#2-012621	01/26/2021	N	**1.9**		**4.8**		**10**	
Current STP Ponds (SWMU E03)	HWAD-HUMW#3	HWAD-HUMW#3-012621	01/26/2021	N	**12**		**29**		**6.6**	
WADF 117-10: Fire Response	HWAD-IRPMW58	HWAD-IRPMW58-012621	01/26/2021	N	**6.5**		**2.9**		1.9	U
WADF 117-10: Fire Response	HWAD-IRPMW59	HWAD-IRPMW59-012621	01/26/2021	N	1.8	U	1.8	U	1.8	U
WADF 117-10: Fire Response	HWAD-WADF-1	HWAD-WADF-1-GW-020921	02/09/2021	N	**2.9**		2.0	U	**1.1**	J

Table 7-1 - Groundwater PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection
2. Gray-shaded values indicate the result was detected greater than the Office of the Secretary of Defense (OSD) risk screening levels for tap water (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.)
3. Groundwater samples were analyzed for PFOS, PFOA, and PFBS using USEPA Method 537 Modified.

Acronyms/Abbreviations:
-- = not applicable
AFFF = aqueous film-forming foam
AOPI = area of potential interest
FD = field duplicate sample
HWAD = Hawthorne Army Depot
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
NW = northwest
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier
STP = sewage treatment plant
SWMU = solid waste management unit
WADF = Western Area Demilitarization Facility
USEPA = United States Environmental Protection Agency

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

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

AOPI	Location	Sample/Parent 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
Fire Station #1 (Building 8): Back Apron, South Main Avenue	HWAD-FS1-1	HWAD-FS1-1-SO-012621	01/26/2021	N	**0.032**	J	**0.00080**	J	0.0021	U
Fire Station #1 (Building 8): Back Apron, South Main Avenue	HWAD-FS1-2	HWAD-FD-1-SO-012221 / HWAD-FS1-2-SO-012221	01/22/2021	FD	**0.0097**	J+	**0.0011**	J	0.0020	UJ
		HWAD-FS1-2-SO-012221	01/22/2021	N	**0.012**	J+	**0.0014**	J	0.0021	UJ
Shop Street	HWAD-SHOP-1	HWAD-SHOP-1-SO-020421	02/04/2021	N	**0.22**		**0.0068**		0.0021	U
Shop Street	HWAD-SHOP-2	HWAD-SHOP-2-SO-012621	01/26/2021	N	**0.0035**	J	0.00062	U	0.0021	U
Fire Truck Steam Cleaning (Building 11 exterior)	HWAD-BLDG11-1	HWAD-BLDG11-1-SO-012621	01/26/2021	N	**0.0022**	J	**0.00051**	J	0.0021	U
Historical Metals Plating (Building10)	HWAD-BLDG10-1	HWAD-BLDG10-1-SO-012621	01/26/2021	N	**0.016**	J	**0.00041**	J	0.0020	U
One-Time AFFF Training Area (Building 18 exterior)	HWAD-BLDG18-1	HWAD-BLDG18-1-SO-020321	02/03/2021	N	**0.0026**		0.00059	U	0.0020	U
One-Time AFFF Training Area (Building 18 exterior)	HWAD-BLDG18-2	HWAD-BLDG18-2-SO-012621	01/26/2021	N	**0.0015**	J	0.00063	U	0.0021	U
Drafting Pit: Fire Truck Pump Testing	HWAD-DRAFT-1	HWAD-DRAFT-1-SO-012721	01/27/2021	N	**0.0088**		0.00061	U	0.0020	U
Drafting Pit: Fire Truck Pump Testing	HWAD-DRAFT-2	HWAD-DRAFT-2-SO-012121	01/21/2021	N	**0.0040**		**0.00072**		0.0020	U
Drafting Pit: Fire Truck Pump Testing	HWAD-DRAFT-3	HWAD-DRAFT-3-SO-012121	01/21/2021	N	**0.0074**		0.00058	U	0.0019	U
Conelly Drive	HWAD-CON-1	HWAD-CON-1-SO-012721	01/27/2021	N	**0.0010**	J	0.00059	U	0.0020	U
Conelly Drive	HWAD-CON-2	HWAD-CON-2-SO-012521	01/25/2021	N	0.00062	U	0.00062	U	0.0021	U
Fire Training Pit (SWMU H01)	HWAD-H01-1	HWAD-FD-2-SO-02012021 / HWAD-H01-1-SO-02012021	02/01/2021	FD	**0.022**		**0.0022**		0.0020	U
		HWAD-H01-1-SO-02012021	02/01/2021	N	**0.027**		**0.0030**		0.0020	U
Fire Training Pit (SWMU H01)	HWAD-H01-2	HWAD-H01-2-SO-012121	01/21/2021	N	**0.0055**		0.00059	U	0.0020	U
NW of SWMU H01: Historical AFFF Fire Training Area	HWAD-NWH01-1	HWAD-NWH01-1-SO-02012021	02/01/2021	N	0.00056	U	0.00056	U	0.0019	U

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

AOPI	Location	Sample/Parent 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
NW of SWMU H01: Historical AFFF Fire Training Area	HWAD-NWH01-2	HWAD-NWH01-2-SO-012121	01/21/2021	N	**0.00046**	J	0.00061	U	0.0020	U
NW of SWMU H01: Historical AFFF Fire Training Area	HWAD-NWH01-3	HWAD-NWH01-3-SO-012121	01/21/2021	N	**0.00052**	J	0.00059	U	0.0020	U
Fire Station #2 (Building 94)	HWAD-FS2-1	HWAD-FS2-1-SO-02012021	02/01/2021	N	**0.039**		**0.0033**		0.0024	U
Fire Station #2 (Building 94)	HWAD-FS2-2	HWAD-FS2-2-SO-012221	01/22/2021	N	***3.2***		**0.6**		**0.096**	
Fire Station #2 (Building 94)	HWAD-FS2-3	HWAD-FS2-3-SO-012621	01/26/2021	N	**0.56**	J	**0.031**	J	**0.0023**	J
Fire Station #2 (Building 94)	HWAD-FS2-4	HWAD-FS2-4-SO-012621	01/26/2021	N	***2.9***	J	**0.092**	J	**0.017**	J
Fire Station #2 (Building 94)	HWAD-FS2-5	HWAD-FS2-5-SO-012221	01/22/2021	N	**0.64**		**0.0032**		0.0020	U
Fire Station #2 (Building 94)	HWAD-FS2-6	HWAD-FS2-6-SO-012221	01/22/2021	N	**0.0017**		0.00064	U	0.0021	U
Former Evaporation Ponds (SWMU E02)	HWAD-E02-1	HWAD-E02-1-SO-012121	01/21/2021	N	**0.0055**		**0.0028**		0.0020	U
Former Evaporation Ponds (SWMU E02)	HWAD-E02-2	HWAD-E02-2-SO-012121	01/21/2021	N	0.00060	U	0.00060	U	0.0020	U
Former Evaporation Ponds (SWMU E02)	HWAD-E02-3	HWAD-E02-3-SO-012121	01/21/2021	N	**0.0047**		**0.0016**		0.0020	U
Former Evaporation Ponds (SWMU E02)	HWAD-E02-4	HWAD-E02-4-SO-012121	01/21/2021	N	**0.00069**		0.00060	U	0.0020	U
Current STP Ponds (SWMU E03)	HWAD-E03-1	HWAD-E03-1-SO-012621	01/26/2021	N	0.00060	U	0.00060	U	0.0020	U
Current STP Ponds (SWMU E03)	HWAD-E03-2	HWAD-E03-2-SO-012621	01/26/2021	N	**0.0075**		**0.0030**		0.0021	U
WADF 117-10: Fire Response	HWAD-WADF-1	HWAD-WADF-1-SO-020421	02/04/2021	N	**0.0034**		0.00061	U	0.002	U
WADF 117-10: Fire Response	HWAD-WADF-2	HWAD-WADF-2-SO-012221	01/22/2021	N	**0.0031**		0.00064	U	0.0021	U
WADF 117-10: Fire Response	HWAD-WADF-3	HWAD-WADF-3-SO-012221	01/22/2021	N	0.00058	U	0.00058	U	0.0019	U
WADF 117-10: Fire Response	HWAD-WADF-4	HWAD-WADF-4-SO-012221	01/22/2021	N	**0.011**		**0.00048**	J	0.0018	U

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

AOPI	Location	Sample/Parent 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
Vehicle Maintenance (Building 64)	HWAD-BLDG64-1	HWAD-BLDG64-1-SO-110421	11/04/2021	N	**0.024**		**0.0078**		**0.00067**	J
Vehicle Maintenance (Building 64)	HWAD-BLDG64-2	HWAD-FD-1-SO-110421 / HWAD-BLDG64-2-SO-110422	11/04/2021	FD	**0.0014**		0.00091	U	0.00091	U
	HWAD-BLDG64-2	HWAD-BLDG64-2-SO-110422	11/04/2021	N	**0.0041**		0.0010	U	0.0010	U
Vehicle Maintenance (Building 64)	HWAD-BLDG64-3	HWAD-BLDG64-3-SO-110423	11/04/2021	N	**0.002**		0.0010	U	0.0010	U
Vehicle Maintenance (Building 64)	HWAD-BLDG64-4	HWAD-BLDG64-4-SO-110424	11/04/2021	N	**0.011**		**0.00069**	J	0.0010	U
Vehicle Maintenance (Building 64)	HWAD-BLDG64-5	HWAD-BLDG64-5-SO-110425	11/04/2021	N	**0.0031**		0.0010	U	0.0010	U
Vehcile Maintenance (Building 102-52 exterior)	HWAD-BLDG52-1	HWAD-BLDG52-1-SO-110321	11/03/2021	N	**0.00093**	J	0.0010	U	0.0010	U
Vehcile Maintenance (Building 102-52 exterior)	HWAD-BLDG52-2	HWAD-BLDG52-2-SO-110321	11/03/2021	N	**0.00063**	J	0.0010	U	0.0010	U
Vehcile Maintenance (Building 102-52 exterior)	HWAD-BLDG52-3	HWAD-BLDG64-3-SO-110321	11/03/2021	N	**0.0012**		0.0011	U	0.0011	U

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Hawthorne Army Depot, Nevada

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection
2. Data are compared to the Office of the Secretary of Defense (OSD) risk screening levels for both the residential as well as the industrial/commercial scenarios (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.). No concentrations of PFOS, PFOA, or PFBS exceeded the OSD risk screening levels.
3. Gray-shaded values indicate the result was detected greater than the residential scenario risk screening levels (OSD 2021).
4. Gray-shaded and italicized values indicate the result was detected greater than the industrial/commercial scenario (i.e., and therefore greater than the residential scenario) risk screening levels (OSD 2021).
5. Soil samples were analyzed for PFOS, PFOA, and PFBS using USEPA Method 537 Modified.

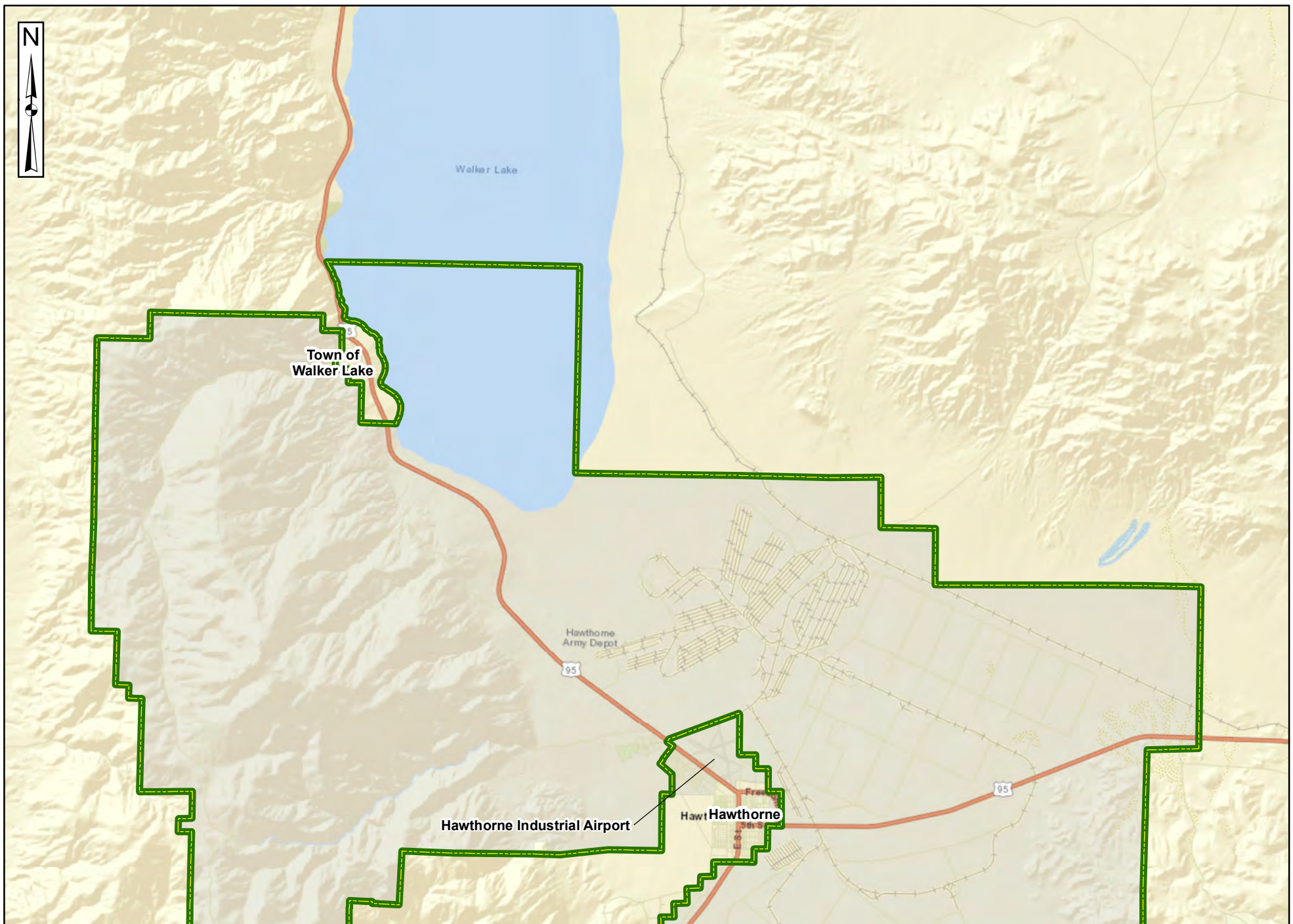
Acronyms/Abbreviations:
AFFF = aqueous film-forming foam
AOPI = area of potential interest
FD = field duplicate sample
HWAD = Hawthorne Army Depot
ID = identification
mg/kg = milligrams per kilogram (parts per million)
N = primary sample
NW = northwest
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier
STP = sewage treatment plant
SWMU = solid waste management unit
WADF = Western Area Demilitarization Facility
USEPA = United States Environmental Protection Agency

