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

Fort Wainwright Sub-Installations, Alaska

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Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

Fort Wainwright Sub-Installations, Alaska

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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), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) at Army installations (installations) nationwide. The PA identifies areas of potential interest (AOPIs) where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred. The SI includes multi-media sampling at AOPIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. This 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 for four Fort Wainwright (FTWW), Alaska Sub-Installations (collectively referred to as the FTWW Sub-Installations herein): Haines Fuel Terminal (HFT), Tok Fuel Terminal (TFT), Sears Creek Pump Station (SCPS), and Gerstle River Test Site (GRTS).

HFT, TFT, SCPS, and GRTS are sub-installations managed as part of U.S. Army Garrison FTWW. HFT, comprised of about 203 acres, is the start of the Haines-Fairbanks Pipeline (HFP) and is located between the Chilkat and Chilkoot inlets on the Chilkat Peninsula, at Tanani Point, approximately 2.9 miles north of Haines, Alaska. TFT, comprised of about 202 acres, is located 7 miles north of Tok Junction along the Tanana River. SCPS, comprised of about 11.24 acres, is located southeast of FTWW along the Alaska Highway and Tanana River, approximately 50 miles southeast of Delta Junction, Alaska; the nearest community is Dot Lake, approximately 12 miles to the southeast. GRTS, comprised of approximately 20,000 acres, is located near Fort Greely, Alaska, in Delta Junction.

The FTWW Sub-Installations PA identified nine AOPIs for investigation during the SI phase (i.e., seven AOPIs at HFT and two at TFT). No AOPIs were identified at SCPS or GRTS. SI sampling results from the nine AOPIs were compared to risk-based screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, PFBS, PFNA, and PFHxS. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI at the FTWW Sub-Installations; therefore, there are no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels. HFPO-DA is also not typically associated with AFFF/fire training activities and would not be expected to be present at DoD sites associated with those activities. PFOS, PFOA, PFBS, PFNA and/or PFHxS were detected in soil and/or groundwater at seven AOPIs (i.e., five AOPIs at HFT and two at TFT); one of the seven AOPIs with detections had PFOS, PFOA, PFBS, PFNA, and/or PFHxS present at concentrations greater than the risk-based screening levels. Three additional AOPIs with detections had PFOS, PFOA, PFBS, PFNA, and/or PFHxS present at estimated concentrations greater than the risk-based screening levels and are recommended for confirmation SI sampling (**Table ES-1**). The FTWW Sub-Installations PA/SI identified the need for further study in a CERCLA remedial investigation at HFT. **Table ES-1** below summarizes the PA/SI sampling results and provides recommendations for further study in a remedial investigation or no action at this time at each AOPI.

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

Sub-Installation / AOPI Name	PFOS, PFOA, PFBS, PFNA, and/or PFHxS detected greater than OSD Risk Screening Levels? (Yes/No/ND)		Recommendation
	GW	SO	
HFT - Tank Farm Fire Foam System	No	No	No action at this time
HFT - Firehouse Office, Shop, and Garage Building 1212	Yes	ND	Further study in a remedial investigation
HFT – Fire Pump Building 1208	No*	ND	Confirmation SI sampling
HFT - Hose Cart Building 1209	ND	ND	No action at this time
HFT - Fire Hose Building 1203	No*	No	Confirmation SI sampling
HFT - Marine Dock Fire Hose Building 1236	ND	ND	No action at this time
HFT - Dockmaster Building 1234	ND	No	No action at this time
TFT - Burn Pit and Soil Piles	No	No	No action at this time
TFT - Tank Farm Fire Foam System	No*	ND	Confirmation SI sampling

Notes:

*****PFOS were detected at estimated concentrations higher than the OSD risk screening level in groundwater at HFT – Fire Pump Building 1208, HFT - Fire Hose Building 1203, and TFT - Tank Farm Fire Foam System, therefore confirmation SI sampling is recommended to make a project decision for the AOPI/confirm concentrations in groundwater.

Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
ND – non-detect
No – detection less than the OSD risk screening level
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), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) at Army installations (installations) nationwide. The Army is the lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Executive Order 12580 and is conducting the PA/SI consistent with its authority under CERCLA, 42 United States Code §§ 9600, et seq. (as amended), and the Defense Environmental Restoration Program, 10 United States Code §§ 2701, et seq. The PFAS PA/SI included two distinct efforts. The PA identified locations that are areas of potential interest (AOPIs) at four Fort Wainwright (FTWW) Sub-Installations based on the use, storage and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release has occurred, and the analytical results were compared to the Office of the Secretary of Defense (OSD) PFOS, PFOA, PFBS, PFNA, and PFHxS risk screening levels to determine whether further investigation is warranted. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI; therefore, there are no HFPO-DA SI analytical results to screen against the OSD risk screening levels. This report provides the PA/SI for the four FTWW Sub-Installations (Haines Fuel Terminal [HFT], Tok Fuel Terminal [TFT], Sears Creek Pump Station [SCPS], and Gerstle River Test Site [GRTS]) and was completed in accordance with CERCLA and The National Oil and Hazardous Substances Pollution Contingency Plan.

1.1 Project Background

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

In 2016, the United States Environmental Protection Agency (USEPA) established a lifetime health advisory of 70 nanograms per liter (ng/L) in drinking water for PFOS or PFOA and for the sum of PFOS and PFOA when both are present (USEPA 2016). On 15 October 2019, the OSD provided guidance on the investigation of PFOS, PFOA, and PFBS at Department of Defense (DoD) restoration sites (OSD 2019). The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in tap water and soil, calculated using the USEPA's Regional Screening Level (RSL) calculator for residential and industrial/commercial worker receptor scenarios. Following the issuance of the 2019 OSD memo, on 08 April 2021, USEPA published an updated toxicity assessment for PFBS (USEPA 2021). Based on the updated toxicity assessment for PFBS, the OSD issued a memorandum on 15 September 2021 to include updated PFBS risk screening levels (OSD 2021). On 18 May 2022, the USEPA published an update to the RSLs table. The May 2022 RSL table included six PFAS constituents: PFOS, PFOA, PFBS, PFNA, PFHxS, and HFPO-DA (USEPA 2022). On 06 July 2022, the OSD issued a memorandum to include revised risk screening levels based on the May 2022 USEPA RSLs (OSD 2022). The July 2022 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program is provided for reference as **Appendix A**. These screening criteria are discussed further in **Section 6.5**.

1.2 PA/SI Objectives

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

1.2.1 PA Objectives

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

1.2.2 SI Objectives

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

Sub-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 the FTWW Sub-Installations, 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 the FTWW Sub-Installations. The PA and SI processes are documented in the PA/SI Quality Control Checklist included as **Appendix B**.

1.3.1 Pre-Site Visit

First, an installation kickoff teleconference was held between applicable points of contact (POCs) from United States Army Environmental Command (USAEC), United States Army Corps of Engineers (USACE), representatives from the FTWW Sub-Installations, and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred on 29 June 2018, 6 weeks before the site visit to discuss the goals and scope of the PA, project scheduling, sub-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 sub-installations and external sources for review. The purpose of the records research was to identify any areas on the sub-installations 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 the FTWW Sub-Installations.

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

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

1.3.2 Preliminary Assessment Site Visit

The site visit was conducted on 06 through 09 August 2018 at FTWW proper. The FTWW Sub-Installations were not visited due to the lack of on-site personnel at the sub-installations and the remoteness of the sites. 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 the FTWW Sub-Installations. The interviews focused on confirming information discussed in historical documents, collecting information that may have not been in historical documents, corroborating other interviewees' information.

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. FTWW personnel declined an exit briefing.

1.3.3 Post-Site Visit

Information collected before, during, and after the site visit was reviewed and corroborated by cross-referencing records and reviewing interview details. 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 sub-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 a sub-installation-specific Quality Assurance Project Plan (QAPP) Addendum.

1.3.4 Site Inspection Planning and Field Work

The SI process was initiated at the sub-installations to evaluate PFOS, PFOA, PFBS, PFNA, and PFHxS presence or absence at each AOPI and determine whether further investigation is warranted. An SI kickoff and scoping teleconference was held between the Army PA team and the representatives from the FTWW Sub-Installations.

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

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

A Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP) was developed and finalized in October 2019 for the USAEC PFAS PA/SI (Arcadis 2019). The PQAPP details general planning processes for collecting data and describes the implementation of quality assurance (QA) and quality control (QC) activities for the SI portion for Army installations nationwide. Additionally, a sub-installation-specific QAPP Addendum was developed to define the DQOs, present the sampling design and rationale, and provide qualifications for project personnel (Arcadis 2022). The SI field work was completed in accordance with the PQAPP (Arcadis 2019) and the approved sub-installation-specific QAPP Addendum (Arcadis 2022). A Site Safety and Health Plan (SSHP) was also developed as an attachment to the QAPP Addendum to identify specific health and safety hazards that may be encountered at the sub-installations during sampling. The SSHP was designed to supplement the Accident Prevention Plan (Arcadis 2018), which was developed for Army installations nationwide. The QAPP Addendum and SSHP were submitted to the installation and finalized before commencement of field work.

The DQOs, sampling design and rationale, and field methods employed for the SI are summarized from the QAPP Addendum developed for the FTWW Sub-Installations (Arcadis 2022) 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 sub-installations 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 Pace Analytical, a laboratory which is DoD Environmental Laboratory Accreditation Program (ELAP)-accredited for PFOS, PFOA, PFBS, PFNA, and PFHxS analysis by liquid chromatography with tandem mass spectrometry and compliant with the DoD Quality Systems Manual (QSM) 5.3 (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 SUB-INSTALLATION OVERVIEW

The following subsections provide general information about each of the FTWW Sub-Installations, including the location and layout, the sub-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

The locations of the FTWW Sub-Installations included in the PFAS PA/SI are shown on **Figure 2-1**.

- HFT is comprised of about 203 acres, is the southern end of the Haines to Fairbanks pipeline and is located between the Chilkat and Chilkoot inlets on the Chilkat Peninsula, at Tanani Point, approximately 2.9 miles north of Haines. Haines is a census-designated place located in Haines Borough, Alaska. Tanani Point is located along the shoreline of Tanani Bay. HFT is comprised of two, non-contiguous portions on either side of Lutak Road. Haines is located approximately 70 air miles north of Juneau, Alaska, just south of the Canadian border, and approximately 600 air miles southeast of Anchorage, Alaska (Bristol Environmental Remediation Services, LLC [Bristol] and North Wind, Inc. [North Wind] 2020) (**Figure 2-2a**).
- TFT is comprised of about 202 acres and is located 7 miles west of Tok Junction along the Tanana River (Bristol and Fairbanks Environmental Services [FES] 2019) (**Figure 2-2b**).
- SCPS is comprised of about 11.24 acres and is located southeast of FTWW along the Alaska Highway, approximately 50 miles southeast of Delta Junction, Alaska and 60 miles northwest of Tok, Alaska. The nearest community is Dot Lake, approximately 12 miles to the southeast (Bristol and FES 2018) (**Figure 2-2c**).
- GRTS is comprised of about 20,000-acres and is located about 20 miles southeast of Delta Junction, Alaska and lies between Granite Mountain and the Gerstle River, approximately 3 miles south of the Alaska Highway (U.S. Army Garrison FTWW 2013) (**Figure 2-2d**).

2.2 Mission and Brief Site History

- HFT was constructed in 1954 to provide facilities for tanker dockage, bulk fuel storage and a pipeline system (HFP) to deliver fuel to FTWW and Eielson Air Force Base, both located near Fairbanks, Alaska. HFT was an active fuel storage and pumping facility from 1955 until 1971 when the use of the HFP was discontinued (Bristol and North Wind 2020).

  Following the termination of the HFP operation in 1971, HFT was used for fuel storage from 1971 through 1988. The capacity of the tanks at HFT was 380,000 barrels of fuel stored in 13 above ground storage tanks (ASTs) until 1988, when storage operations ceased. Two of the tanks were removed in 2001, and the remaining tanks were removed in 2003 (Haas 2012; Bristol and North Wind 2020). In addition, all buildings located at HFT were removed in 2005. The majority of underground fuel piping was removed during pipeline investigation activities in 2015 and 2016 during a remedial investigation conducted to explore fuel contamination. HFT had a fuel tank farm, burn pits, various administrative and maintenance buildings (including a firefighting foam storage building), and small housing units onsite during their time of operation. The firefighting foam storage building was located within the tank farm, and piping ran from the firefighting foam storage building to the various tanks (Bristol and North Wind 2020).

The land occupied by and surrounding the HFT is a combination of land withdrawn from the public domain and land acquired from private owners. The area within the HFT boundary is composed entirely of land acquired from private ownership from two homesteads patented in the 1920s. Many site investigations have been conducted by numerous contractors over the past 20 years at HFT. These activities were governed by individual work plans, with the results documented in numerous task specific reports including geologic and hydrogeologic investigation, source area evaluations, removal actions, soil gas surveys, well drilling, tracer tests, and in-situ air sparging system operations (Bristol and North Wind 2020).

- TFT operated from the mid-1950s to 1979 as a fuel pumping and storage facility for the HFP. Similar to HFT, TFT had a fuel tank farm (consisting of 13 bulk fuel ASTs with a total capacity of 286,000 barrels), burn pits, various administrative and maintenance buildings (including a fire foam building), and small housing units onsite during their time of operation. The fire foam building was located within the tank farm, and piping ran from the fire foam building to the various tanks. After the HFP ceased operations, the tank farm continued to be used for storage until 1979. The remaining fuel in storage at TFT was pumped out in 1979. Demolition and removal of the buildings, fuel tanks, and aboveground utilities was completed at TFT in 2002 and 2003, though some structures do remain onsite. Remaining structures included a waterline, concrete footing, asphalt tank pad material, buried utilidors, a burn pit, underground piping, and perimeter fencing. The burn pit liner and underground piping were removed from TFT in 2015 during a remedial investigation conducted to explore fuel contamination (Bristol and FES 2019).

  Many site investigations have been conducted by numerous contractors over the past 20 years at TFT. These activities were governed by individual work plans, with the results documented in numerous task specific reports including geologic and hydrogeologic investigation, source area evaluations, removal actions, soil gas surveys, well drilling, tracer tests, and in-situ air sparging system operations (Bristol and FES 2019).

- SCPS was one of six booster stations constructed in 1961 along the HFP to increase pressure and flow through the HFP. SCPS included a composite building (which housed generators, pumps, engines, mechanical rooms, an office, a storage and refrigeration area, and a garage), clean stations, a burn pit, and small housing units (Bristol and FES 2018). The HFP and SCPS ceased operations in 1971. Most of the infrastructure at SCPS was removed in 2015, except the composite building. The septic system piping from the composite building to the septic tank was decommissioned in place.

  Several site investigations have been conducted by numerous contractors over the past 20 years at SCPS. These activities were governed by individual work plans, with the results documented in numerous task specific reports (Bristol and FES 2018).

- GRTS was used as a chemical warfare materiel and munitions testing facility from 1954 through 1967. GRTS housed a laboratory as well as living and dining quarters. GRTS is still an active military facility but is now used only as a maneuver training area. Buildings have been demolished at the facility (U.S. Army Garrison FTWW 2013).

Several site investigations have been conducted by numerous contractors over the past 20 years at GRTS. These activities were governed by individual work plans, with the results documented in numerous task specific reports (U.S. Army Garrison FTWW 2013).

2.3 Current and Projected Land Use

Currently, three of the four FTWW Sub-Installations are not in use, and one is an active military training facility. Future land use has not been determined. There are currently no permanent site workers or residents at the facilities. Additional details for land use surrounding each of the FTWW Sub-Installations is noted below.