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

FIGURES

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 2-1
Site Location



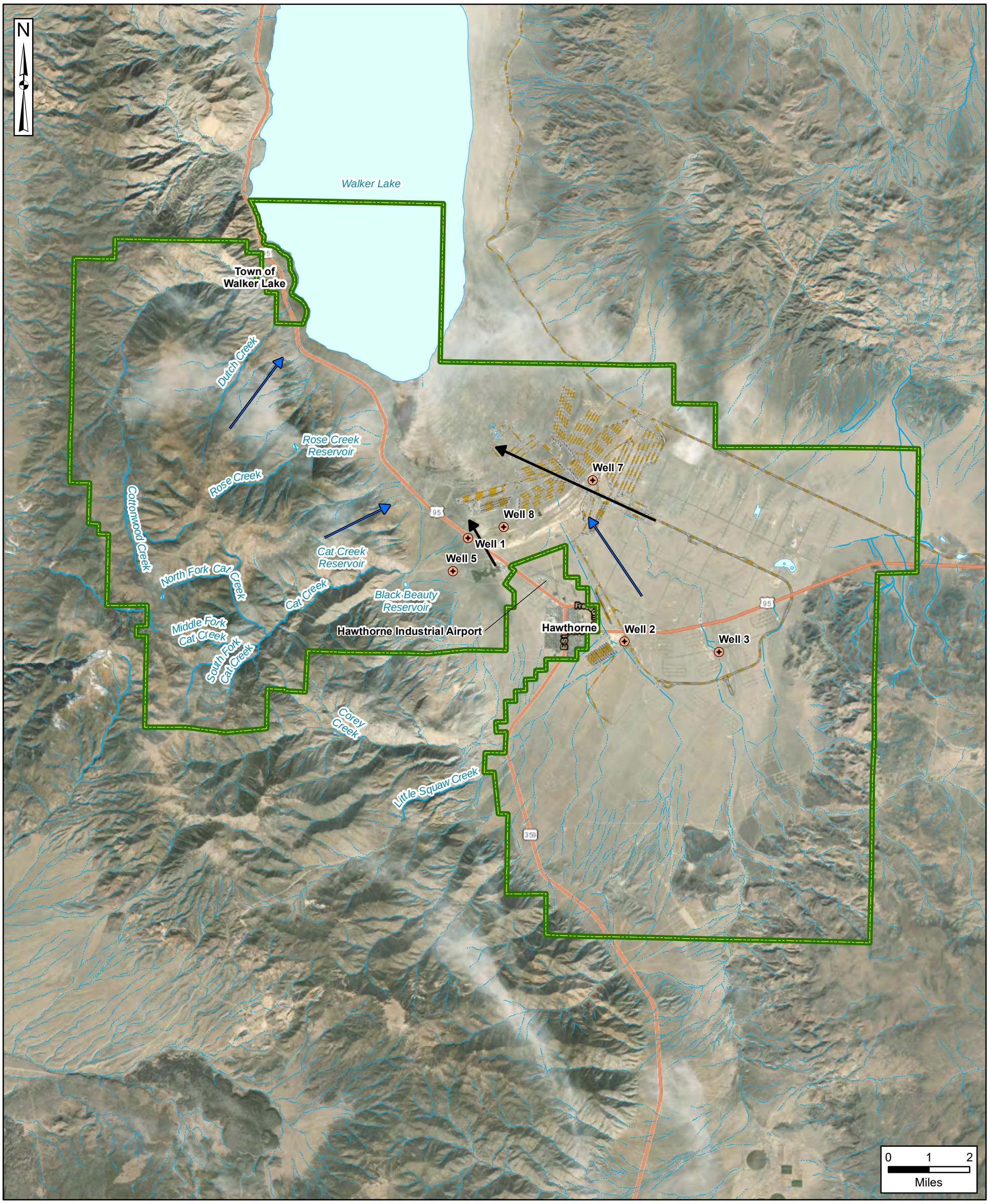
Installation Boundary

Data Sources:
Hawthorne Army Depot, GIS Data, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 2-2
Site Layout

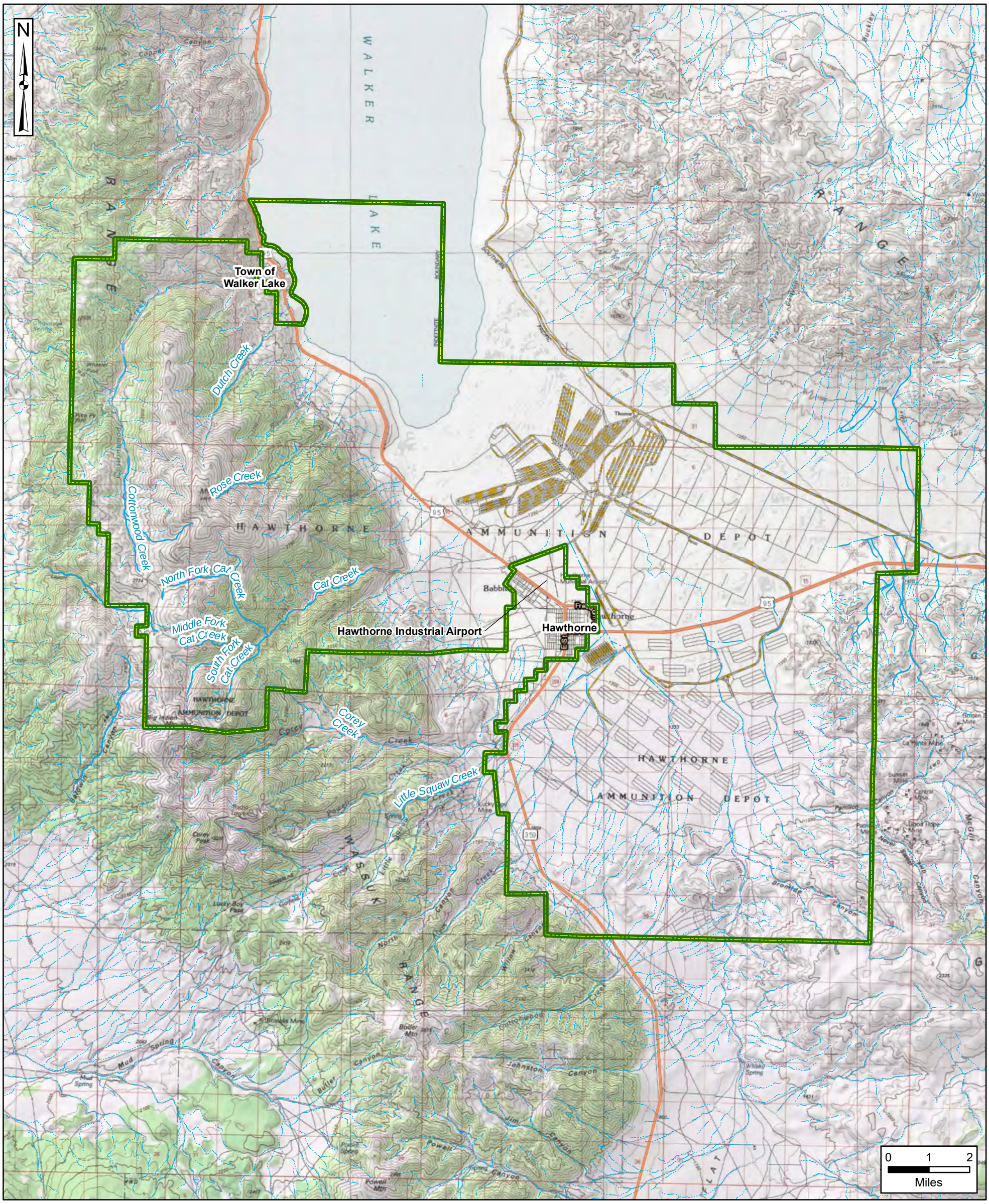


Data Sources:
Hawthorne Army Depot, GIS Data, 2019
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 2-3
Topographic Map



Installation Boundary

River/Stream (Perennial)

Stream (Intermittent)

Canal/Ditch

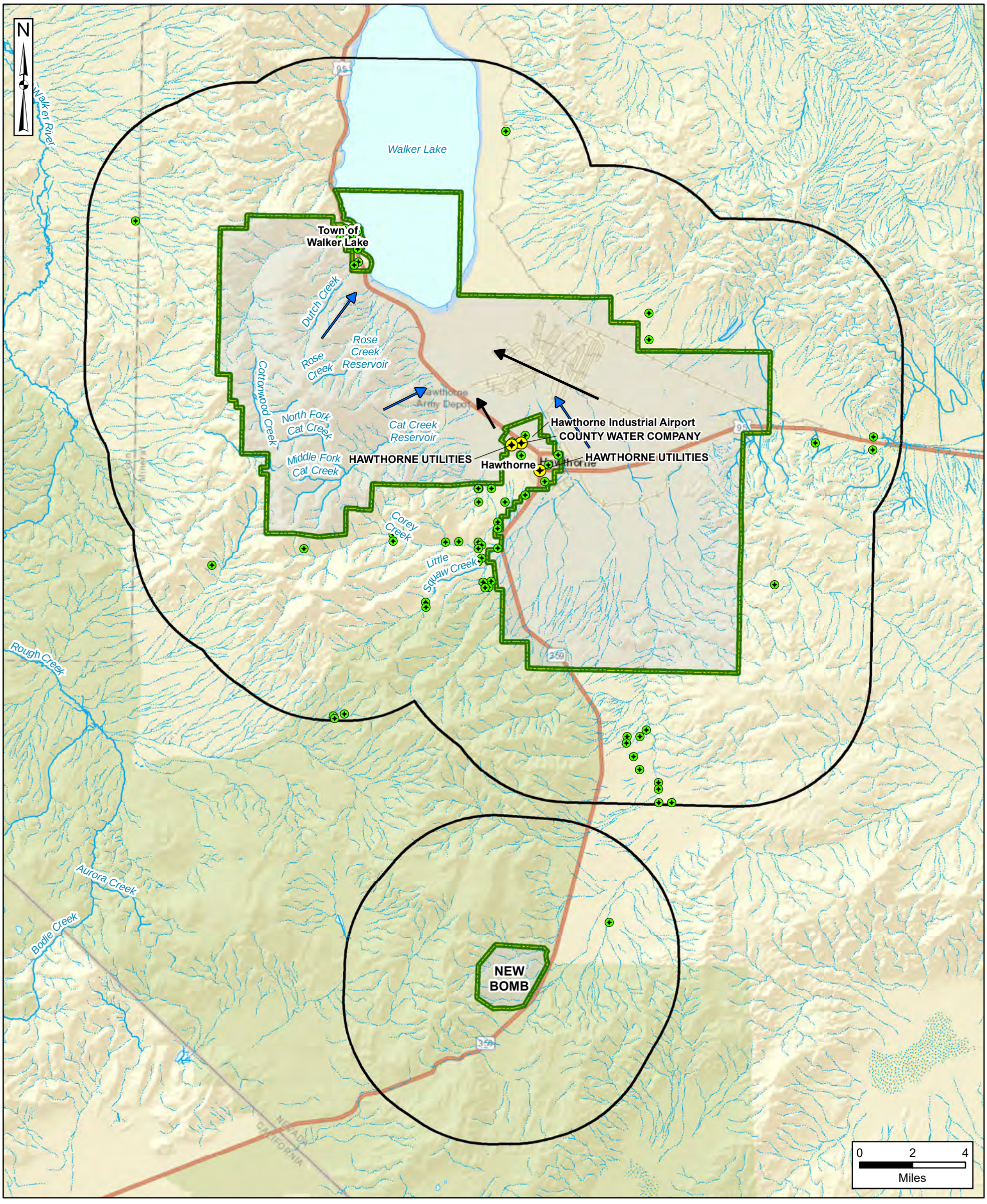
Note: Contour labels are in meters.