- **HFT:** Currently the Army owns 203 acres within the HFT boundary; land within the intertidal zone below the mean high tide (approximately 15.8 feet) is owned by the state of Alaska (Bristol and North Wind 2020). The land within the boundary of HFT is zoned as heavy industrial, although not currently in use. The areas of the HFT property located south and east of Lutak Road are zoned as waterfront/waterfront industrial. A small portion of the property to the southwest of the fenced area of HFT is zoned for rural mixed use (Bristol and North Wind 2020).
- **TFT:** Of the 202 acres owned by the Army, approximately 65 acres of the TFT property is currently fenced (i.e., the main terminal and AST areas); the current land use designation is industrial, although not currently in use. Future land use has not been determined. The land surrounding the TFT on the east, north, and west sides is owned by the State of Alaska Department of Natural Resources. Some private land is located to the south, between the TFT and the Alaska Highway (Bristol and FES 2019).
- **SCPS:** The entire facility is fenced. The land surrounding SCPS is owned by the State of Alaska Department of Natural Resources. A gravel pit used by the State of Alaska Department of Transportation is located west of the facility. The land within the boundary of SCPS is zoned as industrial, although not currently in use (Bristol and FES 2018).
- **GRTS:** Historical buildings including the laboratory, dining facilities, and quarters for site personnel have been demolished at the facility. GRTS is still an active military facility but is now used only as a maneuver training facility. GRTS will continue to be used as an active training area in the future (U.S. Army Garrison FTWW 2013).

2.4 Climate

- **HFT:** is located in the maritime climate zone and has relatively mild winters and summers. The average snowfall is 262 inches per year with an average annual precipitation of 48.51 inches per year (National Oceanic and Atmospheric Administration 2021; Bristol and North Wind 2020). The average number of days with any measurable precipitation is 149. On average, there are 84 sunny days per year in Haines, Alaska. The July high is around 64 degrees Fahrenheit (°F). The January low is -18°F (U.S. Climate Data 2021).
- **TFT:** Climate at the TFT is typical of the subarctic region of interior Alaska. This includes large diurnal and seasonal temperature variation, low precipitation, and low humidity. Average temperatures from the nearby community of Tok range from an average low of -24 °F in January to an average high of

73 °F in July. The average annual precipitation is 9.8 inches, and the average snowfall is 36 inches (Western Regional Climate Center 2018).

- **SCPS:** Climate at SCPS is typical of the subarctic region of interior Alaska. This includes large diurnal and seasonal temperature variation, low precipitation, and low humidity. Average temperatures from the nearby community of Dot Lake range from an average low of -22 °F in the winter (December to February) to an average high of 65 °F in summer (June to August). The average annual precipitation is 11.1 inches, and the average snowfall is 27 inches (Bristol and FES 2018).
- **GRTS:** has the northern continental climate of interior Alaska, which is characterized by short, moderate summers; long, cold winters; and low precipitation and humidity. Weather is influenced by mountain ranges on three sides that form an effective barrier to the flow of warm, moist maritime air during most of the year. Surrounding upland areas tend to aid drainage and the settling of cold Arctic air into Tanana Valley lowlands (U.S. Army Garrison FTWW 2013). Average temperatures from the nearby community of Delta Junction range from an average low of -10 °F in the winter (December to February) in the winter to an average high of 69 °F in summer (June to August). The average annual precipitation is 1.2 inches, and the average snowfall is 3.5 inches (National Oceanic and Atmospheric Administration 2022).

2.5 Topography

- **HFT:** The land surface elevation is greatest at the central western edge (approximately 530 feet above mean sea level [amsl]) of HFT. The ground surface slopes northeastward, eastward, and southeastward to sea level to the Chilkoot Inlet. The southern portion of HFT, where the former administrative buildings were located, is relatively flat at approximately 50 feet amsl (**Figure 2-2a**).
- **TFT:** The regional topography slopes west and north towards the Tanana River, which is approximately 2 miles north of TFT. The southern half of TFT, the former main terminal area, is relatively flat and ranges in elevation from approximately 1,585 feet amsl to 1,595 feet amsl. The topography breaks sharply in the center of TFT, rising to a hilltop in at the northern boundary, with a maximum elevation of approximately 1,805 feet amsl. The former bulk fuel storage ASTs and firefighting foam pipelines were located on the hillside (Bristol and FES 2019) (**Figure 2-2b**).
- **SCPS:** The regional topography slopes west and north towards the Tanana River, which is approximately 2 miles north of SCPS. Topography where the SCPS facilities are located is relatively flat; however, the topography rises sharply immediately to the south of SCPS, with the greatest elevation being approximately 1,349 feet amsl. The closest surface water body is the Johnson Slough, which is 0.4 mile north of SCPS, and north of the Alaska Highway (Bristol and FES 2018) (**Figure 2-2c**).
- **GRTS:** The regional topography is relatively flat. The terrain slopes from around 1,300 feet at the northwestern edge upward to nearly 3,400 feet toward the southwestern edge of the GRTS (U.S. Army Alaska 2011) (**Figure 2-2d**).

2.6 Geology

- **HFT:** HFT is situated on the Chilkat block of the Coastal Granite Plutonic Complex, in southeastern Alaska. The regional geology is controlled by the active plate boundary of the northern Pacific Basin (Redman et al. 1984, as cited in Bristol and North Wind 2020). Major strike-slip right-later faults with near-horizontal displacement have caused large- and small-scale displacement (Peapple et al. 1999, as cited in Bristol and North Wind 2020). The linear river valleys and marine inlets in the HFT region are controlled by these major faults (Bristol and North Wind 2020). The oldest rocks in the HFT area are Early Cretaceous metabasalt of the Chilkat block. Exposed bedrock near the HFT consists of the metamorphic and hornblende diorite igneous rocks. The surficial deposits of the region predominantly consist of glacial and glacial-marine sediments (Peapple et al. 1999, as cited in Bristol and North Wind 2020). The till at the HFT has an abundance of gravel and cobbles, but also includes sand and silt with variable clay content. The gravel and cobble-size material reflects the local bedrock. The glacial till is generally poorly sorted, unstratified, and compact. Previous glaciation has scoured earlier sediments and the underlying bedrock. The HFT also contains colluvium and artificial fill (Bristol and North Wind 2020).

  A bedrock ridge composed of diorite is evident in the subsurface extending from Tanani Point to the area near the HFT fuel dock. A bedrock low, or trough, is present to the west of the bedrock ridge. The trough is either the result of glacial scour or from faulting. Several channels have been eroded through the bedrock ridge before the deposition of surficial sediments following the most recent glacial advance. These channels may offer preferential pathways for groundwater flow (Bristol and North Wind 2020).

- **TFT:** The TFT is located in the Tanana Lowland where the geology generally consists of gravel, sand, and silt deposits along alluvial streams, outwash fans, and wind-deposited loess. Till deposits (a heterogeneous mixture of cobbles, gravel, sand, silt, and clay transported by glaciers) are also found in the Tanana Lowland. The main terminal area is located on a Pleistocene alluvial gravel plain; the alluvium is described as poorly graded gravels and sands with cobbles and minor silt content to a depth of at least 55 feet below ground surface (bgs). Bedrock is of mafic volcanic origin and is encountered as shallow as 1 to 17 feet on the hillside where the bulk fuel ASTs were located (Holmes 1965, as cited in Bristol and FES 2019).

- **SCPS:** The geology at SCPS is similar to that of TFT (i.e., that of the Tanana Lowland area). The native soil material overlays bedrock, which was identified between 55 and 60 feet bgs in borings completed at SCPS during previous investigations (North Wind 2010, as cited in Bristol and FES 2018).

- **GRTS:** Most of GRTS is composed of Quaternary glacial deposits. Climactic fluctuations during the Quaternary Period caused glacial expansion and recession. While central Alaska was not glaciated, glaciers during glacial advances surrounded the area. Rivers flowing from glaciers deposited several hundred feet of silt, sand, and gravel in the Tanana and Yukon valleys. Soils are derived from glacial actions and modified by streams and discontinuous permafrost. Isolated patches of permafrost exist under GRTS's sandy gravel from 2 to 40 feet bgs. Thickness of permafrost varies between 10 to 118 feet. Existing and abandoned river channels, lakes, wetlands, and other low-lying areas are permafrost-free (U.S. Army Garrison FTWW 2013).

2.7 Hydrogeology

- **HFT:** The fine-grained sediments of the HFT dramatically limit the productivity and transmissivity of groundwater aquifers at HFT. Additionally, the fine-grained sediments tend to isolate stratigraphic units of slightly higher transmissivity into separate and often discontinuous individual aquifers. The different geologic strata deposited at separate times and by different methods at HFT transmit groundwater in different directions with distinctly different hydrological properties, resulting in six distinct aquifers: the bedrock fractures within the granite-diorite aquifer, discontinuous sands and gravels overlying bedrock aquifer, perched emergent beach aquifer, deep aquifer underlying confining layer (artesian), marine varve aquifer, Northern Tank Farm aquifer, and the perched upper colluvium aquifer. A review of previous sampling data indicates that monitoring wells at the HFT can be pumped at rates that range from a few gallons per hour to as little as less than one quart per hour. There are currently 100 active monitoring wells at HFT, installed in various water-bearing strata. Groundwater flow is northeastward, eastward, and southeastward from the southwestern topographic high toward the Chilkoot Inlet (Bristol and North Wind 2020) (**Figure 2-2a**).
- **TFT:** The hydrogeology of the Tanana Lowland includes unconfined and confined conditions. The unconfined groundwater is generally found in unconsolidated material in valleys and fractured bedrock underlying high slopes and ridges. Confined groundwater occurs as a result of permafrost or other impermeable sedimentary layers and is generally found under artesian conditions (HLA/Wilder 2004, as cited in Bristol and FES 2019). Groundwater underlying the main terminal area is unconfined and generally encountered between approximately 28 to 33 feet bgs, and on the hillside between 92 to 117 feet bgs. Based on static water levels measured in bedrock and alluvial wells in 2015, the unconfined groundwater at TFT is likely part of the regional aquifer of the Tanana Lowlands (Bristol and FES 2019). Groundwater flow in the main terminal area is predominately to the west. Groundwater flow within the bedrock underlying the hillside has a slight southwest component on the east side of the hill, changing to a slight northwest components on the west side of the hill (Bristol and FES 2019) (**Figure 2-2b**).
- **SCPS:** The hydrogeology at SCPS is similar to that of TFT. Groundwater underlying SCPS is encountered between approximately 32 and 52 feet bgs. The shallowest groundwater is found on the south edge of SCPS. Groundwater flow is northwesterly on the east side of and in the middle portion of SCPS, and northeasterly in the southwest corner of SPCS. This is generally consistent with site topography. A steeper gradient appears to exist at the southern end of SCPS, which may be a result of bedrock influence on the alluvial aquifer in the area. Seasonal water table fluctuations are between 0.8 and 5.4 feet (Bristol and FES 2018) (**Figure 2-2c**).
- **GRTS:** Groundwater underlying GRTS is encountered at depths less than 200 feet bgs. Seasonal fluctuation varies from 20 to 60 feet in response to recharge from river and stream channels, and from precipitation. Water levels are lowest in late May or early June, after which recharge from surface waters reaches the aquifer. The groundwater levels rise through the summer and peak in October, after which the rivers freeze and recharge ceases (U.S. Army Alaska 2011) (**Figure 2-2d**).

2.8 Surface Water Hydrology

- **HFT:** HFT is surrounded to the northeast, east, and southeast by the Chilkoot Inlet. Several groundwater seeps are present along the coastline in the intertidal zone (**Figure 2-2a**). Otherwise, no permanent surface water features are present within HFT (Bristol and North Wind 2020).
- **TFT:** There are no permanent surface water features on or immediately surrounding the TFT. The nearest surface water body is the Tanana River, approximately 2 miles to the north (Bristol and FES 2019).
- **SCPS:** The closest surface water body is the Johnson Slough, which is 0.4 mile north of SCPS, and north of the Alaska Highway. The slough empties into the Tanana River near the confluence of the Johnson and Tanana Rivers 3 miles northwest of the SCS. The Tanana River is approximately 2 miles north of SCPS (Bristol and FES 2018).
- **GRTS:** GRTS lies entirely within the Tanana River drainage basin. The area has a number of glacial features, including terminal moraines, outwash fans, braided streams, kettle lakes, and loess deposits. Sawmill Creek drains the majority of the GRTS, while some drains into the Gerstle River. Both are tributaries of the Tanana River (U.S. Army Garrison FTWW 2013) (**Figure 2-2d**).

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 the FTWW Sub-Installations.

2.9.1 Stormwater Management System Description

There is no record specifying the construction details of the stormwater management systems for any of the sub-installations at FTWW.

2.9.2 Sewer System Description

- **HFT:** One septic system was identified at HFT. It was located on the southeast side of the administration area. The septic system was originally designed and constructed with a septic tank only. The effluent from the septic tank was drained to the beach southeast of the facility. A leach field was installed east of the septic tank sometime after the facility began operation. After the leach field was constructed, the effluent was permanently diverted to the leach field. The septic system was assumed to be demolished during the 2004 removal action (Bristol and North Wind 2020).
- **TFT:** Two septic systems were identified at the TFT. The primary system was located north of the former housing area on the east side of the main terminal area. Sewer lines from each building were 8-inches in diameter and were routed across TFT in a 24-inch utilidor. The sewer lines were connected to a 12,000-gallon septic tank which has been abandoned. This septic system was reportedly constructed with six leaching wells and a leach field was installed east of the septic tank sometime after the facility began operation. The six leaching wells stretched over 200 feet in a north-south orientation approximately 120 feet east of the septic tank. In 2005, efforts were made to locate

the leaching wells by excavating to a depth of 11 feet bgs, but no evidence of the wells was found. It was assumed that they were demolished during the 2004 removal action. A second septic system associated with the trailer court south of the main terminal area was identified on as-built drawings. However, no construction details were available, and the system was not investigated prior to closure (North Wind 2007, as cited in Bristol and FES 2019).

- **SCPS:** One septic system was identified at SCPS. It was removed in 2015 along with the associated dry well, drain line, septic lines, and leach wells. The septic system piping was decommissioned in place (Bristol 2016, as cited in Bristol and FES 2018).
- **GRTS:** One septic system was identified at GRTS. It serviced the former administrative building and was used for domestic waste. The septic system was demolished and closed in the fall of 2013. All buildings have been demolished and no permanent structures remain (USAEC 2017).

Septic tanks at all sub-installations were uncovered using an excavator, and any remaining liquid in the tanks were removed and disposed of by a local septic pumping service. If the tank was concrete, a pavement breaker attachment mounted on a skid steer was used to break the bottom of the tank. The upper portions of concrete walls were collapsed into the tank and the lid was broken up and put into the tank. Leach wells were located by following the piping downstream of the septic tanks and then removed. Lime was applied to the septic tank excavations before backfilling. In order to eliminate a potential pathway for future migration of contaminants, existing floor drains were plugged, and piping associated with dry wells and septic systems were removed or demolished (Bristol 2016).

2.10 Potable Water Supply and Drinking Water Receptors

- **HFT:** A surface water catchment reservoir and dam located northwest of the HFT was used for the procurement of water during the operation of the facility. The water was transferred to the HFT by way of a fresh-water pipeline. The surface water reservoir is still operational and provides water for the Alaska Marine Highway System terminal. No wells were found to have sufficient storativity and transmissivity to provide water service to the facility during the period of HFT operation. During the remedial investigation conducted by Bristol and North Wind in 2020, groundwater at HFT was considered to be a drinking water source, (Bristol and North Wind 2020).
- **TFT:** Though a water supply well is noted to still exist at the TFT facility (Bristol and FES 2019), the well was not specified as potable use and no potential receptors exist on-post. TFT is surrounded by State of Alaska-owned land to the west, north, and east, with some private properties located to the south. Though no private wells are listed near the property in the Alaska Well Log Tracking System, two residential water wells may exist approximately 2,000 feet upgradient and cross-gradient of groundwater flow direction from TFT, south of the facility (Bristol and FES 2019).
- **SCPS:** Groundwater underlying SPCS is not used for drinking water or for agricultural purposes, though the water supply well installed in 1961 remains in place at the composite building (Bristol and FES 2018). No other drinking water wells are known to be located in the vicinity of the facility (Bristol and FES 2018).
- **GRTS:** Groundwater underlying GRTS is not used for drinking water or for agricultural purposes. A drinking water well associated with the former chemical test facility at GRTS was installed in 1955,

however it has since been abandoned. The next nearest well is approximately 3.8 miles northeast of GRTS. No other drinking water wells are known to be located in the vicinity of the facility (U.S. Army Garrison FTWW 2013). Information on where personnel at GRTS for training purposes obtain their water supply was not available.

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 the FTWW Sub-Installations, which along with state and county geographic information system provided by the installation identified several off-post public and private wells within 5 miles of the installation boundary (**Figure 2-3a** through **Figure 2-3d**). The EDR report providing well search results provided as **Appendix D**.