Data Sources:
Hawthorne Army Depot, GIS Data, 2019
NHD, Water Bodies, 2019
ESRI ArcGIS Online, USA Topo Maps

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 2-4
Off-Post Supply Wells

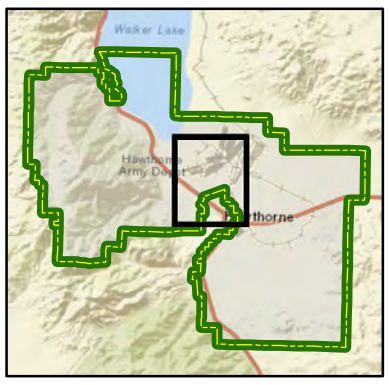


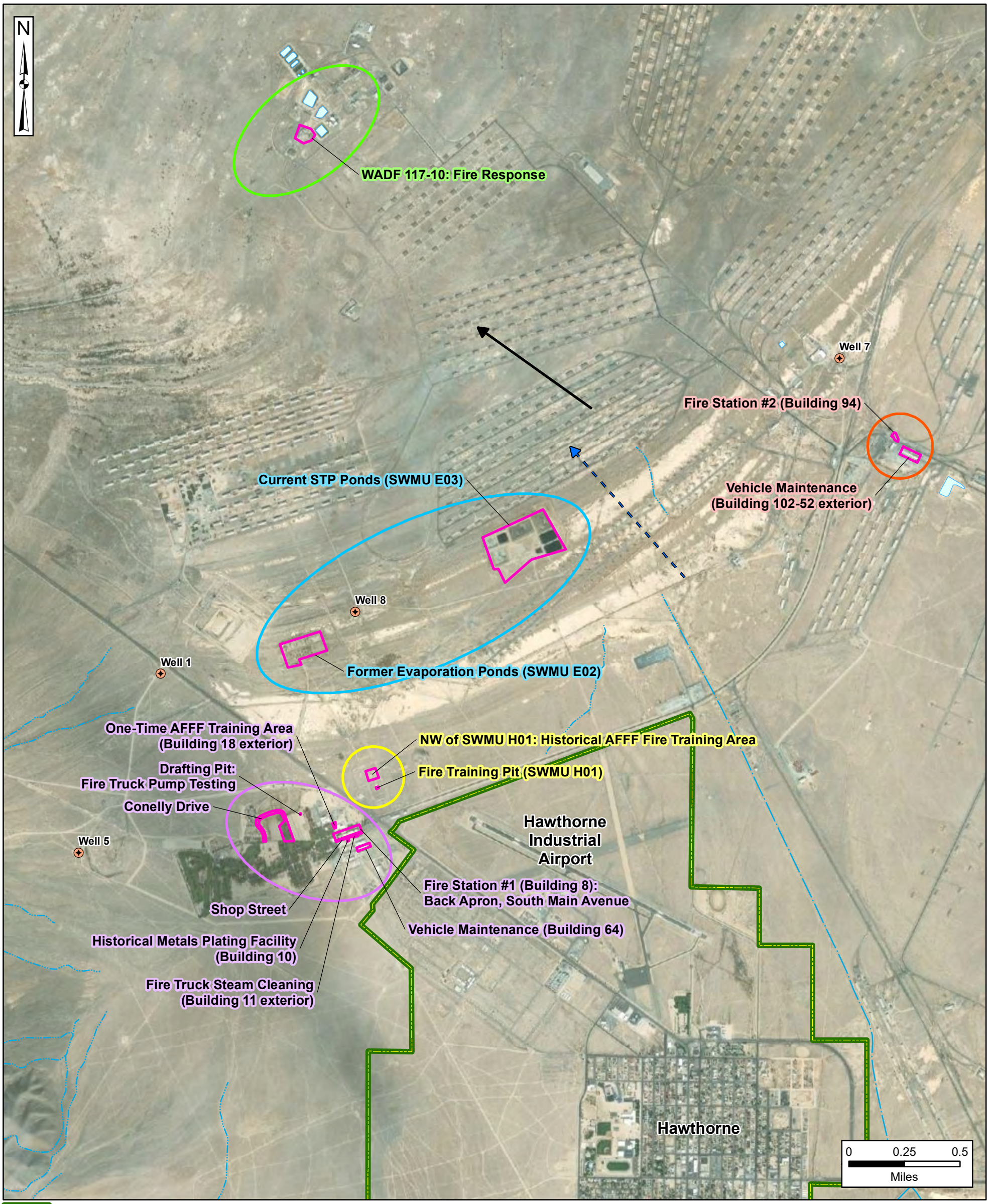
Data Sources:
Hawthorne Army Depot, GIS Data, 2019
EDR, Well Data, 2018
NHD, Water Bodies, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 5-2
AOPI Locations





Installation Boundary
AOPI
Stream (Intermittent)
Canal/Ditch
Groundwater Flow Direction
Surface Runoff Flow Direction

AOPI Grouping
Cantonment
Fire Station 2
Fire Training
WADF 117
Wastewater Treatment

Production Well: Non-Drinking Water

AFFF = aqueous film-forming foam
AOPI = area of potential interest
NW = northwest
STP = sewage treatment plant
SWMU = solid waste management unit
WADF = Western Area Demilitarization Facility

Data Sources:
Hawthorne Army Depot, GIS Data, 2019
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

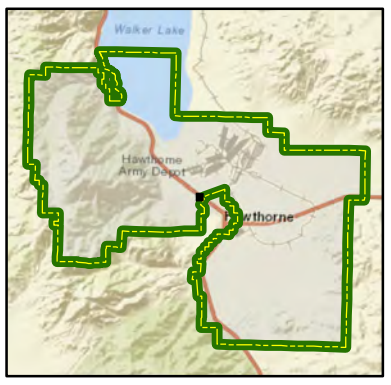
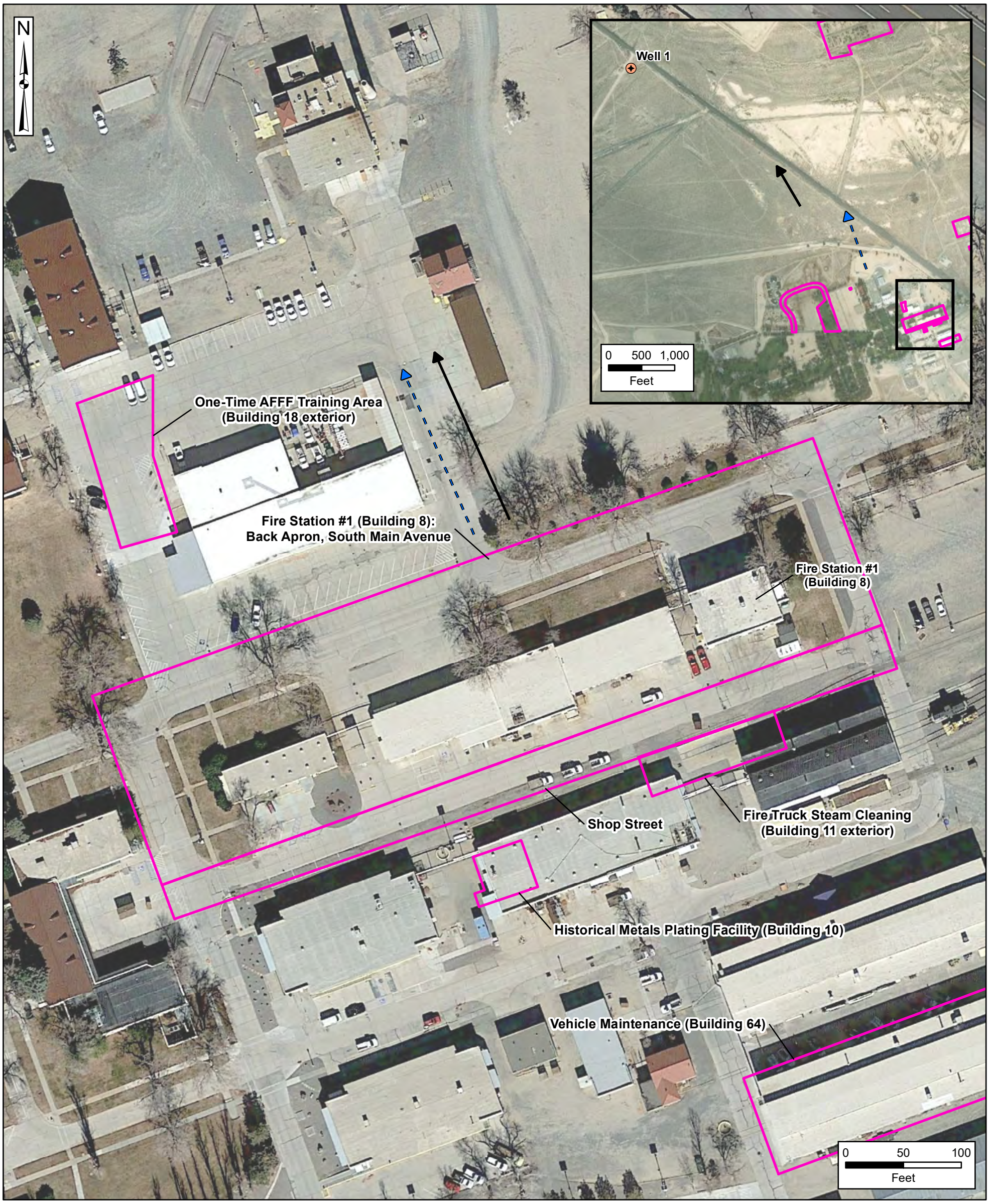


Figure 5-3
Aerial Photo of Fire Station #1, Fire Truck Steam Cleaning, Shop Street, Historical Metals Plating Facility, and One-Time AFFF Training Area



Installation Boundary
AOPI
Groundwater Flow Direction
Surface Runoff Flow Direction
Production Well: Non-Drinking Water

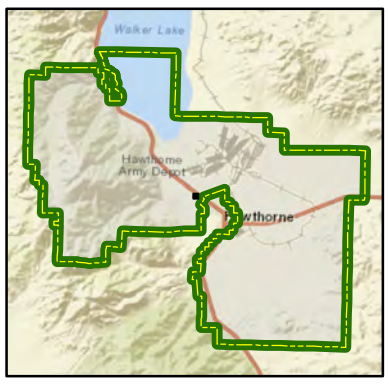
AFFF = aqueous film-forming foam
AOPI = area of potential interest

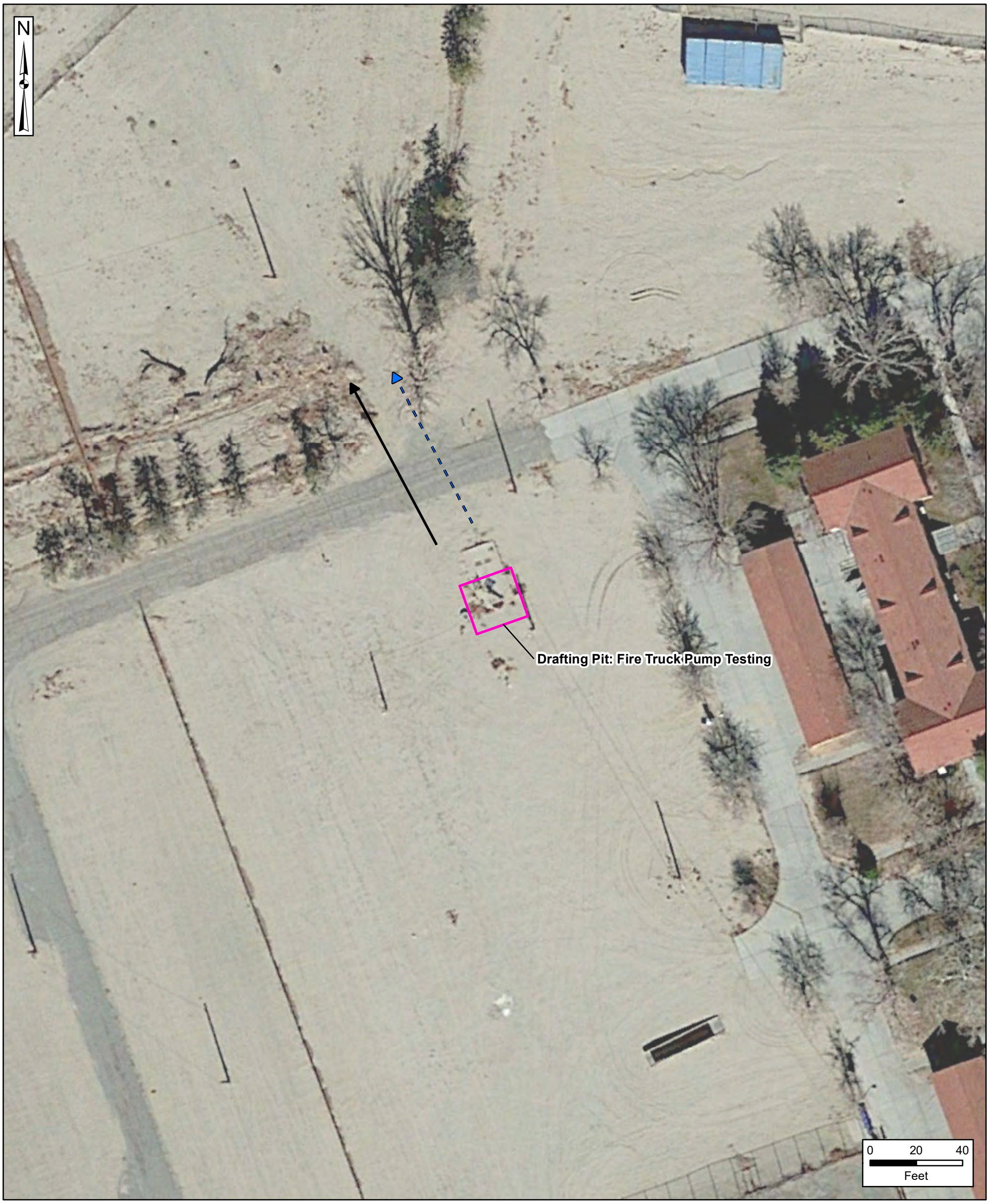
Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 5-4
Aerial Photo of
Drafting Pit: Fire Truck Pump Testing