2.11 Ecological Receptors

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

- **HFT:** Upland terrestrial habitat associated with the HFT and surrounding area is within and consistent with the coastal western hemlock-Sitka spruce forest ecoregion (Alaska Department of Environmental Conservation [ADEC] 1999, as cited in Bristol and North Wind 2020). Undisturbed old growth forest is present to the west of HFT, which is bounded to the east by Lutak Inlet and to the south by Tanani Bay. The HFT was clear cut and maintained during historical operations, but vegetation is recovering across the area since operations ceased. Bare ground and sparse grasses and weedy vegetation is present in association with former ASTs, especially in association with pads/footings and berms, with grasses dominant in containment basins and scrub-shrub and young trees dominant in areas surrounding the former tanks and associated containment berms. More developed young forest composed of young alder, spruce and, and understory dominated by herbaceous cover and willow, is present in surrounding areas especially in areas outside of former tank-containment berm footprints and access roads (Bristol and North Wind 2020). Overall habitat quality within the tank berms and footings is generally poor but is moderate to good quality throughout adjacent areas, which include including undisturbed old growth forest off site along the western and northern extent of the area.

  Wildlife in the Southeast ecoregion includes large and small terrestrial mammals, and resident and migratory birds. No formal wildlife surveys or other quantitative biological surveys or sampling have been conducted at HFT. Large terrestrial mammals identified as occasional visitors at the HFT include brown bear, black bear, and moose, all of which are recreationally hunted in Alaska. Coyotes have also been observed at HFT. While not observed at the HFT, weasels (marten, short-tailed weasels) are known to occur regionally. However, for each of these wide-ranging species, site presence is not expected to be significant, as home ranges far exceed the footprint of the former Bulk Fuel Storage Area and HFT site as a whole. Therefore, presence and population density for these species is expected to be very low and site presence insignificant. The former Bulk Fuel Storage Area does not provide a sufficiency of ecological resources to support game or commercially valuable animal populations. Birds observed at the overall HFT site include bald eagles, crows, ravens, magpies, gray jays, Steller's jays, and other passerines (Bristol and North Wind 2020). State and/or federally listed (threatened or endangered) species regulated by the Alaska Department of Fish and Game and/or U.S. Fish and Wildlife Service are not expected at HFT.

- **TFT:** Habitat at TFT is upland terrestrial; no water bodies are present on TFT. TFT is located in the Interior Bottomlands ecoregion and Tanana Lowlands subregion of Alaska. Long warm summer days promote significant terrestrial vegetative growth. Forests are generally dominated by close stands of broadleaf, needle leaf, and mixed woodlands with intermixed tall scrub-shrub communities and smaller areas of bogs, marshes, and wet grassy meadows. Needle leaf forests typically include black spruce in poorly drained/wet areas and white spruce in drier areas (Bristol and FES 2019). Undisturbed forest occupies about 40 percent (%) of TFT. Other tree species include white birch, balsam poplar, and quaking aspen. Wildlife in the region includes large and small terrestrial mammals, and resident and migratory birds. No formal wildlife surveys (i.e., systematic bird and/or mammal identification and abundance surveys) or other quantitative biological surveys or sampling have been conducted at TFT. Large terrestrial mammals identified as occasional visitors at TFT include bear, moose, and fox. Small terrestrial mammals known to occur in the ecoregion may include meadow voles, common shrews, meadow jumping mice, arctic ground squirrels, and weasels. Additionally, upland passerine/small bird species and non-passerine bird species are common and abundant in the region (i.e., jays, sparrows, thrushes, sooty grouse, rock ptarmigan) (ADEC 1999b, as cited in Bristol and FES 2019). State and/or federally listed (threatened or endangered) species regulated by the Alaska Department of Fish and Game and/or U.S. Fish and Wildlife Service are not expected at TFT.
- **SCPS:** Vegetative cover is comprised of weedy plants, grasses, and low shrubs, While exposure to ecological receptors within SCPS is possible, given the small footprint of the area, significant exposure to higher trophic level receptors (birds and mammals) is not expected when considering wildlife home ranges (Bristol and FES 2018). State and/or federally listed (threatened or endangered) species regulated by the Alaska Department of Fish and Game and/or U.S. Fish and Wildlife Service are not expected at SCPS.
- **GRTS:** There are two recognized cover types at GRTS: open, low growing spruce forests and closed, spruce-hardwood forests. The only plant species of concern within GRTS is *Carex atratiformis*. Moose and bison are the most visible wildlife species at GRTS. GRTS is a portion of the Delta Junction Bison Range Management Area. Bison move to the Delta Bison Range during July through August when they move north of the Alaska Highway into the agricultural fields. Bison are most found on GRTS during winter. Large predators including grizzly and black bears, wolves, foxes, martens, coyotes, wolverines, lynx, and snowshoe hare are also found on GRTS (U.S. Army Garrison 2013). State and/or federally listed (threatened or endangered) species regulated by the Alaska Department of Fish and Game and/or U.S. Fish and Wildlife Service are not expected at GRTS.

2.12 Previous PFAS Investigations

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

Several areas were investigated for PFAS constituents at three of the four FTWW Sub-Installations. The approximate historical PFAS sampling locations and analytical results are shown on **Figure 2-4a** (HFT; Bristol and North Wind 2020), **Figures 2-4b through 2-4d** (TFT; Bristol and FES 2019), and **Figure 2-4e** (SCPS; Bristol and FES 2018). The data are provided on **Table 2-1**. Data qualifiers shown are defined as provided in the referenced reports (Bristol and North Wind 2020, Bristol and FES 2019) where 'J' indicates that the result qualified as an estimate because it was less than the limit of detection (LOD) and 'QN' indicates that the result qualified as an estimate due to a quality control issue. Historical soil data are reported in milligram per kilogram (mg/kg), or parts per million, and historical groundwater data are reported in ng/L, or parts per trillion.

- **HFT:** Four soil samples were collected at HFT as part of a remedial investigation conducted in 2015 and 2016. PFOS was detected in two of the three soil samples from near a former fire foam building at concentrations of 0.0029 mg/kg and 0.0055 mg/kg. PFOA was not detected at concentrations greater than the LOD in any of the soil samples collected. PFBS, PFNA, and PFHxS were not analyzed for in the soil samples collected during this investigation. Groundwater samples were not collected at HFT.
- **TFT:** Eighteen soil samples and two groundwater samples were collected at TFT as part of a remedial investigation conducted in 2015. PFOS, PFOA, PFBS, and/or PFHxS were detected in three of the soil samples at maximum concentrations of 0.0036 mg/kg, 0.0015 mg/kg, 0.00037 J, and 0.083 QN, respectively. PFNA was not detected at concentrations greater than the LOD in the soil samples collected. PFHxS was detected in one groundwater sample at TFT at a concentration of 55 ng/L. PFOS, PFOA, PFBS, and PFNA were not detected at concentrations greater than the LOD in the groundwater samples collected.
- **SCPS:** Five soil samples and three groundwater samples were collected at SCPS as part of a remedial investigation conducted in 2015. PFOS and PFOA were not detected at concentrations greater than the LOD in the soil or groundwater samples collected. PFBS, PFNA, and PFHxS were not analyzed for in the soil or groundwater samples collected during this investigation.
- **GRTS:** At the time of the PA, no historical investigations for PFAS-constituents had been conducted at GRTS.

The analytical method utilized for these samples was proprietary method DV-LC-0012 (i.e., Test America Denver method), whereas samples collected in accordance with the PQAPP (Arcadis 2019) would be analyzed by liquid chromatography/tandem mass spectrometry, compliant with Table B-15 of the DoD Quality Systems Manual 5.1.1 (or later version as the laboratory obtains updated certification [DoD 2018]). While the DV-LC-0012 method employed to analyze samples collected in 2015 and 2016 was not the same as the current DoD QSM, the fundamentals of the method procedures are the same for as those required by QSM 5.1 and later versions. The DV-LC-0012 method uses solid phase extraction and isotope dilution for quantification. The QSM does have more stringent acceptance criteria for surrogate recoveries, which results in additional laboratory reanalysis of the samples relative to the older Denver method. Laboratory detection limits have been lowered and PFAS sampling field methods have improved since the 2015 and 2016 investigations, and PFAS constituents may be present at additional areas at the FTWW Sub-Installations at concentrations greater than the current laboratory detection limits

The historical analytical results obtained through field activities prior to this PA/SI are described in more detail in the context of the site history for each AOPI identified in **Section 5.2**.

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 the FTWW Sub-Installations, data was collected from three principal sources of information and are described in the subsections below:

1. Records review
2. Personnel interviews at FTWW only
3. Site reconnaissance at FTWW only

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 E**) during the PA process for the FTWW Sub-Installations is presented in **Section 4**. Further discussion regarding rationale for not retaining areas for further investigation is presented in **Section 5.1**, and further discussion regarding categorizing areas as AOPIs is presented in **Section 5.2**.

3.1 Records Review

The records reviewed for this PA included, but were not limited to, various Installation Restoration Program administrative record documents, compliance documents, FTWW directorate of public works documents, and geographic information system files. Internet searches were also conducted to identify publicly available and other relevant information. A list of the specific documents reviewed for the FTWW Sub-Installations is provided in **Appendix E**.

3.2 Personnel Interviews

Interviews were conducted during the site visit at FTWW proper. The list of roles for the FTWW installation personnel interviewed during the PA process for FTWW is presented below (affiliation is with FTWW unless otherwise noted).

- Installation Restoration Program Manager
- Resource Planning Chief
- Compliance Program Manager
- USACE Project Manager (Alaska District)
- Current USACE Environmental Division Regional POC
- Former USACE Environmental Division Regional POC (Alaska District)
- USACE Technical Lead (and former Project Manager for the remedial investigations at HFT, TFT, and SCPS)

No interviews were conducted during the PA process for the FTWW Sub-Installations because no personnel are stationed at the sub-installations.

3.3 Site Reconnaissance

Due to the remote locations of the FTWW Sub-Installations and because no personnel were stationed at the sub-installations to escort the PA team, site reconnaissance and visual surveys were not conducted during the PA. A desktop PA was conducted for the FTWW Sub-Installations to identify preliminary locations where PFAS containing materials may have been used, stored, or disposed at the FTWW Sub-Installations based on the records review process, information obtained during the installation site visit in-brief meeting, and personnel interviews. Historical reports were available to allow review of existing groundwater monitoring well locations for potential SI sampling.

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

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

4.1 AFFF Use, Storage, and Disposal Areas

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

PFAS-containing materials including fluoroprotein foams and AFFF may have been used, stored, or disposed at the FTWW Sub-Installations. PFAS-containing foams could have been used, stored, or disposed at a burn pit and/or soil piles at TFT, where PFAS constituents have historically been detected in soil and groundwater. PFAS-containing materials may have also been used, stored, or disposed at the fire-related buildings (e.g., fire pump building, firehouse building, and hose cart building) noted on **Figure 2-4a** at HFT (described further in **Section 5**).

Limited information is available regarding the historical operations at the FTWW Sub-Installations as related to use, storage, and/or disposal of PFAS-containing materials. No fire training areas, nozzle testing areas, or fire stations have been reported at the FTWW Sub-Installations.

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

Following document research and personnel interviews, other potential PFAS source types were not identified at the sub-installations or did not warrant further research or constitute categorization as AOPIs, except for one burn pit area at TFT. PFAS constituents were detected in samples collected in previous investigations at one former burn pit area, as described further in **Section 5.2**. Burn pits at which no PFAS constituents were detected in soil during previous PFAS investigations were not retained for further investigation (per the rationale described further in **Section 5.1**). The intent of burn pit operations is to allow materials to burn completely, and use of firefighting foams is not likely. No evidence of use, storage, or disposal of PFAS-containing materials at other former burn pits at the FTWW Sub-Installations was identified based on personnel interviews or historical records during the PA process.

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 the FTWW Sub-Installations) is not part of the PA/SI. However, potential off-post PFAS sources within a 5-mile radius of the FTWW Sub-Installations that were identified during the records search are described below.

The Haines Airport lies on the Chilkat Inlet approximately 3.25 miles southwest of HFT. Also, The Tanacross Airfield lies approximately 3.5 miles west-northwest of TFT, near the Tanana River. AFFF is commonly stored in airport hangars and near flightlines for use in potential aircraft fire responses, so there is a potential for PFAS impacts to soil and/or groundwater associated with these airports.

No readily identifiable potential off-post PFAS sources were noted for the SCPS or GRTS FTWW sub-installations.

5 SUMMARY AND DISCUSSION OF PA RESULTS

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

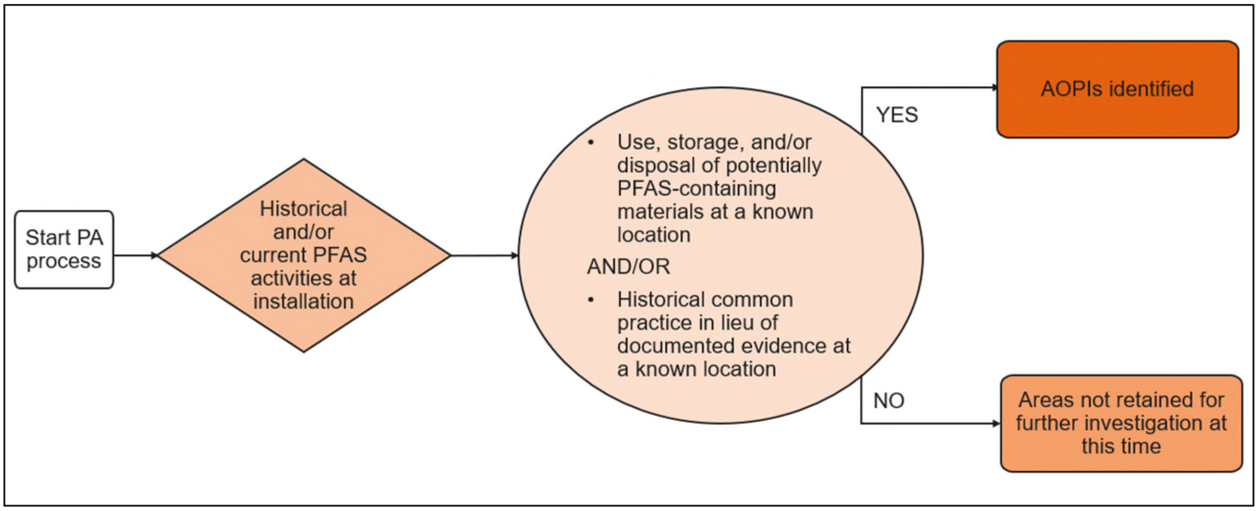

Figure 5-1: AOPI Decision Flowchart

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

Data limitations for this PA/SI at the FTWW Sub-Installations 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. Sub-Installation Areas Not Retained for Further Investigation

Sub-Installation / Area Description	Dates of Operation	Relevant Site History	Rationale
HFT: Incinerator	Unknown (likely 1954 to 1971)	Fired by a diesel oil burner, the incinerator was used to burn garbage under all weather conditions. There is no documentation of AFFF use.	No evidence of use, storage, or disposal of PFAS-containing materials based on historical documents and interviews. Waste burned at incinerators is typically allowed to burn to ash, and use of PFAS-containing foams to extinguish the burning waste is not likely.
HFT: Lutak Burn Pit	Approximately 1963 to 1997	The burn pit was constructed as a replacement to the Tank Farm Burn Pit when Tank 100 was built. The burn pit perimeter was defined by a metal ring approximately 40 feet in diameter by 1 foot tall, and the pit was approximately 5 feet deep. Waste fuel was burned in the pit. In 1997, approximately 1,800 cubic yards of soil was removed from the former Lutak Burn Pit and stockpiled in an area north of the former Quarters Area (i.e., just north of former Buildings 1213 and 1214). The contaminated soils were later transported to Juneau for treatment in 1999. The excavated area was approximately 60 feet in diameter and reached a depth of 24 feet. Bedrock was exposed in the southern portion of the excavation at 24 feet bgs. Piping was also removed within the limits of the excavation. The excavation was reportedly covered with large boulders and a liner (Bristol and North Wind 2020).	The site has been excavated, and there is no evidence of use, storage, or disposal of PFAS-containing materials. PFOS and PFOA were analyzed in a soil sample collected 12 to 13 feet bgs as part of a historical investigation, but were not detected.
HFT: Lutak Excavation Soil Stockpiles	1997	Approximately 1,800 cubic yards of excavated soil from the Lutak Burn Pit was reportedly stockpiled north of the former Quarters Area, north of Buildings 1213 and 1214 (Bristol and North Wind 2020). Soil excavated from the Lutak Burn Pit was reportedly transported offsite for treatment and disposal in Juneau in 1999. Confirmatory sampling was conducted in the area for petroleum constituents from the ground surface under the stockpiles after they were removed.	The stockpiles have been removed and were unlikely to have contained PFAS constituents based the likely use of the burn pit from which the soil was excavated. There is no evidence of use, storage, or disposal of PFAS-containing materials in the stockpiles.