Installation Boundary

AOPI

Groundwater Flow Direction

Surface Runoff Flow Direction

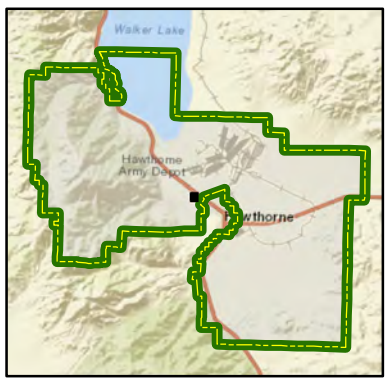
AOPI = area of potential interest

Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 5-5
Aerial Photo of
Conelly Drive



Installation Boundary

AOPI

Groundwater Flow Direction

Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

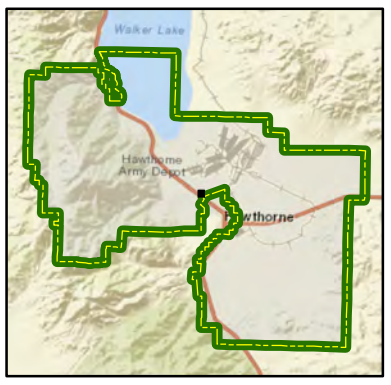
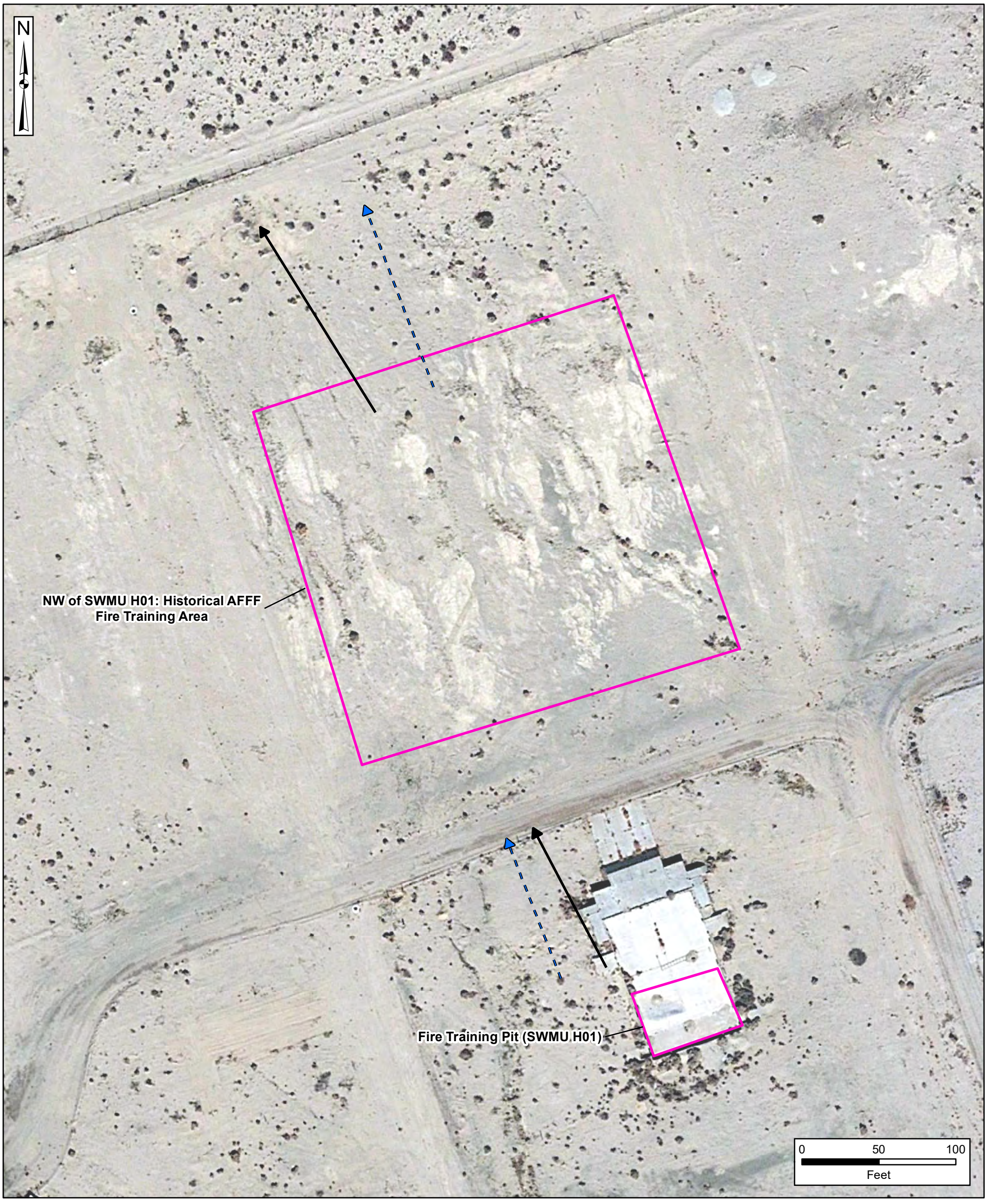


Figure 5-6
Aerial Photo of
Fire Training Pit (SWMU H01) and
NW of SWMU H01: Historical AFFF Fire Training Area



Installation Boundary

AOPI

Groundwater Flow Direction

Surface Runoff Flow Direction

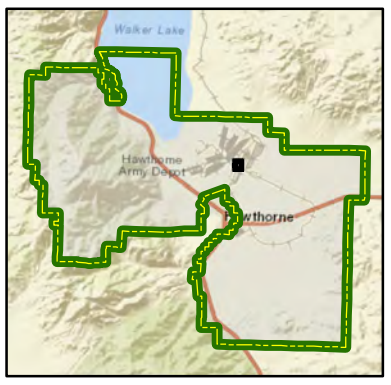
AFFF = aqueous film-forming foam
AOPI = area of potential interest
NW = northwest
SWMU = solid waste management unit

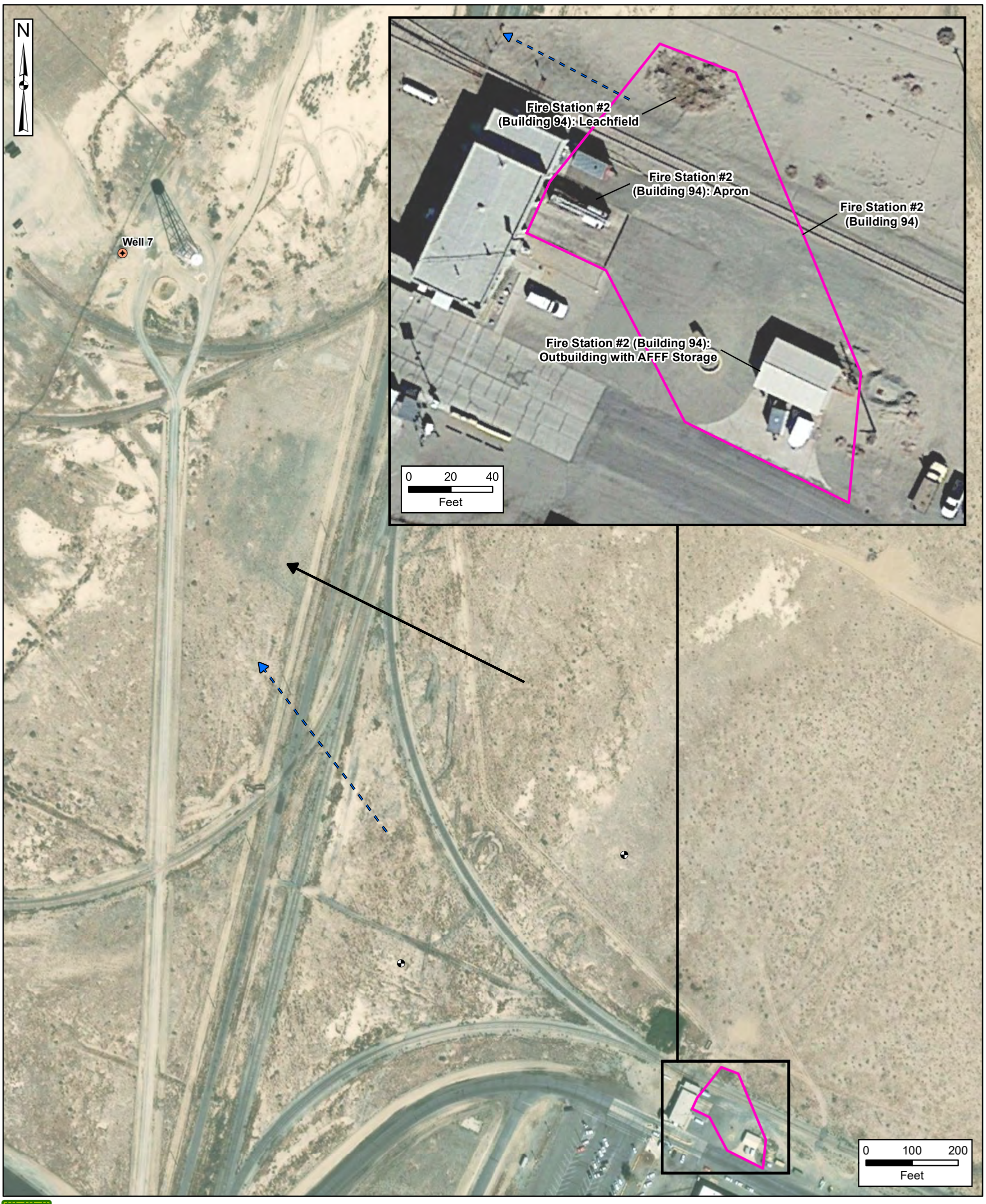
Data Sources:
Google Earth, Aerial Imagery, 2014

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 5-7
Aerial Photo of
Fire Station #2 (Building 94)





Installation Boundary
AOPI
Production Well: Non-Drinking Water
Monitoring Well
Groundwater Flow Direction
Surface Runoff Flow Direction

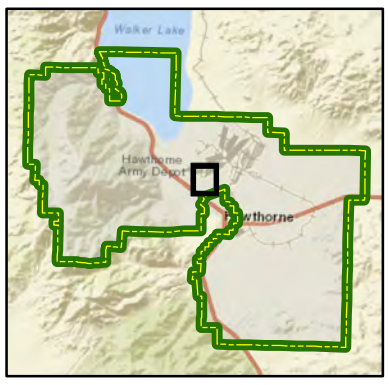
AFFF = aqueous film-forming foam
AOPI = area of potential interest

Data Sources:
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery
Google Earth, Aerial Imagery (inset)

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 5-8
Aerial Photo of
Former Evaporation Ponds (SWMU E02) and
Current STP Ponds (SWMU E03)



Installation Boundary
AOPI
Stream (Intermittent)
Monitoring Well
Groundwater Flow Direction
Surface Runoff Flow Direction

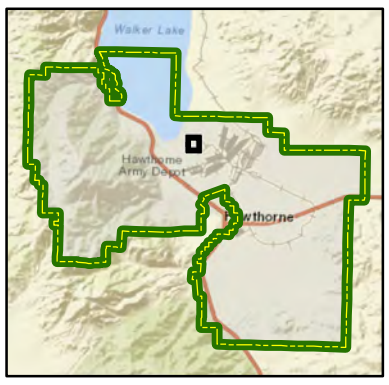
AOPI = area of potential interest
STP = sewage treatment plant
SWMU = solid waste management unit

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 5-9
Aerial Photo of
WADF 117-10: Fire Response



Installation Boundary
AOPI
Groundwater Flow Direction
Surface Runoff Flow Direction
Monitoring Well

AOPI = area of potential interest
WADF = Western Area Demilitarization Facility

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

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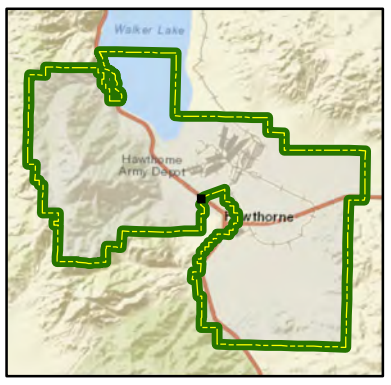


Figure 5-10
Aerial Photo of
Vehicle Maintenance (Building 64)

Installation Boundary

AOPI

Potential Historical PFAS-Containing (AFFF)
Sand and Debris Disposal Area

Groundwater Flow Direction

Surface Runoff Flow Direction

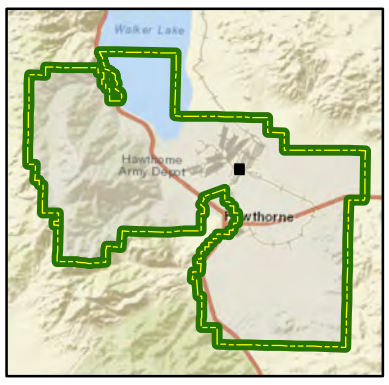
AFFF = aqueous film-forming foam
AOPI = area of potential interest

Data Sources:
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 5-11
Aerial Photo of
Vehicle Maintenance (Building 102-52 exterior)



Installation Boundary
AOPI
Wash Rack Drain Pipe
Monitoring Well
Groundwater Flow Direction
Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

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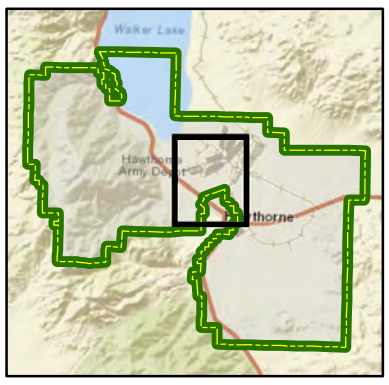
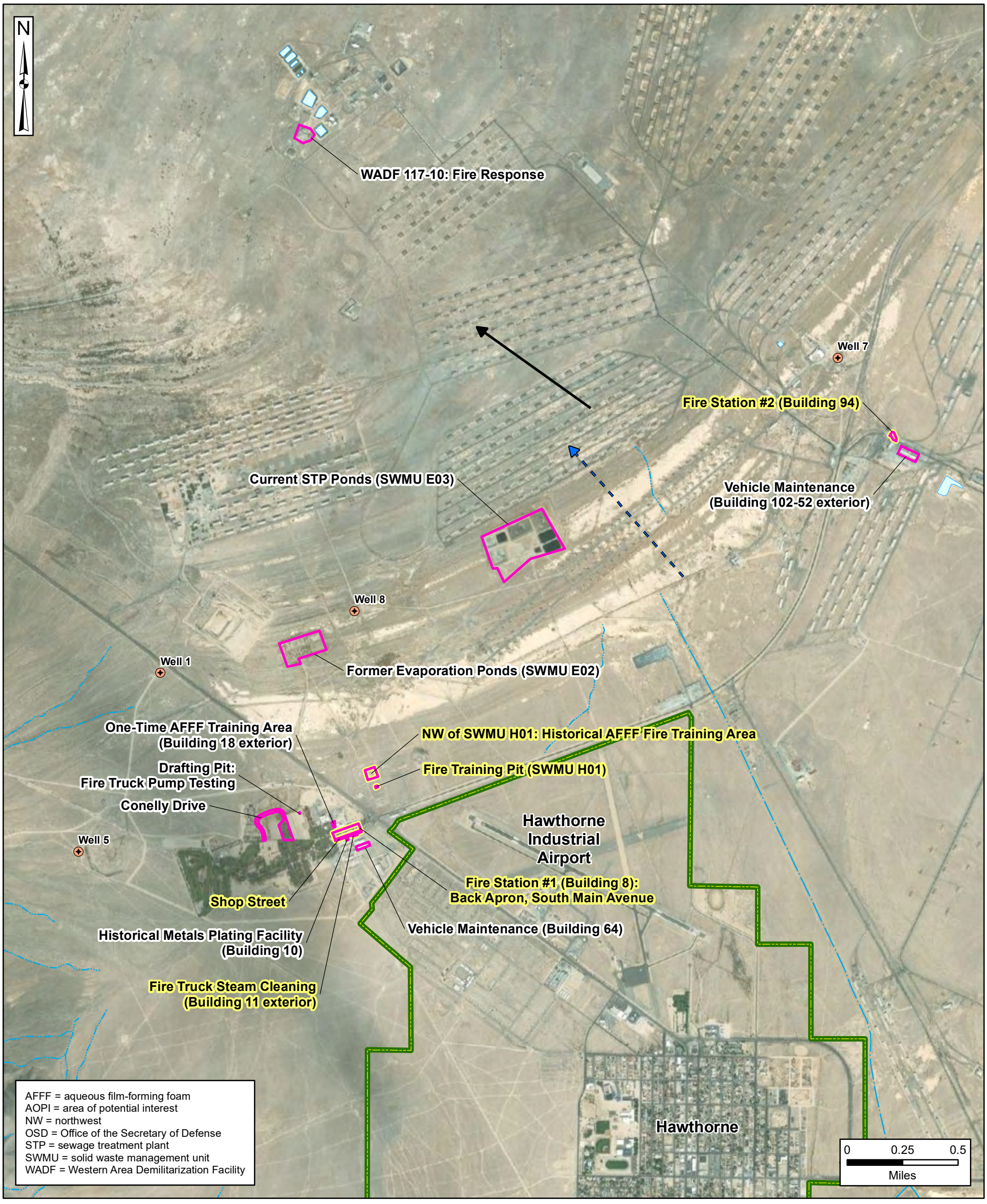
Hawthorne Army Depot, NV

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





AFFF = aqueous film-forming foam
AOPI = area of potential interest
NW = northwest
OSD = Office of the Secretary of Defense
STP = sewage treatment plant
SWMU = solid waste management unit
WADF = Western Area Demilitarization Facility

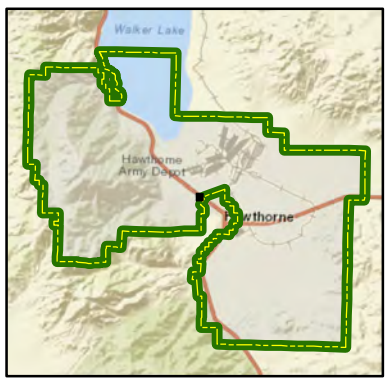
Installation Boundary
AOPI
AOPI with OSD Risk Screening Level Exceedance
Stream (Intermittent)
Canal/Ditch
Groundwater Flow Direction
Surface Runoff Flow Direction
Production Well: Non-Drinking Water

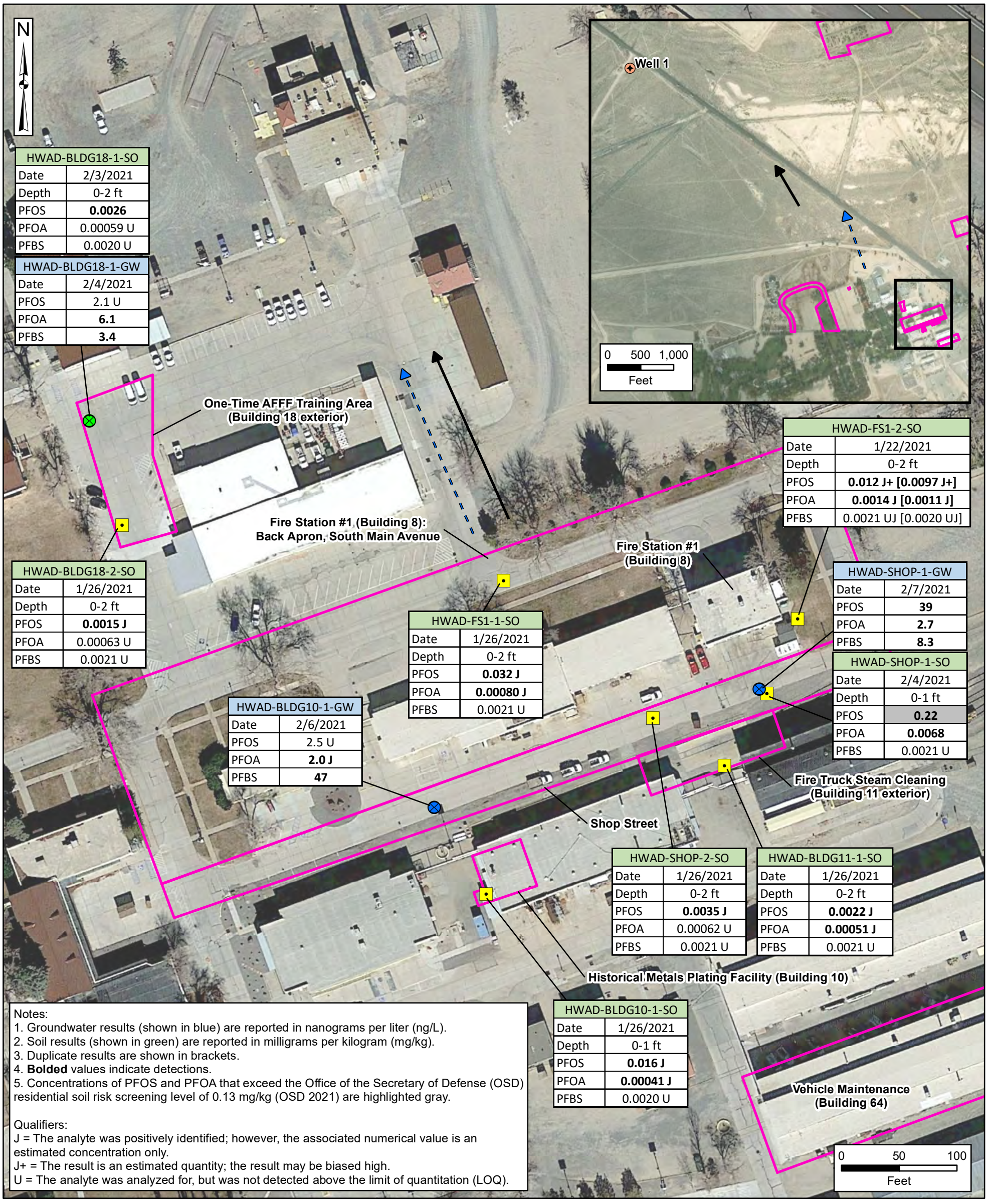
Data Sources:
Hawthorne Army Depot, GIS Data, 2019
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 7-2
Fire Station #1, Fire Truck Steam Cleaning, Shop Street, Historical Metals Plating Facility, and One-Time AFFF Training Area
PFOS, PFOA, and PFBS Analytical Results





Notes:
1. Groundwater results (shown in blue) are reported in nanograms per liter (ng/L).
2. Soil results (shown in green) are reported in milligrams per kilogram (mg/kg).
3. Duplicate results are shown in brackets.
4. **Bolded** values indicate detections.
5. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.

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

- Installation Boundary
- AOPI
- Groundwater Flow Direction
- Surface Runoff Flow Direction
- Production Well: Non-Drinking Water
- Shallow Soil Sampling Location
- Soil/Groundwater Sampling Location
- Groundwater Sampling Location (Boring)

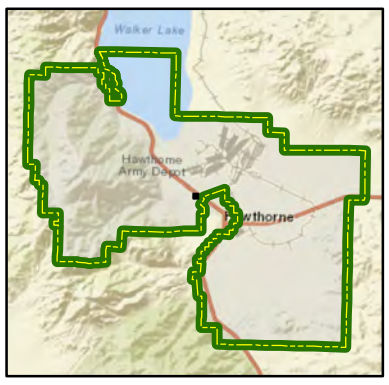
AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

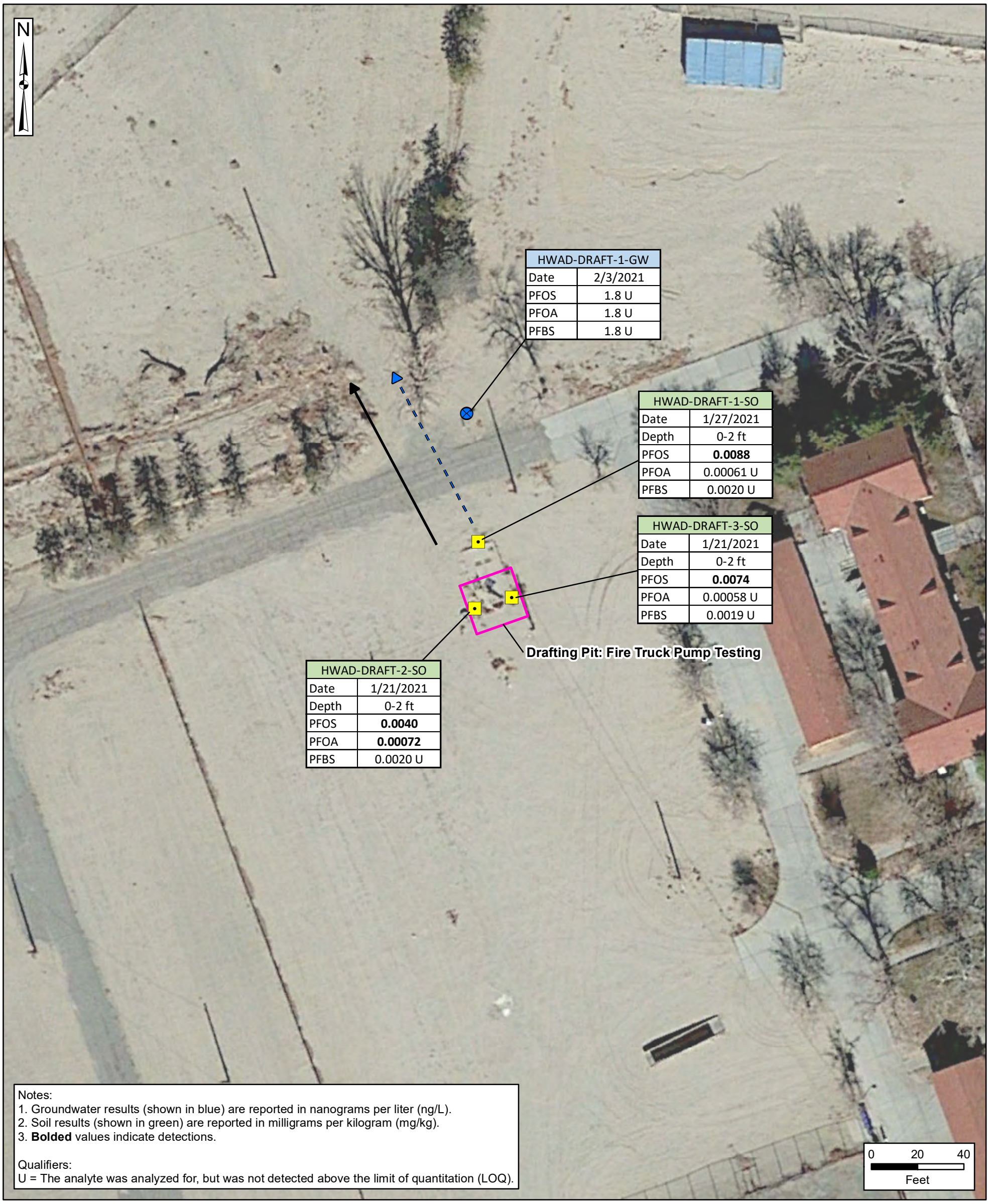
Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 7-3
Drafting Pit: Fire Truck Pump Testing
PFOS, PFOA, and PFBS Analytical Results