Sub-Installation / Area Description	Dates of Operation	Relevant Site History	Rationale
HFT: Tanani Point Burn Pit (or the Tanani Burn Pit)	1960s to 2005	Waste fuel received from the Mainline Pump House was burned in a pit with a metal liner. The pit was constructed around the time of the Lutak Burn Pit construction in the early 1960s. Soils were excavated from the Tanani Point Burn Pit in 2005 and were stockpiled at the Tank 100 area (Bristol and North Wind 2020). The former pit is adjacent to another potential disposal area, known as the "Goo Pit", where drums of asphalt remaining from road construction may have been buried (Bristol and North Wind 2020).	Soil has been excavated from the former burn pit, and there is no evidence of use, storage, or disposal of PFAS-containing materials. Fires in such burn pits are not typically extinguished, but are allowed to fully consume the waste, so the use of PFAS-containing foam is not likely.
HFT: Tank Farm Burn Pit	1963 to 2009	The pit, located next to former Tank 100, was used to incinerate waste fuels and potentially waste tank sludge, spent solvents, acids, lubricants, and waste oils. The burn pit was reportedly allowed to fill with water and the floating fuel was then ignited. After the combustible materials were completely burned, the remainder of the waste and water was emptied (Bristol and North Wind 2020). The adjacent Tank 100 was removed in 2003 (Bristol and North Wind 2020). Contaminated soils were removed from the Tank Farm Burn Pit and from the Tank 100 area in 2009; the soils were stockpiled in treatment cells within the footprint of the former Tank 100 structure and in the southern portion of the Tank 100 containment basin. A total of 2,060 cubic yards of contaminated soil was removed and treated; also, 2,900 cubic yards of clean soil was excavated from and returned to the area. The soils were treated via System ET-20 microbes in 2009 and 2010 and then left in place after removing the liners used during treatment.	Soil has been excavated from the former burn pit, and there is no evidence of use, storage, or disposal of PFAS-containing materials. Fires in such burn pits are not typically extinguished, but are allowed to fully consume the waste, so the use of PFAS-containing foam is not likely.
HFT: Potential Quarters Landfill	Unknown (likely 1954 to 1971)	Historical documents reported receipt of domestic waste and small amounts of refuse from former shops. Metallic anomalies were observed here (i.e., northwest of the HFT former apartment buildings) during previous geophysical investigations (Bristol and North Wind 2020).	No evidence of use, storage, or disposal of PFAS-containing materials based on historical documents.

Sub-Installation / Area Description	Dates of Operation	Relevant Site History	Rationale
HFT: Northwest Landfill	Approximately 1975 (after HFT closed) to 1985	The Northwest Landfill is located northwest of the tank farm. Historical documents did not indicate what the Northwest Landfill received. Given that it was not constructed until after HFT was shut down, the landfill may have received construction debris. The landfill is closed, and closure activities included capping and surface water management (Center for Environmental Management of Military Lands 2003).	No evidence of receipt of PFAS-containing materials based on historical documents.
HFT: Garages, Shops, and Warehouses	Unknown (likely 1954 to 1971)	Waste oil was likely generated and Stoddard solvent was disposed at these facilities (Bristol and North Wind 2020).	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.
HFT: Manifold Building	Unknown (likely 1954 to 1971)	Leaded gasoline was likely transferred from the fuel dock through piping at the Manifold building to the mainline pump house (Bristol and North Wind 2020).	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.
HFT: Goo Pit	Unknown (likely 1954 to 1971)	An area approximately 25 to 30 feet in diameter in the southeast portion of HFT reportedly contained tar, asphaltic material, and buried metal. Historical aerial photographs have shown as many as 200 55-gallon drums stacked into an excavated pit in the area, with 25 additional drums stacked nearby (Center for Environmental Management of Military Lands 2003).	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.
HFT: Dry Wells	Unknown (likely 1954 to 1971)	Several potential dry well locations were investigated and identified at HFT. Historical reports available during the PA did not specify what materials were disposed in the dry wells (Center for Environmental Management of Military Lands 2003).	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.
TFT: Incinerator	Unknown (likely mid-1950s to 1979)	Incinerator located in the Main Terminal Area of TFT. The use of an incinerator has been described in historical documents for burning household waste. However, it was reportedly only used for a short time and then was removed because it did not operate properly in cold temperatures.	No evidence of use, storage, or disposal of PFAS-containing materials based on historical documents. Refuse burned at incinerators is typically allowed to burn completely, so use of PFAS-containing foams to extinguish the burns is not likely.

Sub-Installation / Area Description	Dates of Operation	Relevant Site History	Rationale
TFT: Potential Ski Hill Burn Pit		During a 2004 investigation, personnel interviewed indicated that sludge was removed from the bottom of the bulk fuel ASTs during cleaning operations and burned in a pit at the base of the Ski Hill (USACE 2004, as cited in Bristol and FES 2019). The Ski Hill is located approximately 200 feet east of the Northwest Landfill and west of the bulk fuel ASTs. A 2015 site visit identified an area of soil mounds (Soil Piles) north of the potential burn pit location at Ski Hill; the area of soil mounds appeared to be associated with the Northwest Landfill. PFOS and PFOA were analyzed in four soil samples collected in the former pit area; continuous cores were collected from the borings until refusal was encountered (from 5 to 12.5 feet bgs). Neither PFOS nor PFOA were detected in any of the soil samples. Groundwater was not encountered in any of the borings completed at the Potential Ski Hill Burn Pit, but farther to the west at the Northwest Landfill, groundwater was encountered at approximately 30 feet bgs (Bristol and FES 2019).	No evidence of use, storage, or disposal of PFAS-containing materials. PFAS compounds were not detected soil samples.
TFT: Southeast Landfill	Unknown (likely mid-1950s to 1979)	Solid waste was disposed in three landfills at TFT: the Southeast Landfill contents were described as household waste and construction debris.	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.
TFT: Monofill Landfills	Unknown (2002 to unknown)	Solid waste was disposed in three landfills at TFT: the Monofill Landfill was constructed for the debris associated with demolition of the TFT in 2002 to 2003 and was unlined; one cell was used for disposal of regulated asbestos-containing materials and one cell was used for disposal of inert demolition debris with a final volume of 30,000 cubic yards including 2-feet thick final soil cover (Bristol and FES 2019)	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.
TFT: Northwest Landfill	Unknown	Solid waste was disposed in three landfills at TFT: no information regarding the contents of the Northwest Landfill was available.	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.

Sub-Installation / Area Description	Dates of Operation	Relevant Site History	Rationale
TFT: Manifold and Main Line Pump Buildings	Unknown (likely mid-1950s to 1979)	Piping transferred fuel from the HFP through the manifold building (Bristol and FES 2019).	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.
SCPS: Dry Well	Unknown (likely 1961 to 1973)	Off-specification oil and fuels may have been disposed of down a dry well. As-built drawing showed that the dry well consisted of seven perforated 55-gallon drums connected together by cast-iron pipe. The drums, which were buried approximately 10 feet bgs, were excavated and removed by Bristol (Bristol and FES 2018).	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.
SCPS: Burn Pit and Disposal Line	1961 to 1973	Waste fuels and other materials were burned at a pit located at the southeast corner of SCPS. The burn pit was a 6-foot deep, square depression. Unlike the burn pits at HFT and TFT, no metal liner was identified at this burn pit, but geotextile fabric was encountered during borehole advancement during a remedial investigation conducted in 2015. A buried 2-inch steel underground disposal line from the Composite Building ran approximately 170 feet southeast to the burn pit. The line's sump appeared to connect to floor drains in the engine and pump rooms and to drip pans from the engines in the Composite Building. Excavation of the Disposal Line from the connection at the Composite Building to within 20 feet of the Burn Pit was completed in 2015. Approximately 20 feet of the steel line was left in place due to known contamination in the Burn Pit area. In 2015, five surface soil samples and four groundwater samples were collected and analyzed for PFOS and PFOA; no PFOS or PFOA was detected greater than the laboratory LOD in the samples. No over-excavation of soil was completed where soil contamination (i.e., from petroleum products) was found (Bristol and FES 2018).	Soil has been excavated, and there is no evidence of use, storage or disposal of PFAS-containing materials. Waste disposed in burn pits is typically allowed to burn completely, and use of PFAS-containing foams to extinguish the burning waste is not likely. PFAS compounds were not detected in soil and groundwater samples. .
GRTS: Laboratory Building	1954 to approximately 1972	The laboratory building at GRTS has been used by the Army for testing of chemical nerve agents and high explosive munitions.	No evidence of use, storage, and/or disposal of PFAS-containing materials based on historical documents.

5.2 AOPIs

Overviews for each AOPI identified during the PA process are presented in this section (**Figure 5-2a** and **Figure 5-2b**). The AOPI and current site status are discussed within each AOPI subsection presented below. At the time of this PA/SI, three of the FTWW Sub-Installations have historically been investigated for the possible presence of PFAS.

The AOPI locations are shown on **Figure 5-2a** (HFT) and **Figure 5-2b** (TFT). Aerial photographs include active monitoring wells in the vicinity of each AOPI. No AOPIs were identified at SCPS or GRTS.

5.2.1 Haines Fuel Terminal

The following subsections describe the the AOPIs identified at HFT, which was in operation from 1954 to 1973. HFT is located on the coast of the Lutak Inlet and the Tanani Bay (**Figure 2-2a**). While no information regarding the type of firefighting foam stored or used within the HFT AOPIs was available; protein foam was stored and disposed at TFT, and may also have been used, stored, and/or disposed at HFT. The protein foam likely contained PFAS compounds, as PFAS-containing foams are the most effective and the most common type of foam used for extinguishing petroleum fuel related fires.

5.2.1.1 Tank Farm Fire Foam System

The Tank Farm Fire Foam System at HFT was identified as an AOPI following document research and interviews due to potential historical storage and/or disposal of protein firefighting foam, which likely contained PFAS compounds. The AOPI includes the locations of the former Fire Foam Building 1231 and its fire suppression system pipelines connecting to each fuel tank in the tank farm for firefighting foam distribution (**Figure 5-2a**). The single-story building was steel-framed, with a flat roof and metal siding. The inside of the building drained and discharged to a sewer system, but some areas of the building reportedly drained to the ground surface outside. No fires or fire responses were reported at the fuel tank farm, and the fire foam system was never activated or used to extinguish fires (Center for Environmental Management of Military Lands 2003). The Fire Foam Building 1231 was demolished in the early 2000s. The site is designated as industrial/commercial land use and is expected to remain such for the foreseeable future.

As described in **Section 2.12**, four soil samples were collected during a 2015 to 2016 investigation in the Tank Farm Fire System area. PFOS was detected in two of the four shallow soil samples collected near the former Fire Foam Building 1231, with concentrations of 0.0029 mg/kg and 0.0055 mg/kg (**Table 2-1**, **Figure 2-4a**). The PFOS detected in soil samples may be due to potential historical leaks from the fire suppression system piping or incidental spills. No groundwater samples were collected for PFAS analysis during the 2015 and 2016 remedial investigation sampling events at this AOPI (Bristol and North Wind 2020).

5.2.1.2 Firehouse Office, Shop, and Garage Building 1212

The Firehouse Office, Shop, and Garage Building 1212 was identified as an AOPI following document research and interviews due to relation of firefighting activities and therefore potential use, storage, and/or disposal of PFAS-containing materials. The Firehouse Office, Shop, and Garage Building 1212 was a single-story steel building with three shop bays on the south side (**Figure 5-2a**) (Bristol and North Wind 2020). Firefighting crews were required to test nozzles and hoses periodically, which was likely performed in the field next to Building 1212.

5.2.1.3 Fire Pump Building 1208

The Fire Pump Building 1208 was identified as an AOPI following document research and interviews due to relation of firefighting activities and therefore potential use, storage, and/or disposal of PFAS-containing materials. The Fire Pump Building 1208 was a single-story steel building, fire pump house (**Figure 5-2a**). The building was demolished in 2004 (Bristol and North Wind 2020).

5.2.1.4 Fire Hose Building 1203

The Fire Hose Building 1203 was identified as an AOPI following document research and interviews due to the potential for residual PFAS-containing foam, to have flowed from hoses to the ground surface. The Fire Hose Building 1203 was a wood-framed, single-story, unheated building used to store fire hoses (**Figure 5-2a**) (Bristol and North Wind 2020).

5.2.1.5 Hose Cart Building 1209

The Hose Cart Building 1209 was identified as an AOPI following document research and interviews due to relation of firefighting activities and therefore potential use, storage, and/or disposal of PFAS-containing materials. The Hose Cart Building 1209 was a wood framed, singe-story, unheated building used to store fire hose carts (**Figure 5-2a**) (Bristol and North Wind 2020).

5.2.1.6 Marine Dock Fire Hose Building 1236

The Marine Dock Fire Hose Building 1236 was identified as an AOPI following document research and interviews due to relation of firefighting activities and therefore potential use, storage, and/or disposal of PFAS-containing materials. The Marine Dock Fire Hose Building 1236 was a wood-framed, single-story, unheated shed structure near the HFT dock (**Figure 5-2a**). The building was used to store fire hoses (Bristol and North Wind 2020).

5.2.1.7 Dockmaster Building 1234

The Dockmaster Building 1234 was identified as an AOPI following document research and interviews due to the historical presence of fuel piping and a fire foam tank, and therefore potential use, storage, and/or disposal of PFAS-containing materials (Bristol and North Wind 2020). The building, which was a single-story, steel-framed office, was demolished between 2003 and 2004 (**Figure 5-2a**).

5.2.2 Tok Fuel Terminal

The following subsections describe the AOPIs at TFT. TFT was in operation from 1954 to 1973.

5.2.2.1 Tank Farm Fire Foam System

The Tank Farm Fire Foam System at TFT was identified as an AOPI following document research and interviews due to historical storage and disposal of protein firefighting foam, which likely contained PFAS compounds. The fire suppression system included as part of the infrastructure at the TFT was comprised of a Fire Foam Pump House and aboveground distribution piping to each of several bulk fuel ASTs (**Figure 5-2b**)**.** As-built drawings show the building was located on the hill above the main terminal area near the ASTs. This building and piping were reportedly used for the storage and distribution of firefighting foams and water (Bristol and FES 2019). There are no available records of fires or fire responses at the TFT.

During demolition of the building, liquid (later identified as protein firefighting foam concentrate) was observed on the concrete floor. Additionally, protein foam concentrate was reportedly spilled on the ground surface outside the building when a valve on the storage tank was broken during removal. The spilled concentrate was left in place and covered with gravel to reduce odors; the remainder of the protein foam concentrate in the storage tank was discharged on the ground surface at the request of FTWW Directorate of Public Works personnel after it was confirmed that the liquid was protein-based (HLA/Wilder 2004, as cited in Bristol and FES 2019).

In 2015, five soil borings were completed in the area (two samples were collected from each boring, between 2 and 15 feet bgs [maximum depth to refusal was encountered at 15 feet bgs]) and soil samples were analyzed for 16 PFAS constituents (**Table 2-1, Figure 2-4b**); PFOS, PFOA, and PFBS were not detected in any of the 10 soil samples collected. No groundwater samples were collected as part of the 2015 remedial investigation.