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

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

Installation Boundary
AOPI
Groundwater Flow Direction
Surface Runoff Flow Direction
Shallow Soil Sampling Location
Groundwater Sampling Location (Boring)

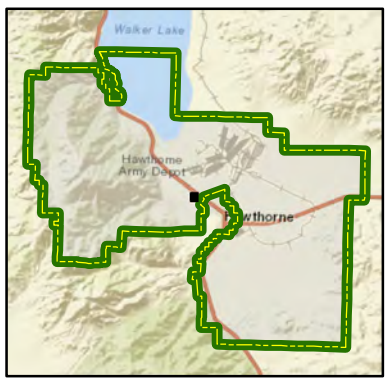
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

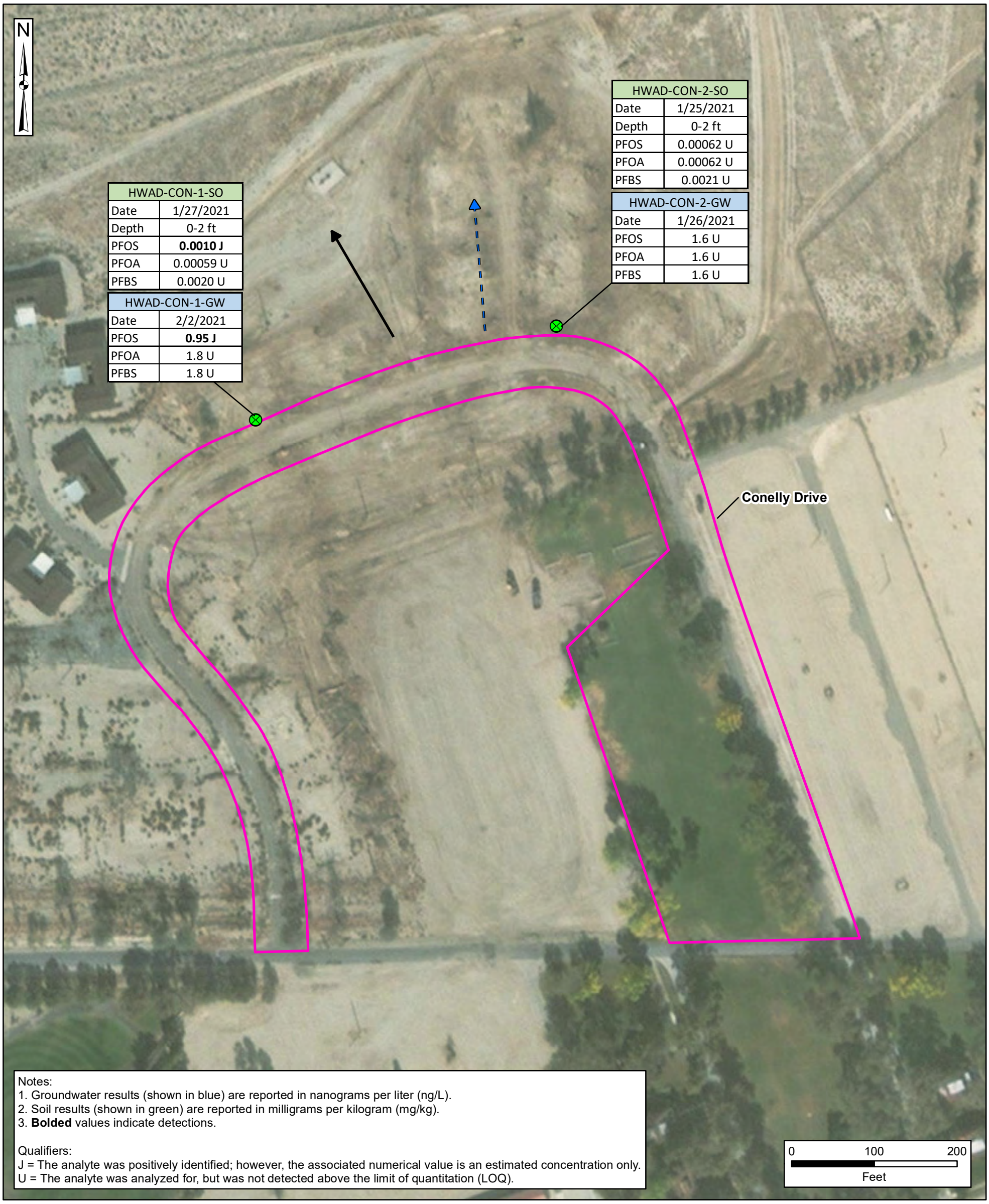
Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 7-4
Conelly Drive
PFOS, PFOA, and PFBS Analytical Results





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

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

Installation Boundary
AOPI
Groundwater Flow Direction
Surface Runoff Flow Direction
Soil/Groundwater Sampling Location

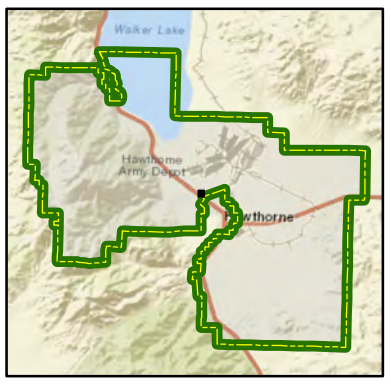
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

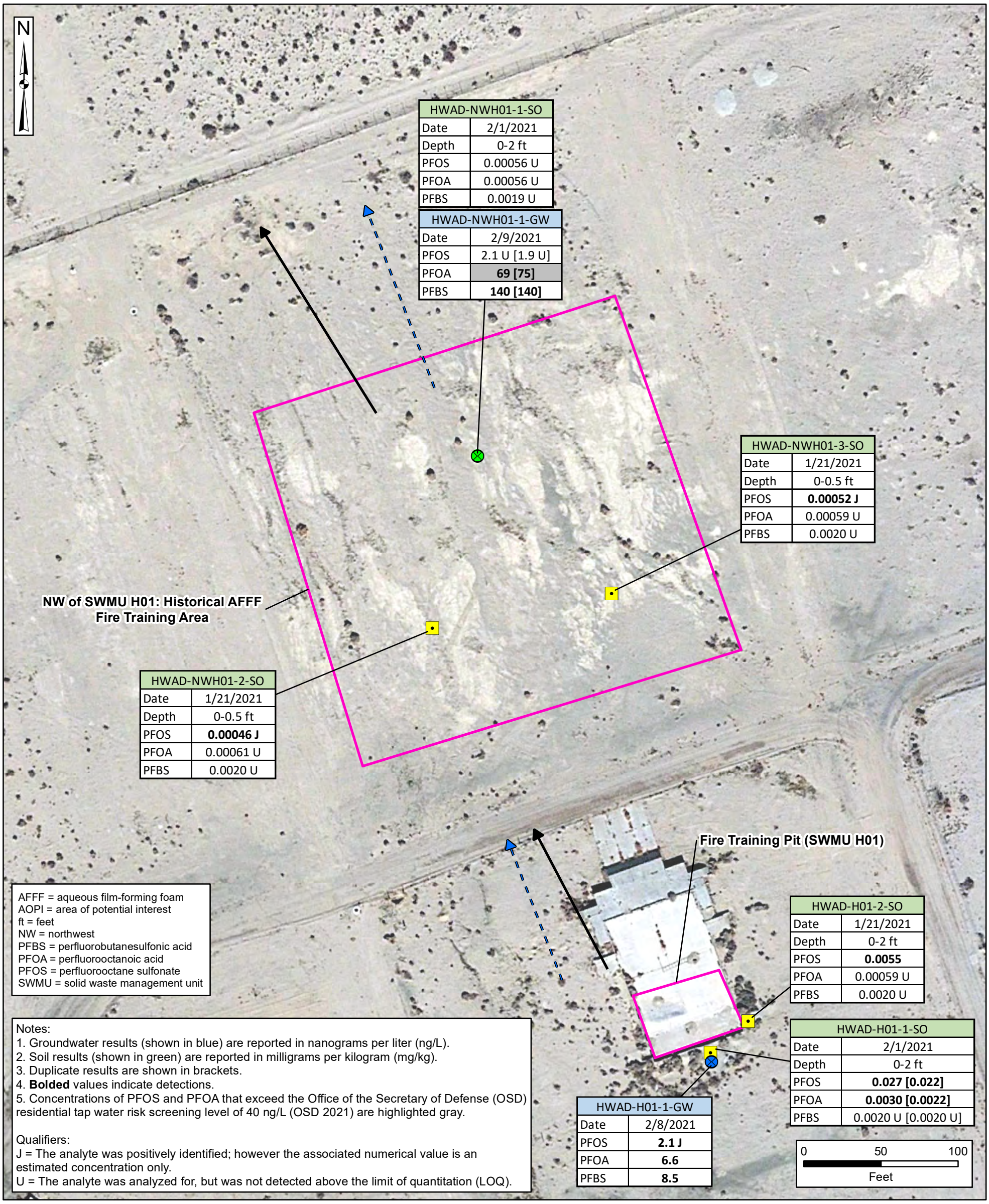
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 7-5
Fire Training Pit (SWMU H01) and NW of SWMU H01: Historical AFFF Fire Training Area PFOS, PFOA, and PFBS Analytical Results





AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet
NW = northwest
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SWMU = solid waste management unit

Notes:
1. Groundwater results (shown in blue) are reported in nanograms per liter (ng/L).
2. Soil results (shown in green) are reported in milligrams per kilogram (mg/kg).
3. Duplicate results are shown in brackets.
4. **Bolded** values indicate detections.
5. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.

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

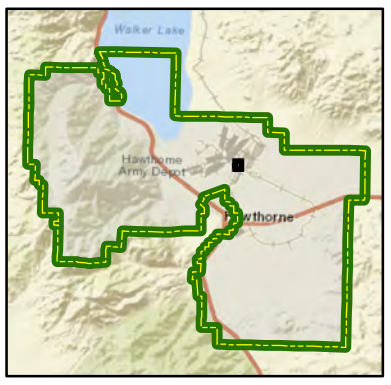
- Installation Boundary
- AOPI
- Groundwater Flow Direction
- Surface Runoff Flow Direction
- Shallow Soil Sampling Location
- Soil/Groundwater Sampling Location
- Groundwater Sampling Location (Boring)

Data Sources:
Google Earth, Aerial Imagery, 2014

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 7-6
Fire Station #2 (Building 94)
PFOS, PFOA, and PFBS Analytical Results



N

Well 7

Fire Station #2 (Building 94): Leachfield

Fire Station #2 (Building 94): Apron

Fire Station #2 (Building 94)

Fire Station #2 (Building 94): Outbuilding with AFFF Storage

HWAD-FS2-1-SO	
Date	2/1/2021
Depth	0-2 ft
PFOS	**0.039**
PFOA	**0.0033**
PFBS	0.0024 U

HWAD-FS2-1-GW	
Date	2/10/2021
PFOS	**11,000 J-**
PFOA	**17,000**
PFBS	22 U

HWAD-FS2-2-SO	
Date	1/22/2021
Depth	0-2 ft
PFOS	***3.2***
PFOA	**0.60**
PFBS	**0.096**

HWAD-FS2-3-SO	
Date	1/26/2021
Depth	0-1 ft
PFOS	**0.56 J**
PFOA	**0.031 J**
PFBS	**0.0023 J**

HWAD-FS2-4-SO	
Date	1/26/2021
Depth	0-1 ft
PFOS	***2.9 J***
PFOA	**0.092 J**
PFBS	**0.017 J**

HWAD-FS2-5-SO	
Date	1/22/2021
Depth	0-2 ft
PFOS	**0.64**
PFOA	**0.0032**
PFBS	0.0020 U

HWAD-FS2-6-SO	
Date	1/22/2021
Depth	0-2 ft
PFOS	**0.0017**
PFOA	0.00064 U
PFBS	0.0021 U

HWAD-MW23	
Date	1/26/2021
PFOS	1.9 U
PFOA	1.9 U
PFBS	**2.0**

HWAD-MW21	
Date	1/26/2021
PFOS	1.8 U
PFOA	1.8 U
PFBS	**3.1**

0 20 40
Feet

0 100 200
Feet

Notes:
1. Groundwater results (shown in blue) are reported in nanograms per liter (ng/L).
2. Soil results (shown in green) are reported in milligrams per kilogram (mg/kg).
3. **Bolded** values indicate detections.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L or residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
5. Concentrations of PFOS and PFOA that exceed the OSD industrial soil risk screening level of 1.6 mg/kg (OSD 2021) are highlighted gray and italicized.