5.2.2.2 Burn Pit and Soil Piles

The Burn Pit and Soil Piles was identified as an AOPI following document research and interviews due to detections of PFAS compounds in samples collected in a previous investigation. A burn pit, located near the former administrative area of TFT, is where waste fuel (and possibly other waste) was burned (**Figure 5-2b**). The burn pit was connected to various buildings in the main terminal area with a 2-inch underground fuel waste line (Bristol and FES 2019). Previous investigations reported that a 100-square-foot metal liner existed under the pit, approximately 1.5 feet bgs. Additionally, two soil piles (approximately 10 feet square and 3 feet tall) containing excavated soil from the burn pit were observed in 2002 on deteriorating plastic liners approximately 75 feet north of the burn pit. The pit has been demolished, along with other infrastructure at the sub-installation; the burn pit liner was removed in 2015 (Bristol and FES 2019).

The site is designated as industrial/commercial land use and is expected to remain such for the foreseeable future. Although protein foam was stored and disposed at TFT, there is no documentation indicating that the foam was used at the burn pit. However, sample data from 2015 indicate PFAS were detected in shallow soil and groundwater samples from the AOPI (Bristol and FES 2019).

Prior to removal of the liner at the TFT burn pit, three surface soil samples were collected (one adjacent to the burn pit valve and two above the steel liner) in June 2015 and analyzed for 16 PFAS compounds (**Table 2-1**, **Figure 2-4c**). PFOS was detected in all three surface soil samples collected from soil above the metal liner of the burn pit, with concentrations ranging from 0.00051 J mg/kg to 0.0036 mg/kg (a J flagged result indicates that the value is an estimate because it is less than the limit of quantitation). PFOA was detected in two of these three soil samples, with concentrations of 0.00093 J mg/kg and 0.0015 mg/kg. PFBS was detected in one of the primary samples (0.00037 J mg/kg) and in the field duplicate for a different sampling location (0.00019 J mg/kg). After the July 2015 removal of the burn pit liner, four samples were collected from the soil piles created during the excavation and from soil below the metal liner; PFOS, PFOA, and PFBS were not detected in any of the four samples. Eight additional subsurface soil samples were collected in September 2015 from five discrete soil borings around the perimeter of the burn pit (**Table 2-1**, **Figure 2-4c**) and analyzed for PFOS and PFOA only; PFOS and PFOA were not detected in any of these perimeter soil samples.

In addition, groundwater samples were collected from two monitoring wells in the area cross- or downgradient of the AOPI (**Figure 2-4c**) in August 2015 and analyzed for 16 PFAS compounds: MW-5 (screened from 22 to 35 feet bgs) and MW-40 (screened from 25.5 to 40.5 feet bgs). PFOS, PFOA, and PFBS were not detected in samples from either monitoring well (**Table 2-1**).

During the 2015 investigation and burn pit liner removal, two soil piles approximately 4 to 5 feet high were created adjacent to the burn pit from the excavated soil above the liner. Each contained about 4 cubic yards of soil and were situated on plastic liners. A total of four soil samples were collected from the piles (**Figure 2-4d**) in 2015 at approximately 3 feet and 4 to 5 feet below the surface of the piles and were analyzed for 16 PFAS compounds. PFOS, PFOA, PFBS were not detected at concentrations greater than the LOD (**Table 2-1**).

PFAS present at this AOPI may be from historical burning of PFAS-containing materials (some petroleum products or other industrial or domestic wastes) or from incidental leaks or spills of protein foam associated with the fire suppression system.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at the FTWW Sub-Installations, an SI for PFOS, PFOA, PFBS, PFNA, and PFHxS was conducted in accordance with CERCLA. SI sampling was completed at the FTWW Sub-Installations at all nine AOPIs to evaluate presence or absence of PFOS, PFOA, PFBS, PFNA, and PFHxS in comparison with the OSD risk screening levels. As such, a sub-installation-specific QAPP Addendum (Arcadis 2022) 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/or sediment pathways as potentially complete which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on each AOPI's preliminary CSM. The SI scope of work was completed in June 2022 through the collection of field data and analytical samples.

The SI field work was completed in accordance with the standard operating procedures (SOPs), technical guidance instructions (TGIs), sampling design, and QA/QC requirements as detailed in the QAPP Addendum (Arcadis 2022) 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 the FTWW Sub-Installations. Non-conformances to the prescribed procedures in the PQAPP and QAPP Addendum are described in **Section 6.3.3**. Analytical results obtained through SI field activities are summarized in **Section 7**.

6.1 Data Quality Objectives

As identified during the DQO process and outlined in the site-specific QAPP Addendum (Arcadis 2022), the objective of the SI is to identify whether there has been a release to the environment at the AOPIs identified in the PA and to determine if further investigation is warranted. This SI evaluated groundwater, and soil for PFOS, PFOA, PFBS, PFNA, and PFHxS presence or absence at each of the sampled AOPIs.

6.2 Sampling Design and Rationale

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

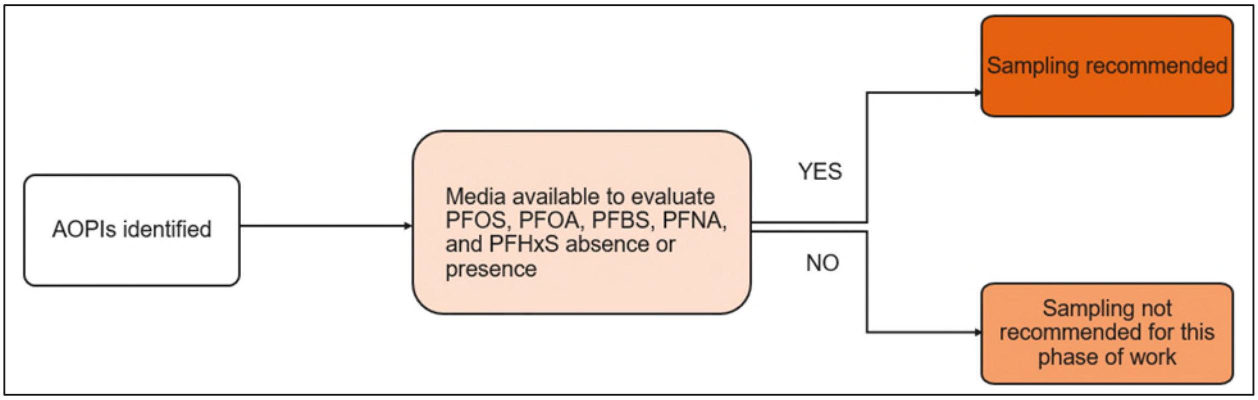

Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at the FTWW Sub-Installations is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2022). Briefly, soil and groundwater samples were collected from areas within the HFT and TFT FTWW Sub-Installations, of known or suspected PFAS-containing materials use, storage, and/or disposal. Groundwater was sampled to identify PFOS, PFOA, PFBS, PFNA, and PFHxS presence, type (of the selected constituents as listed in Worksheet #15 of the QAPP Addendum, including PFOS, PFOA, PFBS, PFNA, and PFHxS and concentrations (Arcadis 2022). Soil was sampled to identify PFOS, PFOA, PFBS, PFNA, and PFHxS presence, type (of the 18 selected constituents as listed in Worksheet #18 of the PQAPP), and concentrations (Arcadis 2019). One soil sample per AOPI with planned soil sampling was also analyzed for total organic carbon (TOC), pH, and moisture content. These data are collected as they may be useful in future fate and transport studies. These targeted sampling areas are believed to have the potential for the greatest PFAS concentrations closest to known or suspected use, storage, and/or disposal of PFAS-containing materials.

The sampling depths at existing monitoring wells were at approximately the center of the saturated screened interval. **Table 6-1** includes the monitoring well construction details for the wells sampled during the SI (if available).

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 2022), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2022). 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 2022). The subsections below provide a summary of the field methods and procedures utilized to complete the SI scope of work. Field notes and field forms (i.e., soil boring logs, groundwater purging logs, and sample collection logs) documenting the SI sampling activities are included in **Appendices F** and **G**, respectively. Photographs of the sampling activities are included in **Appendix H**.

6.3.1 Field Methods

Groundwater samples were collected using low-flow purging methods from approximately the center of the saturated screened interval at existing monitoring wells. Composite soil samples were collected via a decontaminated stainless-steel hand auger from the uppermost 2 feet of soil; soil from each 0 to 2 feet bgs interval was homogenized on PFAS-free high-density polyethylene plastic sheeting with a decontaminated stainless-steel trowel prior to placement in sample containers.

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

6.3.2 Quality Assurance/Quality Control

Worksheets #20 of the PQAPP and QAPP Addendum provide QA/QC requirements for field duplicates, matrix spike/matrix spike duplicates, equipment blanks (EBs), 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 2022), 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, PFBS, PFNA, and PFHxS, and TOC only. EBs were collected for media sampled for PFOS, PFOA, PFBS, PFNA, and PFHxS, at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2022). The decontaminated reusable equipment from which EBs were collected include hand augers, water-level meters, and portable pumps as applicable to the sampled media. Analytical results for blank samples are discussed in **Section 7.5**.

6.3.3 Field Change Reports

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

FCR-FTWW-01: At HFT, surface water samples were planned to be collected from seeps which discharge groundwater from beneath the AOPIs, if the seeps were flowing at the time of the sampling event. The likelihood of seeps being able to be collected during the limited time onsite for the SI sampling was low and it was recognized that samples from monitoring wells at the majority of HFT AOPIs would be able to meet DQOs. At the majority of the AOPIs, the proposed seep locations were downgradient of proposed monitoring wells and would have added little value that the monitoring wells did not already. However, there was one seep location at the Dockmaster Building 1234 and Marine Dock Fire Hose Building 1236 that was located downgradient in the path of groundwater flow without any other downgradient monitoring wells. If this seep was observed, it would have been preferable to sample. However, in the absence of this seep during the SI field work, an upgradient monitoring well was chosen for sampling instead.

FCR-FTWW-02: One FCR was completed for the planned monitoring well sampling locations. In the QAPP Addendum, the monitoring well sampling consisted of 10 wells at HFT and six wells at TFT. After review, five wells at HFT and two wells at TFT were replaced with other wells. The table detailed in this FCR displays the wells proposed in the QAPP Addendum and the corresponding replacement well. It should also be noted that an error in the field occurred and two of the original wells were mistakenly sampled. Fortunately, the volume of water generated during the purging was low enough that it was able to be disposed of by the laboratory instead of discharged to the ground.

FCR-FTWW-03: One FCR was completed for the planned IDW disposal method created during the sampling event. In the QAPP Addendum, the proposed method for disposal of IDW media was discharge to the surface for purged groundwater and boring backfill with soil. The method for soil disposal was unchanged with the minimal soil cuttings generated being returned to the borehole. The method for groundwater was proposed to be changed to a conservative, onsite granular activated carbon (GAC) treatment as detailed in this FCR.

6.3.4 Decontamination

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

6.3.5 Investigation-Derived Waste

IDW soil cuttings were returned to the borehole. IDW including groundwater and decontamination fluids were treated with an onsite GAC treatment method prior to discharge at the ground surface. A 5-gallon bucket filled with GAC was the selected treatment for these sites. The GAC used in the buckets was FILTRASORB® 400 GAC, which is a proven media for removing PFAS from water. Given the unknowns surrounding potential PFAS concentrations in groundwater at these sites, the use of this high performing carbon for PFAS removal was recommended. Each site had a dedicated 5-gallon bucket of GAC to treat an assumed total of 50 gallons of purge water generated at each site. After all of the wells were sampled at each site, the purge water was combined and pumped through the GAC bucket and discharged at a single location onsite. Water was not transported between sites and a confirmation sample of the discharged water was sampled for PFAS at each site to verify treatment efficacy. After sampling activities, the buckets of spent GAC were shipped to the Highlands Ranch, Colorado Arcadis office for eventual disposal by a to be determined vendor. Further rationale for the GAC treatment method along with treatment breakthrough calculation are included in FCR-FTWW-03 as part of **Appendix I**.

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 was bagged and disposed in an off-post waste receptable. Non-IDW wastes were removed from the site immediately upon completion of each day's field activities. Analytical results for IDW samples collected during the SI are discussed in **Section 7.3**.

6.4 Data Analysis

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

6.4.1 Laboratory Analytical Methods

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

Additionally, the following general chemistry and physical characteristic analyses were completed for select soil samples in accordance with Worksheet #18 of the QAPP Addendum (Arcadis 2022) 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 were collected as they may be useful in future fate and transport studies.

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

6.4.2 Data Validation

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

6.4.3 Data Usability Assessment and Summary

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

Based on the final data usability assessment, the environmental data collected at the FTWW Sub-Installations during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUSR and its associated data validation reports (**Appendix J**), and as indicated in the full analytical tables (**Appendix K**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and the FTWW Sub-Installations QAPP Addendum (Arcadis 2022). Data qualifiers applied to laboratory analytical results for samples collected during the SI at the FTWW Sub-Installations are provided in the data tables, data validation reports, and the Data Usability Summary Table located at the end of DUSR. Qualifiers for data shown on figures are defined in the notes of figures.

6.5 Office of the Secretary of Defense Risk Screening Levels

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

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

Chemical	Residential Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator		Industrial/Commercial Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator
	Tap Water (ng/L or ppt) [1]	Soil (mg/kg or ppm) [1,2]	Soil (mg/kg or ppm) [1,2]
PFOS	4	0.013	0.16
PFOA	6	0.019	0.25
PFBS	601	1.9	25
PFNA	6	0.019	0.25
PFHxS	39	0.13	1.6
HFPO-DA[3]	6	0.023	0.35

Notes:
1. Risk screening levels for tap water and soil provided by the OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July 06 (**Appendix A**).
2. All soil data will be screened against both the Residential Scenario and Industrial/Commercial risk screening levels (if collected from less than 2 feet bgs), regardless of the current and projected land use of the AOPI.
3. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI; therefore, there are no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels.
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 the FTWW Sub-Installations are industrial/commercial, both residential and industrial/commercial soil risk screening levels for PFOS, PFOA, PFBS, PFNA, and PFHxS will be used to evaluate detected soil concentrations. The data from the SI sampling event are compared to the OSD risk screening levels in **Section 7**. If concentrations of PFOS, PFOA, PFBS, PFNA, or PFHxS are detected greater than the applicable OSD risk screening levels, further study in a remedial investigation is recommended in **Section 8**.

7 SUMMARY AND DISCUSSION OF SI RESULTS

This section summarizes the analytical results obtained from samples collected during the SI at the FTWW Sub-Installations (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 2022). The sample results discussion below focuses on the PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results because they have OSD risk screening levels. The Army will make subsequent investigation decisions based on these constituents' concentrations relative to the OSD risk screening levels.

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

Field parameters measured for groundwater during low-flow purging and sample collection are provided on the field forms in **Appendix G**. Soil descriptions are provided on the field forms in **Appendix G**. 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 3 to 50 feet bgs at the HFT AOPIs and at depths of approximately 32 to 123 feet bgs at the TFT AOPIs.

Table 7-3 AOPIs and OSD Risk Screening Level Exceedances

Sub-Installation / AOPI Name	OSD Exceedances (Yes/No)
HFT – Tank Farm Fire Foam System	No
HFT – Firehouse Office, Shop, and Garage Building 1212	Yes
HFT – Fire Pump Building 1208	No*
HFT – Hose Cart Building 1209	No
HFT – Fire Hose Building 1203	No*
HFT – Marine Dock Fire Hose Building 1236	No
HFT – Dockmaster Building 1234	No
TFT – Burn Pit and Soil Piles	No
TFT – Tank Farm Fire Foam System	No*

*****PFOS were detected at estimated concentrations higher than the OSD risk screening level in groundwater at HFT – Fire Pump Building 1208, HFT - Fire Hose Building 1203, and TFT - Tank Farm Fire Foam System, therefore confirmation SI sampling is recommended to make a project decision for the AOPI/confirm concentrations in groundwater.

7.1 Haines Fuel Terminal

The subsections below summarize the soil and groundwater PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with AOPIs at HFT shown on **Figure 7-2a** through **Figure 7-2c** and **Tables 7-1** and **7-2**. Note that some of the existing monitoring wells sampled are downgradient of multiple AOPIs and the results from those existing monitoring wells are therefore presented in each of the related AOPI subsections below.

7.1.1 Tank Farm Fire Foam System

7.1.1.1 Groundwater

Five grab groundwater samples were collected from five existing monitoring wells downgradient of the Fire Foam Building 1231, Tank Farm Burn Pit, Lutak Burn Pit, and associated ASTs at the HFT Tank Farm Fire Foam System AOPI (HFT-AP-137-GW, HFT-AP-207-GW, HFT-AP-515-GW, HFT-AP-533-GW, HFT-AP-534-GW [duplicate sample collected at HFT-AP-137-GW]; **Figure 7-2a**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected at a concentration less than the OSD risk screening level of 4 ng/L in groundwater sample HFT-AP-515-061222 (2.9 J ng/L).