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

Installation Boundary
AOPI
Production Well: Non-Drinking Water
Monitoring Well
Groundwater Flow Direction
Surface Runoff Flow Direction
Soil Sampling Location
Soil/Groundwater Sampling Location
Groundwater Sampling Location (Existing Well)

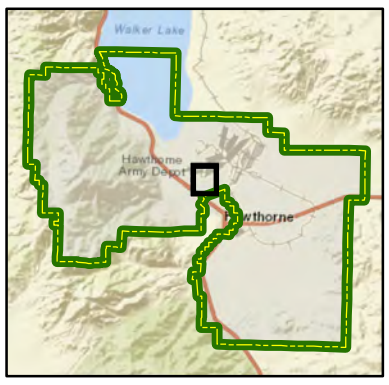
AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

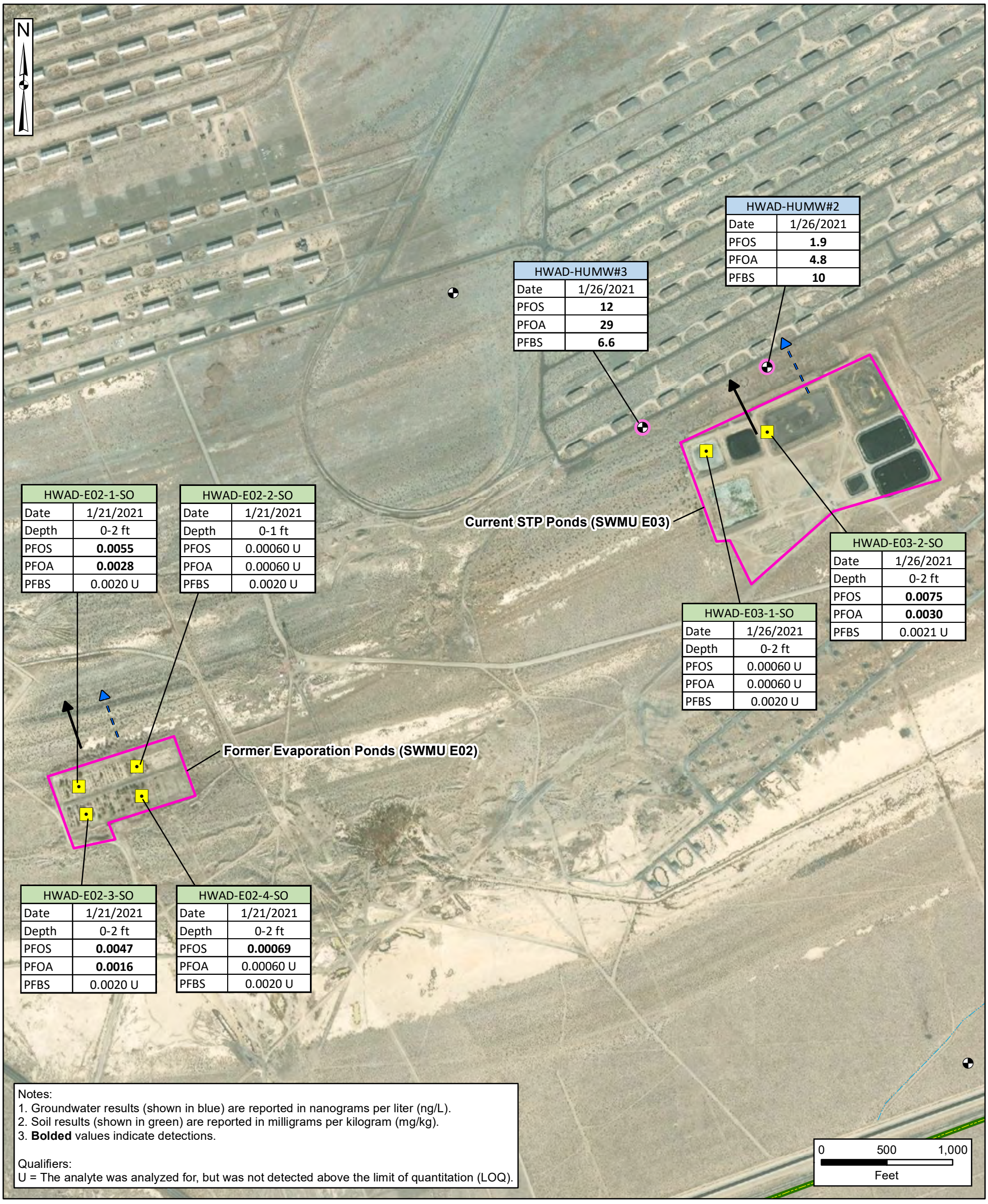
Data Sources:
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery
Google Earth, Aerial Imagery (inset)

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 7-7
Former Evaporation Ponds (SWMU E02) and Current STP Ponds (SWMU E03) PFOS, PFOA, and PFBS Analytical Results





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

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

Installation Boundary
AOPI
Monitoring Well
Groundwater Flow Direction
Surface Runoff Flow Direction
Shallow Soil Sampling Location
Groundwater Sampling Location (Existing Well)

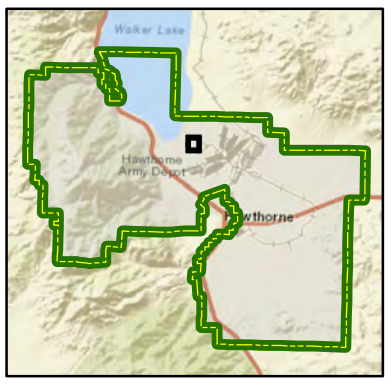
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
STP = sewage treatment plant
SWMU = solid waste management unit

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 7-8
WADF 117-10: Fire Response
PFOS, PFOA, and PFBS Analytical Results



HWAD-IRPMW58	
Date	1/26/2021
PFOS	**6.5**
PFOA	**2.9**
PFBS	1.9 U

HWAD-IRPMW59	
Date	1/26/2021
PFOS	1.8 U
PFOA	1.8 U
PFBS	1.8 U

HWAD-WADF-1-SO	
Date	2/4/2021
Depth	0-2 ft
PFOS	**0.0034**
PFOA	0.00061 U
PFBS	0.0020 U

HWAD-WADF-1-GW	
Date	2/9/2021
PFOS	**2.9**
PFOA	2.0 U
PFBS	**1.1 J**

HWAD-WADF-2-SO	
Date	1/22/2021
Depth	0-2 ft
PFOS	**0.0031**
PFOA	0.00064 U
PFBS	0.0021 U

HWAD-WADF-3-SO	
Date	1/22/2021
Depth	0-2 ft
PFOS	0.00058 U
PFOA	0.00058 U
PFBS	0.0019 U

HWAD-WADF-4-SO	
Date	1/22/2021
Depth	0-2 ft
PFOS	**0.011**
PFOA	**0.00048 J**
PFBS	0.0018 U

WADF 117-10: Fire Response

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

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

0 200 400
Feet

Installation Boundary
AOPI
Groundwater Flow Direction
Surface Runoff Flow Direction
Monitoring Well
Shallow Soil Sampling Location
Soil/Groundwater Sampling Location
Groundwater Sampling Location (Existing Well)

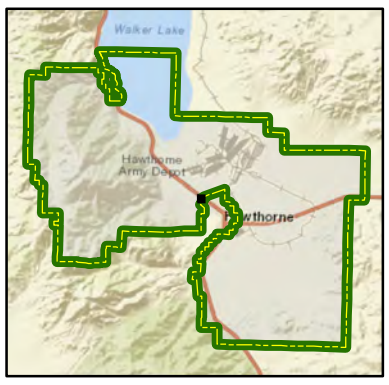
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
WADF = Western Area Demilitarization Facility

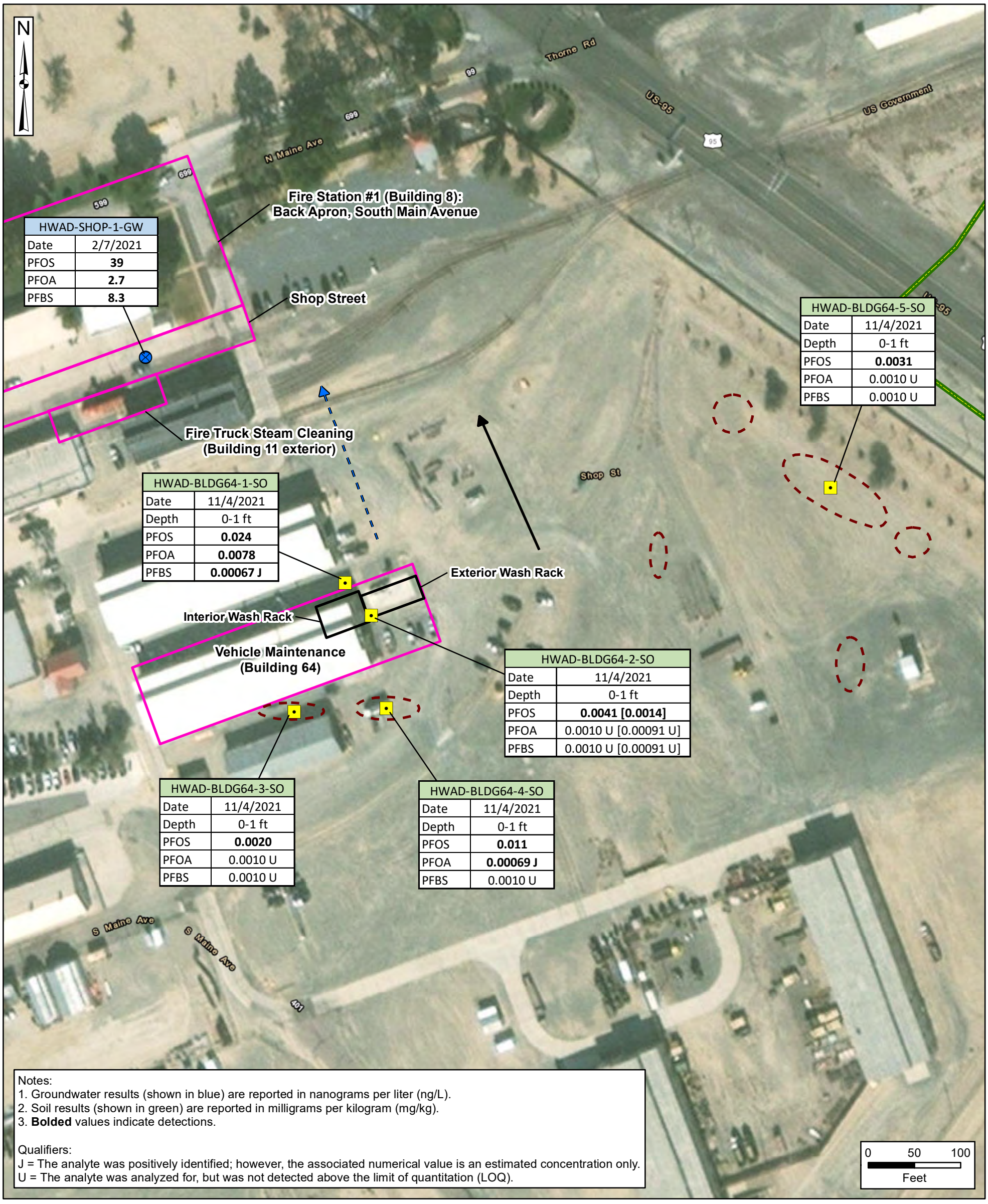
Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 7-9
Vehicle Maintenance (Building 64)
PFOS, PFOA, and PFBS Analytical Results





HWAD-SHOP-1-GW	
Date	2/7/2021
PFOS	**39**
PFOA	**2.7**
PFBS	**8.3**

HWAD-BLDG64-1-SO	
Date	11/4/2021
Depth	0-1 ft
PFOS	**0.024**
PFOA	**0.0078**
PFBS	**0.00067 J**

HWAD-BLDG64-5-SO	
Date	11/4/2021
Depth	0-1 ft
PFOS	**0.0031**
PFOA	0.0010 U
PFBS	0.0010 U

HWAD-BLDG64-2-SO	
Date	11/4/2021
Depth	0-1 ft
PFOS	**0.0041 [0.0014]**
PFOA	0.0010 U [0.00091 U]
PFBS	0.0010 U [0.00091 U]

HWAD-BLDG64-3-SO	
Date	11/4/2021
Depth	0-1 ft
PFOS	**0.0020**
PFOA	0.0010 U
PFBS	0.0010 U

HWAD-BLDG64-4-SO	
Date	11/4/2021
Depth	0-1 ft
PFOS	**0.011**
PFOA	**0.00069 J**
PFBS	0.0010 U

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

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

Installation Boundary
AOPI
Potential Historical PFAS-Containing (AFFF) Sand and Debris Disposal Area
Groundwater Flow Direction
Surface Runoff Flow Direction
Shallow Soil Sampling Location
Groundwater Sampling Location (Boring)

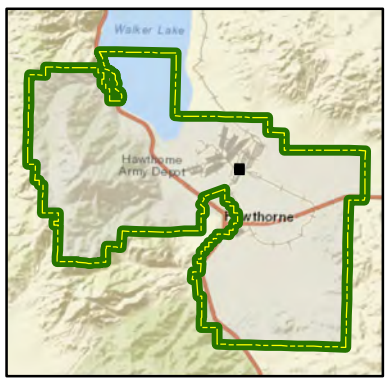
AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, NV

Figure 7-10
Vehicle Maintenance (Building 102-52 exterior)
PFOS, PFOA, and PFBS Analytical Results



N

HWAD-MW21	
Date	1/26/2021
PFOS	1.8 U
PFOA	1.8 U
PFBS	**3.1**

Fire Station #2 (Building 94)

HWAD-BLDG52-1-SO	
Date	11/3/2021
Depth	0-1 ft
PFOS	**0.00093 J**
PFOA	0.0010 U
PFBS	0.0010 U

Vehicle Maintenance
(Building 102-52 exterior)

Wash Rack

HWAD-BLDG52-2-SO	
Date	11/3/2021
Depth	0-1 ft
PFOS	**0.00063 J**
PFOA	0.0010 U
PFBS	0.0010 U

Discharge Area

HWAD-BLDG52-3-SO	
Date	11/3/2021
Depth	0-1 ft
PFOS	**0.0012**
PFOA	0.0011 U
PFBS	0.0011 U

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

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

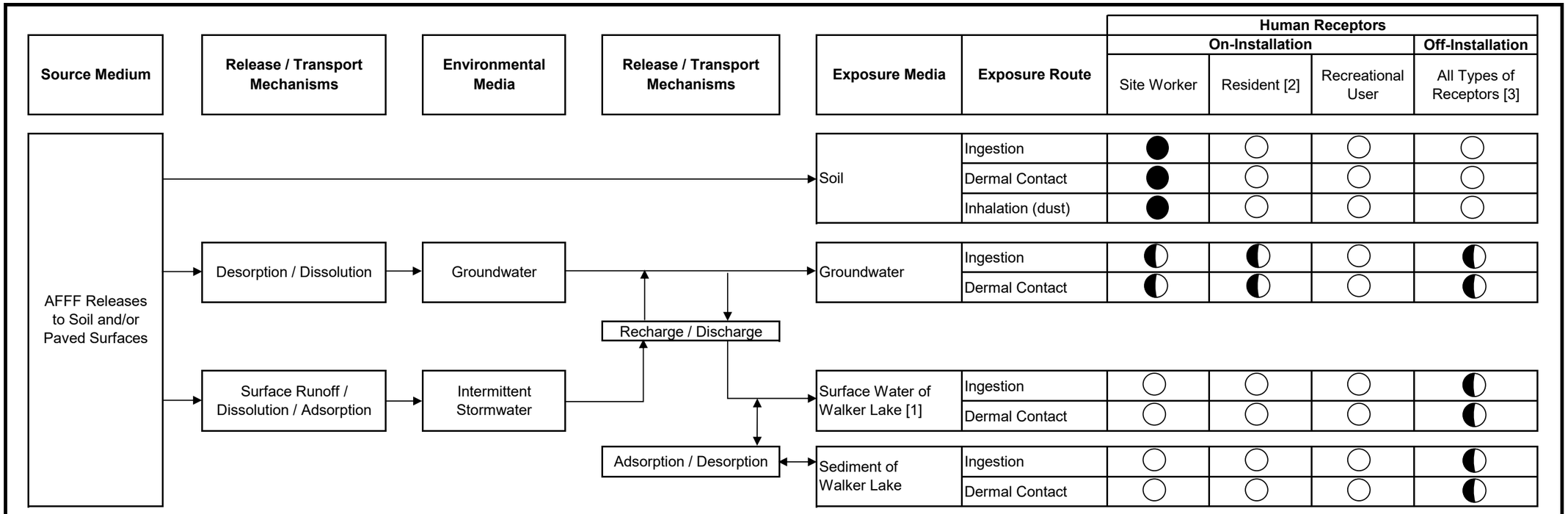
0 100 200
Feet

Installation Boundary
AOPI
Wash Rack Drain Pipe
Monitoring Well
Groundwater Flow Direction
Surface Runoff Flow Direction
Shallow Soil Sampling Location
Groundwater Sampling Location (Existing Well)

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

Data Sources:
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North



Legend:

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

Notes:
The areas of potential interest (AOPIs) addressed by this conceptual site model (CSM) figure are Fire Station #1 (Building 8): Back Apron, South Main Avenue; Shop Street; Fire Truck Steam Cleaning (Building 11 exterior); Historical Metals Plating Facility (Building 10); One-Time AFFF Training Area (Building 18 exterior); Conelly Drive; Fire Training Pit (SWMU H01); NW of SWMU H01: Historical Fire Training Area; Fire Station #2 (Building 94); Building 64; and Building 102-52 (exterior).

[1] Walker Lake is not used for drinking water, therefore this exposure pathway describes incidental ingestion and dermal contact during outdoor recreational activities.
[2] Although Conelly Drive is a residential street, the soil exposure pathway for on-installation residents was considered to be incomplete because AFFF releases were limited to the street pavement (not residential soil).
[3] All types of off-installation human receptors include drinking water receptors and recreational users.

AFFF = aqueous film-forming foam
SWMU = solid waste management unit
NW = northwest

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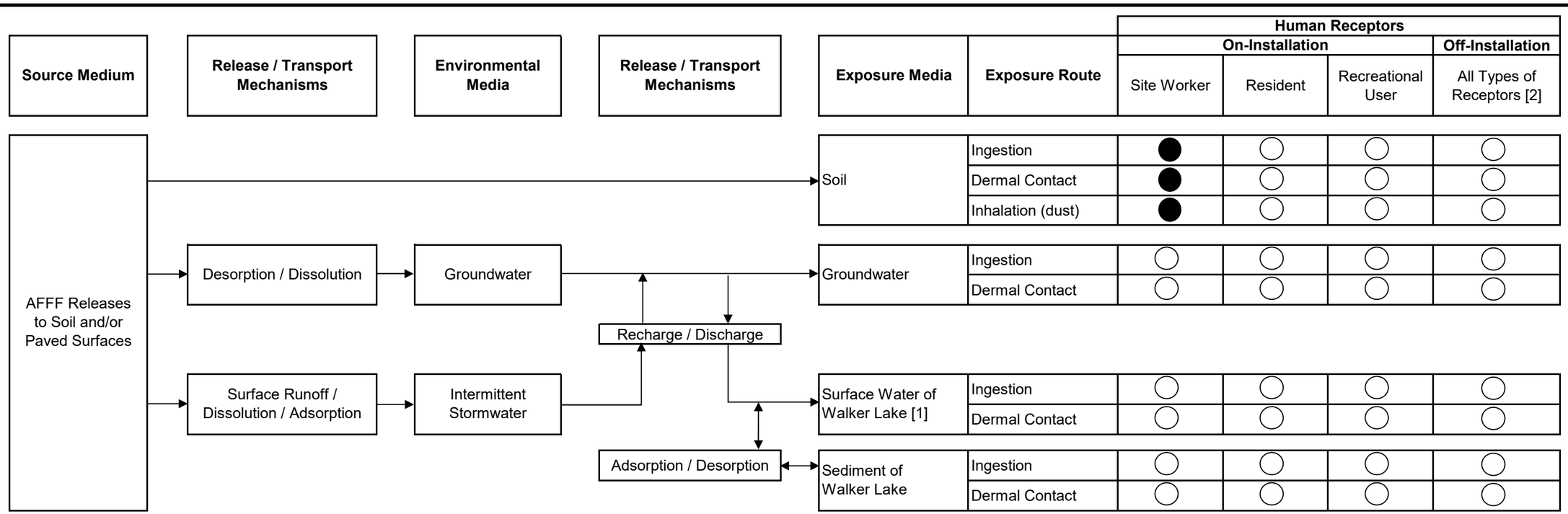
Conceptual Site Model for Cantonment AOPIs, Fire Training AOPIs, Building 102-52 AOPI, and Fire Station 2 AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, Nevada

Figure 7-11



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Notes:
[1] Walker Lake is not used for drinking water, therefore this exposure pathway describes incidental ingestion and dermal contact during outdoor recreational activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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

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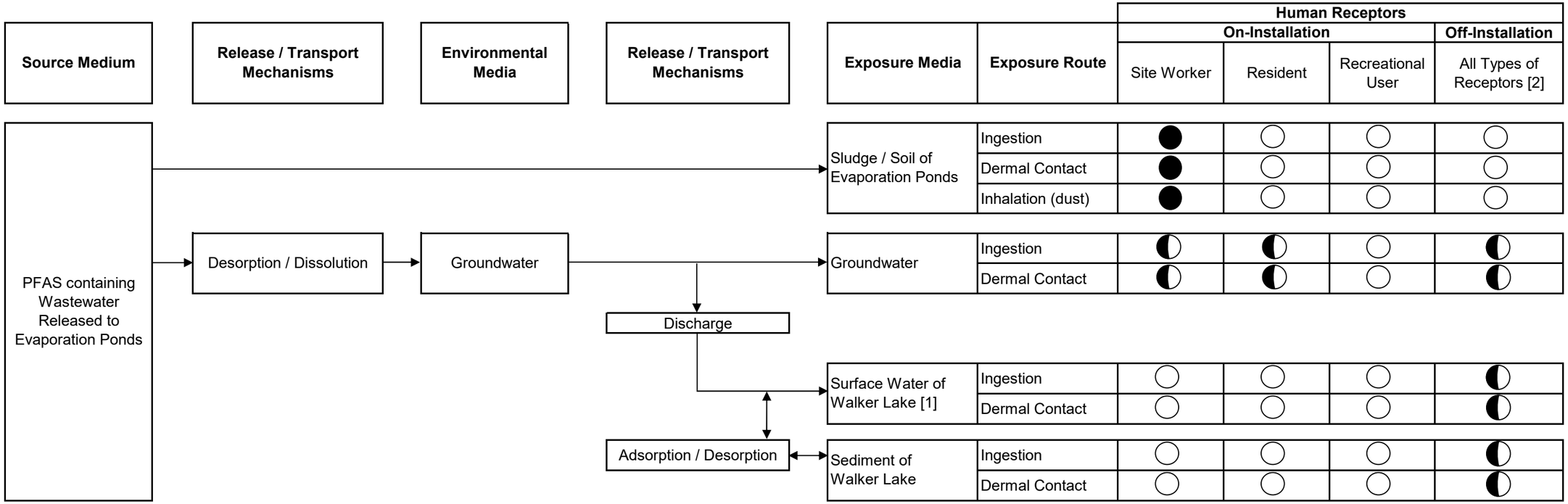
Conceptual Site Model for Drafting Pit: Fire Truck Pump Testing AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, Nevada

Figure 7-12



Legend:

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

Notes:
The areas of potential interest (AOPIs) addressed by this conceptual site model (CSM) figure are Former Evaporation Ponds (SWMU E02) and Current STP Ponds (SWMU E03).

[1] Walker Lake is not used for drinking water, therefore this exposure pathway describes incidental ingestion and dermal contact during outdoor recreational activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

PFAS = per- and polyfluoroalkyl substances
SWMU = solid waste management unit
STP = sewage treatment plant

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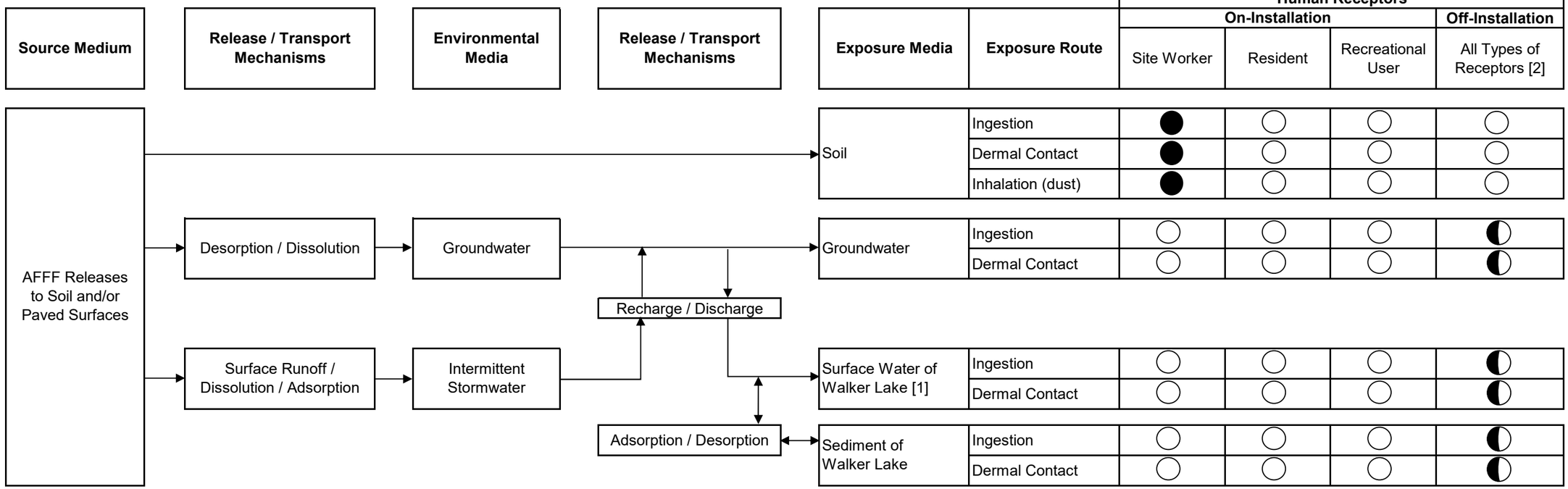
Conceptual Site Model for Wastewater Treatment AOPIs
USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, Nevada

Figure 7-13



Legend:

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

Notes:
The area of potential interest (AOPI) addressed by this conceptual site model (CSM) figure is WADF 117-10: Fire Response.

[1] Walker Lake is not used for drinking water, therefore this exposure pathway describes incidental ingestion and dermal contact during outdoor recreational activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

AFFF = aqueous film-forming foam
WADF = Western Area Demilitarization Facility

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Conceptual Site Model for WADF 117 AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Hawthorne Army Depot, Nevada

Figure 7-14

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