PFHxS was detected at a concentration less than the OSD risk screening level of 39 ng/L in groundwater samples HFT-AP-137-061122 (3.0 J ng/L [3.1 J ng/L]) and HFT-AP-207-061122 (7.1 J- ng/L).

PFOA, PFBS, and PFNA were not detected in any of the groundwater samples collected.

7.1.1.2 Soil

Soil samples were collected from six locations near of the Fire Foam Building 1231 and associated ASTs at the HFT Tank Farm Fire Foam System AOPI (HFT-TFFFS-1-SO, HFT-TFFFS-2-SO, HFT-TFFFS-3-SO, HFT-TFFFS-4-SO, HFT-TFFFS-5-SO, HFT-TFFFS-6-SO [duplicate sample collected at HFT-TFFFS-1-SO]; **Figure 7-2a**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

PFOS was detected at a concentration less than the residential OSD risk screening level of 0.013 mg/kg in soil samples HFT-TFFFS-1-SO-061022 (0.00083 J mg/kg [0.0010 J mg/kg]), HFT-TFFFS-2-SO-061022 (0.00055 J mg/kg), and HFT-TFFFS-5-SO-061022 (0.0010 mg/kg).

PFOA, PFBS, PFNA, and PFHxS were not detected in any of the soil samples collected.

7.1.2 Firehouse Office, Shop, and Garage Building 1212

7.1.2.1 Groundwater

Two grab groundwater samples were collected from two existing monitoring wells downgradient of the HFT Firehouse Office, Shop, and Garage Building 1212 AOPI (HFT-AP-009-GW and HFT-AP-148-GW; **Figure 7-2b**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected at 43 J- ng/L in the groundwater sample from HFT-AP-009-061222.

PFOS concentrations greater than the OSD risk screening level of 4 ng/L were found at HFT-AP-148-061122 (270 ng/L).

PFHxS was detected at a concentration greater than the OSD risk screening level of 39 ng/L in groundwater sample HFT-AP-148-061122 (45 ng/L) and at a concentration less than the OSD risk screening level in groundwater sample HFT-AP-009-061222 (9.7 J- ng/L).

PFOA, PFBS, and PFNA were not detected in any of the groundwater samples collected.

7.1.2.2 Soil

Soil samples were collected from two locations near the former building at the HFT Firehouse Office, Shop, and Garage Building 1212 AOPI (HFT-B1212-1-SO and HFT-B1212-2-SO [duplicate sample collected at HFT-B1212-1-SO]; **Figure 7-2b**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

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

7.1.3 Fire Pump Building 1208

7.1.3.1 Groundwater

Two grab groundwater samples were collected from two existing monitoring wells downgradient at the HFT Fire Pump Building 1208 AOPI (HFT-AP-009-GW and HFT-AP-006-GW; **Figure 7-2b**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected at 43 J- ng/L in the groundwater sample HFT-AP-009-061222.

PFHxS was detected at a concentration less than the OSD risk screening level of 39 ng/L in the groundwater sample HFT-AP-009-061222 (9.7 J- ng/L).

PFOA, PFBS, and PFNA were not detected in any of the groundwater samples collected.

7.1.3.2 Soil

Soil samples were collected from two locations near the former building at the HFT Fire Pump Building 1208 AOPI (HFT-B1208-1-SO and HFT-B1208-2-SO; **Figure 7-2b**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

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

7.1.4 Fire Hose Building 1203

7.1.4.1 Groundwater

Two grab groundwater samples were collected from two existing monitoring wells downgradient at the HFT Fire Hose Building 1203 AOPI (HFT-AP-114-GW and HFT-AP-146-GW; **Figure 7-2b**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected at 87 J- ng/L in the groundwater sample HFT-AP-114-061222.

PFHxS was detected at a concentration less than the OSD risk screening level of 39 ng/L in the groundwater sample HFT-AP-114-061222 (16 J- ng/L).

PFOA, PFBS, and PFNA were not detected in any of the groundwater samples collected.

7.1.4.2 Soil

Soil samples were collected from two locations near the former building at the HFT Fire Hose Building 1203 AOPI (HFT-B1203-1-SO and HFT-B1203-2-SO; **Figure 7-2b**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

PFOS was detected at a concentration less than the residential OSD risk screening level of 0.013 mg/kg in soil sample HFT-B1203-2-SO-061322 (0.00055 J mg/kg).

PFOA, PFBS, PFNA, and PFHxS were not detected in any of the soil samples collected.

7.1.5 Hose Cart Building 1209

7.1.5.1 Groundwater

One grab groundwater sample was collected from one existing monitoring well downgradient at the HFT Hose Car Building 1209 AOPI (HFT-AP-006-GW; **Figure 7-2b**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS groundwater analytical results is provided in **Table 7-1**.

PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in any of the groundwater samples collected.

7.1.5.2 Soil

One soil sample was collected from one location near the former building at the HFT Hose Cart Building 1209 AOPI (HFT-B1209-1-SO; **Figure 7-2b**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

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

7.1.6 Marine Dock Fire Hose Building 1236

7.1.6.1 Groundwater

One grab groundwater sample was collected from one existing monitoring well downgradient at the HFT Marine Dock Fire Hose Building 1236 AOPI (HFT-AP-153-GW; **Figure 7-2c**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS groundwater analytical results is provided in **Table 7-1**.

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

7.1.6.2 Soil

Soil samples were collected from two locations near the former building at the HFT Marine Dock Fire Hose Building 1236 AOPI (HFT-B1236-1-SO and HFT-B1236-2-SO; **Figure 7-2c**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

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

7.1.7 Dockmaster Building 1234

7.1.7.1 Groundwater

One grab groundwater sample was collected from one existing monitoring well downgradient at the HFT Dockmaster Building 1234 AOPI (HFT-AP-153-GW; **Figure 7-2c**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS groundwater analytical results is provided in **Table 7-1**.

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

7.1.7.2 Soil

Soil samples were collected from two locations near the former building at the HFT Dockmaster Building 1234 AOPI (HFT-B1234-1-SO and HFT-B1234-2-SO; **Figure 7-2c**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

PFOS was detected at a concentration less than the residential OSD risk screening level of 0.013 mg/kg in soil sample HFT-B1234-2-SO-061122 (0.00056 J mg/kg).

PFOA, PFBS, PFNA, and PFHxS were not detected in any of the soil samples collected.

7.2 Tok Fuel Terminal

The subsections below summarize the soil and groundwater PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with AOPIs at TFT shown on **Figure 7-2d** and **Figure 7-2e** and **Tables 7-1** and **7-2**.

7.2.1 Tank Farm Fire Foam System

7.2.1.1 Groundwater

Four grab groundwater samples were collected from four existing monitoring wells downgradient at the TFT Tank Farm Fire Foam System AOPI (TFT-MWD1-GW, TFT-MWD3-GW, TFT-MWD4-GW, TFT-MWD7-GW; **Figure 7-2d**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS groundwater analytical results is provided in **Table 7-1**.

PFOS was detected at 6.7 J ng/L in the groundwater sample TFT-MWD1-060722.

PFOA was detected at a concentration less than the OSD risk screening level of 6 ng/L in the groundwater samples TFT-MWD1-060722 (3.2 J ng/L) and TFT-MWD3-060722 (5.5 J- ng/L).

PFBS, PFNA, and PFHxS were not detected in any of the groundwater samples collected.

7.2.1.2 Soil

Soil samples were collected from five locations along the former firefighting foam pipeline at the TFT Tank Farm Fire Foam System AOPI (TFT-TFFFS-1-SO, TFT-TFFFS-2-SO, TFT-TFFFS-3-SO, TFT-TFFFS-4-SO, TFT-TFFFS-5-SO; **Figure 7-2d**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

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

7.2.2 Burn Pit and Soil Piles

7.2.2.1 Groundwater

Two grab groundwater samples were collected from two existing monitoring wells downgradient at the TFT Burn Pit and Soil Piles AOPI (TFT-MW40-GW and TFT-MW5-GW [duplicate sample collected at TFT-MW5-GW]; **Figure 7-2e**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS groundwater analytical results is provided in **Table 7-1**.

PFHxS was detected at a concentration less than the OSD risk screening level of 39 ng/L in the groundwater sample TFT-MW5-060822 (37 J- ng/L [32 J ng/L]).

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

7.2.2.2 Soil

Soil samples were collected from two locations within the former pit at the TFT Burn Pit and Soil Piles AOPI (TFT-BPSP-1-SO and TFT-BPSP-2-SO [duplicate sampled collected at TFT-BPSP-1-SO]; **Figure 7-2e**). A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

PFHxS was detected at a concentration less than the residential OSD risk screening level of 0.13 mg/kg in soil sample TFT-BPSP-2-SO-060822 (0.0019 mg/kg).

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

7.3 Investigation Derived Waste

A composite sample of the purge and decontamination wastewater was collected from the discharge water that was processed with the GAC treatment method at each of the sites (HFT and TFT) to be analyzed for PFAS to verify treatment efficacy. PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in the wastewater and therefore no concentrations exceeded the OSD risk screening levels. The two spent GAC buckets are currently in storage at the Highlands Ranch, Colorado Arcadis office awaiting disposal. The full analytical results (i.e., for all constituents analyzed) for IDW samples collected during the SI are included in **Appendix K**.

7.4 TOC, pH, and Moisture Content, and Grain Size

In addition to sampling soil for PFOS, PFOA, PFBS, PFNA, and PFHxS, one soil sample per AOPI was analyzed for TOC, pH and 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 1,290 to 19,300 mg/kg. The TOC at these sub-installations was within range of TOC typically observed in topsoil: 5,000 to 30,000 mg/kg. The combined percentage of fines (i.e., silt and clay) in soils at the FTWW Sub-Installations ranged from 0.4 to 14.9 % with an average of 6.33%. 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, 9.99%, was typical for sandy soil (0 to 10%) or loam (0 to 12%). The pH of the soil was neutral (approximately 7 standard units). Based on these geochemical and physical soil characteristics observed underlying the sub-installations during the SI, PFAS constituents are expected to be relatively more mobile at the FTWW Sub-Installations than in soils with greater percentages of fines and TOC.

7.5 Blank Samples

PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in any of the blank samples collected during the SI work.

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

7.6 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2022) were re-evaluated and updated based on the SI sampling results. The CSMs presented on **Figures 7-3** through **7-8** and in this section therefore represent the current understanding of the potential for human exposure. For some AOPIs, the CSM is the same and thus shown on the same figure.

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

Based on the use, storage, and/or disposal of PFAS-containing materials at the AOPIs, affected media are likely to consist of soil and groundwater, and may include surface water and sediment. Release and transport mechanisms include dissolution/desorption from soil to groundwater, transport via sediment carried in and dissolution to stormwater and surface water, discharge/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, PFBS, PFNA, and PFHxS may be evaluated at a future date if those pathways warrant further consideration.

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

- There are no residents at the decommissioned HFT and TFT sub-installations, and future residential development of the AOPIs is unlikely. Therefore, the soil, groundwater, surface water, and sediment exposure pathways for on-installation residents are incomplete.
- Recreational use is not permitted within the locked gates of the sub-installations. Therefore, the soil, groundwater, surface water, and sediment exposure pathways for on-installation recreational users are incomplete.

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

Figure 7-3 shows the CSM for two AOPIs within the locked gated area at the decommissioned HFT sub-installation: the Tank Farm Fire Foam System AOPI and Fire Hose Building 1203 AOPI. These AOPIs have the potential for PFOS, PFOA, PFBS, PFNA, and/or PFHxS presence due to potential historical releases from tanks of fire-fighting foam agents or fire suppression system piping, or from decommissioned fire hoses.

- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil at these AOPIs. Site workers are not currently present at the decommissioned HFT sub-installation. However, future site workers (e.g., future construction workers) could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.

- The AOPIs are not likely to be accessed by off-installation receptors (i.e., recreational users) as access is restricted by a locked gate. Therefore, the soil exposure pathway for off-installation receptors is incomplete.
- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in groundwater samples collected at these AOPIs. There are no drinking water wells at the decommissioned HFT sub-installation. However, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for on-installation site workers is potentially complete to account for potential future use of the downgradient on-post groundwater as a potable water source.
- Groundwater flows east and northeast off-post towards the Chilkoot Inlet, within approximately 0.25 mile from the AOPIs. Based on the groundwater flow in this area toward the Chilkoot Inlet (brackish water not used as a potable source), the groundwater exposure pathway for off-post drinking water receptors is incomplete.
- Some groundwater is discharged to the surface via seeps, which ultimately flow to the Chilkoot Inlet. Site workers could contact constituents in surface water and sediment via incidental ingestion and dermal contact during site maintenance or construction activities. Off-post receptors (i.e., off-post recreational users) could contact constituents in surface water and sediment via incidental ingestion and dermal contact during activities such as fishing, kayaking, or swimming. Therefore, the surface water and sediment exposure pathways for these receptors are potentially complete.

Figure 7-4 shows the CSM for another two AOPIs within the locked gated area at the decommissioned HFT sub-installation: the Firehouse Office, Shop, and Garage Building 1212 AOPI and Fire Pump Building 1208 AOPI. These AOPIs were sampled for the potential presence of PFOS, PFOA, PFBS, PFNA, and/or PFHxS; however, no information was available in historical reports regarding whether PFAS-containing foams were used, stored, or disposed here.

- PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in soil at these AOPIs. Based on the SI sample results, the soil exposure pathways for all receptors are incomplete.
- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in groundwater samples collected at these AOPIs. There are no drinking water wells at the decommissioned HFT sub-installation. However, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for on-installation site workers is potentially complete to account for potential future use of the downgradient on-post groundwater as a potable water source.
- Groundwater flows east and northeast off-post towards the Chilkoot Inlet, within approximately 0.25 mile from the AOPI. Based on the groundwater flow in this area toward the Chilkoot Inlet (brackish water not used as a potable source), the groundwater exposure pathway for off-post drinking water receptors is incomplete.
- Some groundwater is discharged to the surface via seeps, which ultimately flow to the Chilkoot Inlet. Site workers could contact constituents in surface water and sediment via incidental ingestion and dermal contact during site maintenance or construction activities. Off-post receptors (i.e., off-post

recreational users) could contact constituents in surface water and sediment via incidental ingestion and dermal contact during activities such as fishing, kayaking, or swimming. Therefore, the surface water and sediment exposure pathways for these receptors are potentially complete.

Figure 7-5 shows the CSM for the Hose Cart Building 1209 AOPI located inside the locked gated area at the decommissioned HFT sub-installation, and for the Marine Dock Fire Hose Building 1236 located outside the locked gated area at HFT. These two AOPIs have the potential for PFOS, PFOA, PFBS, PFNA, and/or PFHxS presence due to use of the buildings to store fire hoses; however, no information was available in historical reports regarding whether PFAS-containing foams were used, stored, or disposed here.

- PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in soil or groundwater samples associated with these AOPIs. Based on the SI sample results, the soil, groundwater, surface water, and sediment exposure pathways are incomplete.

Figure 7-6 shows the CSM for the Dockmaster Building 1234 AOPI located outside the locked gated area at the decommissioned HFT sub-installation. This AOPI potentially had fuel piping and a fire foam tank (Bristol and North Wind 2020); however, no information was available in historical reports regarding use of the fire foam tank or if PFAS-containing foam was used at the facility.

- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil at this AOPI. Site workers are not currently present at the decommissioned HFT sub-installation. However, future site workers (e.g., future construction workers) could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- The AOPI could be accessed by off-installation receptors (i.e., recreational users) as access to this area is not restricted, and the AOPI is located along a public road. Therefore, the soil exposure pathway for off-installation receptors is potentially complete.
- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were not detected in the groundwater sample collected at this AOPI. There are no drinking water wells at the decommissioned HFT sub-installation, and shallow groundwater flows off-post towards the Chilkoot Inlet. Based on the SI sample results, the groundwater exposure pathways are incomplete.
- Surface runoff may transport constituents in soil to the Chilkoot Inlet. Site workers could contact constituents in surface water and sediment via incidental ingestion and dermal contact during site maintenance or construction activities. Off-post receptors (i.e., off-post recreational users) could contact constituents in surface water and sediment via incidental ingestion and dermal contact during activities such as fishing, kayaking, or swimming. Therefore, the surface water and sediment exposure pathways for these receptors are potentially complete.

Figure 7-7 shows the CSM for the Tank Farm Fire Foam System AOPI at the decommissioned TFT sub-installation. This AOPI has the potential for PFOS, PFOA, PFBS, PFNA, and/or PFHxS presence due to potential historical releases of firefighting foams due to spills, however it is unknown what type of firefighting foams were used here.

- PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in soil at this AOPI. Based on the SI sample results, the soil exposure pathways for all receptors are incomplete.

- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in groundwater at this AOPI. There are no drinking water wells at the decommissioned TFT sub-installation. However, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for on-installation site workers is potentially complete to account for potential future use of the downgradient on-post groundwater as a potable water source.
- Groundwater originating at this AOPI flows west-northwest and eventually off-post (Bristol and FES 2019). There are no downgradient off-post receptors within 5 miles of the AOPI. However, to account for potential future use of the downgradient groundwater as a source of potable water, the groundwater exposure pathway for off-post drinking water receptors is potentially complete.
- There are no surface water features at the TFT sub-installation. Approximately 2 miles north of the sub-installation lies the Tanana River, which is not known to be used as a source of drinking water. Considering the lack of surface water features at the sub-installation, the only potential migration pathway for constituents originating at the AOPI is groundwater discharge to surface water of the Tanana River. Based on the west-northwest groundwater flow direction in the area, groundwater would travel greater than 5 miles before reaching the Tanana River where off-post receptors may use the surface water for recreation. Therefore, surface water and sediment are not potential exposure media associated with this AOPI.

Figure 7-8 shows the CSM for the Burn Pit and Soil Piles AOPI at the decommissioned TFT sub-installation. Sample data from 2015 indicate PFAS were detected in shallow soil and groundwater samples at the AOPI (Bristol and FES 2019).

- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil at this AOPI. Site workers are not currently present at the decommissioned TFT sub-installation. However, future site workers (e.g., future construction workers) could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- The AOPI is not likely to be accessed by off-installation receptors (i.e., recreational users) as access is restricted by a locked gate. Therefore, the soil exposure pathway for off-installation receptors is incomplete.
- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in groundwater at this AOPI. There are no drinking water wells at the decommissioned TFT sub-installation. However, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for on-installation site workers is potentially complete to account for potential future use of the downgradient on-post groundwater as a potable water source.
- Groundwater originating at this AOPI flows west-northwest and eventually off-post (Bristol and FES 2019). There are no downgradient off-post receptors within 5 miles of the AOPI. However, to account for potential future use of the downgradient groundwater as a source of potable water, the groundwater exposure pathway for off-post drinking water receptors is potentially complete.
- There are no surface water features at the TFT sub-installation. Approximately 2 miles north of the sub-installation lies the Tanana River, which is not known to be used as a source of drinking water. Considering the lack of surface water features at the sub-installation, the only potential migration

pathway for constituents originating at the AOPI is groundwater discharge to surface water of the Tanana River. Based on the west-northwest groundwater flow direction in the area, groundwater would travel greater than 5 miles before reaching the Tanana River where off-post receptors may use the surface water for recreation. Therefore, surface water and sediment are not potential exposure media associated with this AOPI.

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

8 CONCLUSIONS AND RECOMMENDATIONS

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

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

All AOPIs were sampled during the SI at the FTWW Sub-Installations to identify presence or absence of PFOS, PFOA, PFBS, PFNA, and PFHxS at each AOPI. The SI scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the FTWW Sub-Installations QAPP Addendum (Arcadis 2022). Seven AOPIs had detections of PFOS, PFOA, PFBS, PFNA, and/or PFHxS in soil and/or groundwater and one AOPI exceeded OSD risk screening levels. Three additional AOPIs with detections had PFOS, PFOA, PFBS, PFNA, and/or PFHxS present at estimated concentrations greater than the risk-based screening levels and are recommended for confirmation SI sampling.

- Eleven out of 17 collected groundwater samples had detections of PFOS, PFOA, PFBS, PFNA, and/or PFHxS. One out of 17 groundwater samples collected had PFOS, PFOA, PFBS, PFNA, and/or PFHxS detections above their respective OSD risk screening levels (4 ng/L, 6 ng/L, 601 ng/L, 6 ng/L, and 39 ng/L, respectively). Three additional AOPIs had PFOS, PFOA, PFBS, PFNA, and/or PFHxS present in groundwater at estimated concentrations greater than the risk-based screening levels and are recommended for confirmation SI sampling. The maximum groundwater detection for PFOS was observed at the HFT Firehouse Office, Shop, and Garage Building 1212 AOPI (270 ng/L for PFOS), above the OSD risk screening level. The maximum groundwater detection for PFOA was observed at the TFT Tank Farm Fire Foam System AOPI (5.5 J ng/L for PFOA), below the OSD screening level. PFBS and PFNA were not observed above the detection level in groundwater at any of the AOPIs. The maximum groundwater detection for PFHxS was observed at the HFT – Firehouse Office, Shop and Garage Building 1212 AOPI (45 ng/L for PFHxS), above the OSD screening level.
- Seven out of 22 collected soil samples had detections of PFOS, PFOA, PFBS, PFNA, and/or PFHxS. None of the 22 soil samples collected had PFOS, PFOA, PFBS, PFNA, and/or PFHxS detections above their respective residential OSD risk screening levels (0.013 mg/kg, 0.019 mg/kg, 1.9 mg/kg, 0.019 mg/kg, and 0.13 mg/kg, respectively). The maximum soil detection for PFOS was observed at the HFT – Tank Farm Fire Foam System AOPI (0.001 mg/kg for PFOS), below the OSD risk screening level. PFOA, PFBS, and PFNA were not observed above the detection level in soil at any of the AOPIs. The maximum soil detection for PFHxS was observed at the TFT – Burn Pit and Soil Piles AOPI (0.0019 mg/kg), below the OSD screening level.

Following the SI sampling, all seven AOPIs with confirmed PFOS, PFOA, PFBS, PFNA, and/or PFHxS presence were considered to have complete or potentially complete exposure pathways. Soil exposure pathways for on-installation site workers are complete at four AOPIs, and for off-installation receptors are complete at one AOPI, at which PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil. There are six AOPIs at which the groundwater exposure pathways for on-installation site workers are potentially complete to account for potential future use of the downgradient on-post groundwater as a potable water source. Due to a lack of land use controls off-installation and downgradient of the two AOPIs at the decommissioned TFT sub-installation, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete. Shallow groundwater originating at the decommissioned HFT sub-installation is discharged to the surface via seeps, which ultimately flow to the Chilkoot Inlet. Site workers and recreational users may contact surface water and sediment. Therefore, the surface water and sediment exposure pathways are potentially complete at five 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, PFBS, PFNA, and PFHxS to the OSD risk screening levels (**Table 6-2**). **Table 8-1** below summarizes the AOPIs identified at the FTWW Sub-Installations, PFOS, PFOA, PFBS, PFNA, and PFHxS sampling and recommendations for each AOPI; further investigation is warranted at the FTWW Sub-Installations. In accordance with CERCLA, site-specific risk will be assessed during a future phase to evaluate whether remedial actions are required.

Table 8-1 Summary of AOPIs Identified during the PA, PFOS, PFOA, PFBS, PFNA, and PFHxS Sampling at the FTWW Sub-Installations, and Recommendations

Sub-Installation / AOPI Name	PFOS, PFOA, PFBS, PFNA, and/or PFHxS detected greater than OSD Risk Screening Levels? (Yes/No/ND)		Recommendation
	GW	SO	
HFT – Tank Farm Fire Foam System	No	No	No action at this time
HFT – Firehouse Office, Shop, and Garage Building 1212	Yes	ND	Further study in a remedial investigation
HFT – Fire Pump Building 1208	No*	ND	Confirmation SI sampling
HFT – Hose Cart Building 1209	ND	ND	No action at this time
HFT – Fire Hose Building 1203	No*	No	Confirmation SI sampling
HFT – Marine Dock Fire Hose Building 1236	ND	ND	No action at this time

Sub-Installation / AOPI Name	PFOS, PFOA, PFBS, PFNA, and/or PFHxS detected greater than OSD Risk Screening Levels? (Yes/No/ND)		Recommendation
	GW	SO	
HFT – Dockmaster Building 1234	ND	No	No action at this time
TFT – Burn Pit and Soil Piles	No	No	No action at this time
TFT – Tank Farm Fire Foam System	No*	ND	Confirmation SI sampling

Notes:

***PFOS were detected at estimated concentrations higher than the OSD risk screening level in groundwater at HFT – Fire Pump Building 1208, HFT - Fire Hose Building 1203, and TFT - Tank Farm Fire Foam System, therefore confirmation SI sampling is recommended to make a project decision for the AOPI/confirm concentrations in groundwater.

Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
ND – non-detect
No – detection less than the OSD risk screening level
SO – soil

Data collected during the PA (**Sections 3** through **5**) and SI (**Sections 6** through **8**) were sufficient to draw conclusions and recommendations summarized above. The data limitations relevant to the development of this PA/SI for PFOS, PFOA, PFBS, PFNA, and PFHxS at the FTWW Sub-Installations are discussed below.

Records gathered for the use, storage and/or disposal of PFAS-containing materials were reviewed during the PA process. Documentation specific to AFFF may have been limited (e.g., each AFFF use; procurement records, documentation of AFFF used during crash responses or fire training activities) due to lack of recordkeeping requirements for the full timeline of common AFFF practices. Anecdotal accounts of AFFF use (and therefore likely PFOS, PFOA, PFBS, PFNA, and PFHxS use) were limited to available installation personnel, whose knowledge of AFFF use may have been restricted by their time spent at the sub-installations or previous roles held that limited their relevant knowledge of potential AFFF (or other PFAS-containing material) use. The site background information available for the FTWW Sub-Installations limits the ability to identify PFAS releases at the sites. No information regarding the use of AFFF as a firefighting agent are available for the Fire Foam Pump House at TFT.

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 D**).

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

Finally, the available PFOS, PFOA, PFBS, PFNA, and PFHxS analytical data is limited to historical analytical results collected from three of the four sub-installations and the results of the soil and groundwater samples collected during this SI. Available data, including PFOS, PFOA, PFBS, PFNA, and PFHxS, is listed in **Appendix K** which were analyzed per the selected analytical method. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI at the FTWW Sub-Installations; therefore, there are no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels.

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

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ACRONYMS

°F	degrees Fahrenheit
%	percent
ADEC	Alaska Department of Environmental Conservation
AFFF	aqueous film-forming foam
amsl	above mean sea level
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	United States Army
AST	aboveground storage tank
bgs	below ground surface
Bristol	Bristol Environmental Remediation Services, LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	conceptual site model
DoD	Department of Defense
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
FCR	Field Change Report
FES	Fairbanks Environmental Services
FTWW	Fort Wainwright
FTWW Sub-Installations	Fort Wainwright Haines Fuel Terminal, Tok Fuel Terminal, Sears Creek Pump Station, and Gerstle River Test Site, Alaska
GAC	granular activated carbon
GRTS	Gerstle River Test Site
GW	groundwater
HFP	Haines-Fairbanks Pipeline
HFPO-DA	hexafluoropropylene oxide dimer acid

HFT	Haines Fuel Terminal
IDW	investigation-derived waste
installation	United States Army or Reserve installation
LOD	limit of detection
LOQ	limit of quantitation
mg/kg	milligrams per kilogram (parts per million)
ND	non-detect
ng/L	nanograms per liter (parts per trillion)
North Wind	North Wind, Inc.
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexane sulfonate
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	parts per million
ppt	parts per trillion
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RSL	Regional Screening Level
SCPS	Sears Creek Pump Station
SI	site inspection
SO	soil
SOP	standard operating procedure
SSHP	Site Safety and Health Plan

TFT	Tok Fuel Terminal
TGI	technical guidance instruction
TOC	total organic carbon
U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency

TABLES

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PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15HFTB231SB01S001	15HFTB231SB01S201 (Field Duplicate)	15HFTB231SB02S001	16HFTB231SB03S001
			Site Description	Fire Foam Building 1231			
			Sub-Installation	HFT			
			Date	2015			2016
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	3-4	3-4	3-4	3.5-4
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00033 U	0.00036 U	**0.0055**	**0.0029**
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00034 U	0.00037 U	0.00036 U	0.00039 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	--	--	--	--
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	--	--	--	--
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	--	--	--	--

PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	16HFTLUBPSB03S001	15TFTBURN01SS	15TFTBURNP02SS	15TFTBURN03SS
			Site Description	Lutak Burn Pit	Burn Pit and Soil Piles[1]		
			Sub-Installation	HFT	TFT		
			Date	2016	6/6/2015	6/6/2015	6/6/2015
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	12-13	0.67	2.17	2.17
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00039 U	**0.0014**	**0.0036**	**0.00051 J**
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00041 U	0.00063 U	**0.00093 J**	**0.00075 J**
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	--	0.00063 U	**0.00037 J**	0.00081 U
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	--	0.00063 U	0.00086 U	0.00081 U
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	--	**0.0028**	**0.047**	0.04 UJ

PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15TFTBURN04SS (Field Duplicate of 15TFTBURN03SS)	15TFTBPSP01SO	15TFTBPSP02SO	15TFTBPSP03SO
			Site Description	Burn Pit and Soil Piles[1]	Burn Pit and Soil Piles[2]		
			Sub-Installation	TFT	TFT		
			Date	6/6/2015	9/1/2015	9/1/2015	9/1/2015
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	2.17	3	4	3
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	**0.0025**	0.00056 U	0.0006 U	0.00061 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	**0.0015**	0.00056 U	0.0006 U	0.00061 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	**0.00019 J**	0.00056 U	0.0006 U	0.00061 U
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	0.00081 U	0.00056 U	0.0006 U	0.00061 U
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	0.083 UJ	0.00056 U	0.0006 U	0.00061 U

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PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15TFTBPSP04SO	15TFTBPSP05SO (Field Duplicate of 15TFTBPSP04SO)	15TFTBURN01SO	15TFTBURN02SO
			Site Description	Burn Pit and Soil Piles[2]		Burn Pit and Soil Piles[3]	
			Sub-Installation	TFT		TFT	
			Date	9/1/2015	9/1/2015	9/28/2015	9/28/2015
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	5	5	23	34
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00058 U	0.00064 U	0.00033 U	0.00035 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00058 U	0.00064 U	0.00035 U	0.00037 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	0.00058 U	0.00064 U	--	--
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	0.00058 U	0.00064 U	--	--
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	0.00058 U	0.00064 U	--	--

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PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15TFTBURN03SO	15TFTBURN04SO	15TFTBURN05SO	15TFTBURN06SO
			Site Description	Burn Pit and Soil Piles[3]			
			Sub-Installation	TFT			
			Date	9/28/2015	9/28/2015	9/28/2015	9/28/2015
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	2	12	10	20
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00035 U	0.00032 U	0.00034 U	0.00033 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00037 U	0.00033 U	0.00036 U	0.00035 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	--	--	--	--
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	--	--	--	--
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	--	--	--	--

PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15TFTBURN07SO	15TFTBURN08SO (Field Duplicate of 15TFTBURN07SO)	15TFTBURN09SO	15TFTBURN01WG (MW-40)
			Site Description	Burn Pit and Soil Piles[3]			
			Sub-Installation	TFT			
			Date	9/29/2015	9/29/2015	9/29/2015	8/11/2015
			Media	SO	SO	SO	GW
			Units	mg/kg	mg/kg	mg/kg	ng/L
			Sample Depth (feet)	12	12	20	34
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00032 U	0.00034 U	0.00033 U	19 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00033 U	0.00036 U	0.00035 U	9.4 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	--	--	--	8.4 U
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	--	--	--	19 U
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	--	--	--	9.4 U

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PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15TFTBURN02WG (Field Duplicate of 15TFTBURN01WG)	15TFTBURN03WG (MW-5)	15TFTSHBP01SO	15TFTSHBP02SO
			Site Description	Burn Pit and Soil Piles[3]		Potential Ski Hill Burn Pit	
			Sub-Installation	TFT		TFT	
			Date	8/11/2015	8/12/2015	9/28/2015	9/28/2015
			Media	GW	GW	SO	SO
			Units	ng/L	ng/L	mg/kg	mg/kg
			Sample Depth (feet)	34	33	5	10
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	19 U	17 U	0.00034 U	0.00034 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	9.6 U	8.4 U	0.00035 U	0.00035 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	8.6 U	7.5 U	--	--
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	19 U	17 U	--	--
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	9.6 U	**55**	--	--

PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15TFTSHBP03SO	15TFTSHBP04SO	15TFTSHBP05SO	15TFTSHBP06SO
			Site Description	Potential Ski Hill Burn Pit			
			Sub-Installation	TFT			
			Date	9/28/2015	9/28/2015	9/28/2015	9/28/2015
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	2	12	5	5
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00033 U	0.00033 U	0.00034 U	0.00033 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00034 U	0.00035 U	0.00036 U	0.00034 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	--	--	--	--
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	--	--	--	--
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	--	--	--	--

PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15TFTSHBP07SO	15TFTSHBP08SO	15TFTFIRF01SO	15TFTFIRF02SO
			Site Description	Potential Ski Hill Burn Pit		Fire Foam Pump House	
			Sub-Installation	TFT		TFT	
			Date	9/28/2015	9/28/2015	6/3/2015	6/3/2015
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	5	10	6	15
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00033 U	0.00033 U	0.00014 U	0.00015 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00035 U	0.00034 U	0.00024 U	0.00024 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	--	--	0.00014 U	0.00015 U
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	--	--	0.00023 U	0.00023 U
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	--	--	0.00029 U	0.00030 U

			Sample Identification	15TFTFIRF03SO	15TFTFIRF04SO	15TFTFIRF05SO	15TFTFIRF06SO
			Site Description	Fire Foam Pump House			
			Sub-Installation	TFT			
			Date	6/3/2015	6/3/2015	6/3/2015	6/3/2015
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	2	15	2	11
PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00016 U	0.00014 U	0.00015 U	0.00016 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00025 U	0.00024 U	0.00025 U	0.00026 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	0.00016 U	0.00014 U	0.00015 U	0.00016 U
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	0.00025 U	0.00023 U	0.00024 U	0.00024 U
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	0.00031 U	0.00029 U	0.00031 U	0.00031 U

PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15TFTFIRF07SO	15TFTFIRF08SO	15TFTFIRF09SO	15TFTFIRF10SO
			Site Description	Fire Foam Pump House			
			Sub-Installation	TFT			
			Date	6/3/2015	6/3/2015	6/3/2015	6/3/2015
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	6	9	2	9
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00015 U	0.00014 U	0.00014 U	0.00014 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00024 U	0.00022 U	0.00023 U	0.00023 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	0.00015 U	0.00014 U	0.00014 U	0.00014 U
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	0.00023 U	0.00022 U	0.00022 U	0.00022 U
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	0.00030 U	0.00028 U	0.00028 U	0.00028 U

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PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15TFTFIRF11SO (Field Duplicate of 15TFTFIRF07SO)	15SCSPIT01SS	15SCSPIT02SS	15SCSPIT03SS
			Site Description	Fire Foam Pump House	Burn Pit		
			Sub-Installation	TFT	SCPS		
			Date	6/3/2015	9/16/2015	9/16/2015	9/16/2015
			Media	SO	SO	SO	SO
			Units	mg/kg	mg/kg	mg/kg	mg/kg
			Sample Depth (feet)	6	0.5	0.5	0.5
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00015 U	0.00049 U	0.00045 U	0.00046 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00025 U	0.00052 U	0.00048 U	0.00048 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	0.00015 U	--	--	--
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	0.00024 U	--	--	--
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	0.00030 U	--	--	--

PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15SCSPIT04SS	15SCSPIT05SS	15SCSPIT06SS (Field Duplicate of 15SCSPIT05SS)	15SCSMWN05WG
			Site Description	Burn Pit			
			Sub-Installation	SCPS			
			Date	9/16/2015	9/16/2015	9/16/2015	9/15/2015
			Media	SO	SO	SO	GW
			Units	mg/kg	mg/kg	mg/kg	ng/L
			Sample Depth (feet)	0.5	0.5	0.5	
			CAS				
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	0.00049 U	0.00037 U	0.00035 U	20 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	0.00051 U	0.00039 U	0.00037 U	21 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	--	--	--	--
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	--	--	--	--
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	--	--	--	--

PFAS	OSD Soil Risk Screening Levels (mg/kg)	OSD Tap Water Risk Screening Levels (ng/L)	Sample Identification	15SCSMWN07WG (Field Duplicate of 15SCSMWN05WG)	15SCSMWN08WG	15SCSMWN11WG
			Site Description	Burn Pit		
			Sub-Installation	SCPS		
			Date	9/15/2015	9/15/2015	9/15/2015
			Media	GW	GW	GW
			Units	ng/L	ng/L	ng/L
			Sample Depth (feet)			
			CAS			
Perfluorooctane sulfonate (PFOS)	0.013 (R) 0.16 (I/C)	4	1763-23-1	19 U	18 U	19 U
Perfluorooctanoic acid (PFOA)	0.019 (R) 0.25 (I/C)	6	335-67-1	20 U	19 U	20 U
Perfluorobutane sulfonate (PFBS)	1.9 (R) 25 (I/C)	601	375-73-5	--	--	--
Perfluorononanoic acid (PFNA)	0.019 (R) 0.25 (I/C)	6	375-95-1	--	--	--
Perfluorohexane sulfonate (PFHxS)	0.13 (R) 1.6 (I/C)	39	355-46-4	--	--	--

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Notes and Acronyms:

1. Samples collected above metal liner prior to removal
2. Samples from soil piles created during the excavation and from below metal liner
3. Excavation perimeter samples

-- = not analyzed
Bold = detected concentration
Gray shaded values indicate the result was detected greater than the residential scenario risk screening levels (OSD 2022)
GW = groundwater
HFT = Haines Fuel Terminal
HQ = noncancer hazard quotient; the risk screening level based on HQ of 0.1 is used.
I/C = industrial/commercial receptor scenario
J = result qualified as estimate because it is less than the limit of quantitation
mg/kg = milligrams per kilogram (parts per million)
MW = monitoring well
ng/L = nanograms per liter (parts per trillion)
OSD = Office of the Secretary of Defense
R = residential receptor scenario
SCPS = Sears Creek Pump Station
SO = soil
TFT = Tok Fuel Terminal
U = the analyte was analyzed for but was not detected above the limit of quantitation (LOQ).
UJ = the analyte was analyzed for but was not detected. The reported reporting limit (RL) is approximate and may be inaccurate or imprecise.

Sources*:

1. Bristol Environmental Remediation Services, LLC, and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.

2. Bristol Environmental Remediation Services, LLC . 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. Environmental Investigations at Haines Fuel Terminal, Sears Creek Station, Tok Fuel Terminal, Tok, and Gerstle River Test Site, Alaska. June.

3. Office of the Secretary of Defense (OSD). 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July 06.

*If the laboratory reported concentrations in units other than ng/L for aqueous samples or mg/kg for solid samples, the values were converted for easier comparison to the 2022 OSD risk screening values.

Table 6-1 - Monitoring Well Construction Details
USAEC PFAS Preliminary Assessment/Site Inspection
FTWW Sub-Installations, Alaska

Sub-Installation	Well ID	Installation Date	Latitude	Longitude	Ground Surface Elevation (ft NAVD88)	Top of Casing Elevation (ft NAVD88)	Well Diameter (inches)	Total Depth (ft btoc)	Screen Length (ft)[1]	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Screened Interval (ft bgs)[1]
Haines Fuel Terminal	AP-009	1993	59.271437	-135.443240	32.91	35.81	2	17.55	10	4.91	14.91	4.91 - 14.91
	AP-114	UNK	59.271216	-135.443521	31.01	33.51	2	25.00	10	12.51	22.51	12.51 - 22.51
	AP-534	2003	59.275346	-135.4461567	88.15	90.55	2	58.00	5	53	58	53 - 58
	AP-137	1997	59.275392	-135.447622	109.12	111.62	2	62.50	10	50.12	60.12	50.12 - 60.12
	AP-146	1997	59.271244	-135.443466	31.47	33.67	2	76.00	5	68.77	73.77	68.77 - 73.77
	AP-148	1997	59.271949	-135.443705	47.61	50.01	2	25.80	UNK	UNK	UNK	UNK - UNK
	AP-153	1997	59.279142	-135.452958	26.97	29.47	2	20.10	17.1	2.6	19.7	2.6 - 19.7
	AP-207	UNK	59.275755	-135.445380	63.49	65.84	2	21.55	10	9.49	19.49	9.49 - 19.49
	AP-515	2001	59.276003	-135.445043	52.58	52.88	2	5.80	2	47	49	47 - 49
	AP-533	2003	59.276022	-135.445062	53.34	53.34	2	17.50	7	36	43	36 - 43
	AP-006	1993	59.271301	-135.4455773	57.07	59.27	2	17.85	10	42	52	42 - 52
Tok Fuel Terminal	MW5	<2003	63.357467	-143.2072786	1595.10	1594.55	2	36.92	10	25.0	35.0	25 - 35
	MW40	2015	63.357407	-143.2073147	1595.10	1595.37	2	44.06	15	25.5	40.5	25.5 - 40.5
	MWD1	2007	63.360421	-143.2086336	1683.17*	1685.67	2	38.56	UNK	UNK	UNK	UNK - UNK
	MWD3	2007	63.358967	-143.2041214	1676.42*	1678.92	2	131.76	15	115	130	115 - 130
	MWD4	2007	63.357897	-143.203200	1593.56*	1596.06	2	37.01	UNK	UNK	UNK	UNK - UNK
	MWD7	9/11/2015	63.359339	-143.2079892	1656.70	1659.53	2	112.40	20	90	110	90 - 110

Notes:
* = estimated based on stickup height in well inspection photographs

1. At wells where no information is available about the screened interval, it will be assumed that a 5-ft screen length is set at the bottom of the well, and the pump will therefore be set approximately 2.5 ft from the bottom of the well.

Acronyms:
bgs = below ground surface
btoc = below top of casing
ft = feet
ID = identification
NAVD88 = North American Vertical Datum 1988
UNK = unknown

Sources:
Bristol and FES. 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. June.
Bristol and North Wind, Inc. 2020. Final 2019 Technical Memorandum for Former Haines Fuel Terminal Monitoring Well Inventory, Repair and Decomissioning. July.
Bristol Environmental Remediation Services, LLC (Bristol), and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.
Unknown Author. Tok Fuel Terminal Monitoring Well Inspection Forms. Provide by USACE via email in July 2021.

Table 7-1 - Groundwater PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Wainwright Sub-Installations, Alaska

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Location	Sample/ Parent ID	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)		PFNA (ng/L)		PFHxS (ng/L)	
		4		6		601		6		39	
		Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
HFT-AP-114-GW	HFT-AP-114-061222	**87**	J-	8.5	UJ-	8.5	UJ-	8.5	UJ-	**16**	J-
HFT-AP-146-GW	HFT-AP-146-061222	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U
HFT-AP-006-GW	HFT-AP-006-061222	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
HFT-AP-009-GW	HFT-AP-009-061222	**43**	J-	4.7	UJ-	4.7	UJ-	4.7	UJ-	**9.7**	J-
HFT-AP-148-GW	HFT-AP-148-061122	**270**		2.2	U	2.2	U	2.2	U	**45**	
HFT-AP-153-GW	HFT-AP-153-061322	2.3	U	2.3	U	2.3	U	2.3	U	2.3	U
HFT-AP-137-GW	HFT-AP-137-061122	2.2	U	2.2	U	2.2	U	2.2	U	**3.0**	J
	HFT-FD-1-GW-061122 / HFT-AP-137-061122	2.1	U	2.1	U	2.1	U	2.1	U	**3.1**	J
HFT-AP-207-GW	HFT-AP-207-061122	5.0	UJ-	5.0	UJ-	5.0	UJ-	5.0	UJ-	**7.1**	J-
HFT-AP-515-GW	HFT-AP-515-061222	**2.9**	J	2.1	U	2.1	U	2.1	U	2.1	U
HFT-AP-533-GW	HFT-AP-533-061222	3.3	UJ-	3.3	UJ-	3.3	UJ-	3.3	UJ-	3.3	UJ-
HFT-AP-534-GW	HFT-AP-534-061122	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U
TFT-MW40-GW	TFT-MW40-060822	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
TFT-MW5-GW	TFT-MW5-060822	2.2	UJ	2.2	UJ	2.2	UJ	2.2	UJ	**37**	J-
	TFT-FD-1-GW-060822 / TFT-MW5-060822	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	**32**	J
TFT-MWD1-GW	TFT-MWD1-060722	**6.7**	J	**3.2**	J	2.2	UJ	2.2	UJ	2.2	UJ
TFT-MWD3-GW	TFT-MWD3-060722	4.2	UJ-	**5.5**	J-	4.2	UJ-	4.2	UJ-	4.2	UJ-
TFT-MWD4-GW	TFT-MWD4-060822	1.8	UJ	1.8	UJ	1.8	UJ	1.8	UJ	1.8	UJ
TFT-MWD7-GW	TFT-MWD7-060722	3.3	UJ-	3.3	UJ-	3.3	UJ-	3.3	UJ-	3.3	UJ-

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

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

Qualifier	Description
J	The analyte was positively identified; however the associated numerical value is an estimated concentration only
J-	The result is an estimated quantity; the result may be biased low.
U	The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).
UJ	The analyte was analyzed for but was not detected. The reported reporting limit (RL) is approximate and may be inaccurate or imprecise.
UJ-	The analyte was analyzed for but was not detected. The reported limit of quantitation (LOQ) is approximate and may be inaccurate or imprecise. Results may be biased low.

AOPI	Location	Sample/ Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)		PFNA (mg/kg)		PFHxS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	0.16		0.25		25		0.25		1.6	
				OSD Residential Risk Screening Level	0.013		0.019		1.9		0.019		0.13	
				Sample Type	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
HFT - Fire Hose Building 1203	HFT-B1203-1-SO	HFT-B1203-1-SO-061322	06/13/2022	N	0.00046	U	0.00046	U	0.00046	U	0.00046	U	0.00046	U
HFT - Fire Hose Building 1203	HFT-B1203-2-SO	HFT-B1203-2-SO-061322	06/13/2022	N	**0.00055**	J	0.00046	U	0.00046	U	0.00046	U	0.00046	U
HFT - Fire Pump Building 1208	HFT-B1208-1-SO	HFT-B1208-1-SO-061322	06/13/2022	N	0.00048	U	0.00048	U	0.00048	U	0.00048	U	0.00048	U
HFT - Fire Pump Building 1208	HFT-B1208-2-SO	HFT-B1208-2-SO-061322	06/13/2022	N	0.00050	U	0.00050	U	0.00050	U	0.00050	U	0.00050	U
HFT - Hose Cart Building 1209	HFT-B1209-1-SO	HFT-B1209-1-SO-061322	06/13/2022	N	0.00049	U	0.00049	U	0.00049	U	0.00049	U	0.00049	U
HFT - Firehouse Office, Shop, and Garage Building 1212	HFT-B1212-1-SO	HFT-B1212-1-SO-061322	06/13/2022	N	0.00045	U	0.00045	U	0.00045	U	0.00045	U	0.00045	U
		HFT-FD-2-SO-061322 / HFT-B1212-1-SO-061322	06/13/2022	FD	0.00050	U	0.00050	U	0.00050	U	0.00050	U	0.00050	U
HFT - Firehouse Office, Shop, and Garage Building 1212	HFT-B1212-2-SO	HFT-B1212-2-SO-061122	06/11/2022	N	0.00060	U	0.00060	U	0.00060	U	0.00060	U	0.00060	U
HFT - Dockmaster Building 1234	HFT-B1234-1-SO	HFT-B1234-1-SO-061122	06/11/2022	N	0.00050	U	0.00050	U	0.00050	U	0.00050	U	0.00050	U
HFT - Dockmaster Building 1234	HFT-B1234-2-SO	HFT-B1234-2-SO-061122	06/11/2022	N	**0.00056**	J	0.00048	U	0.00048	U	0.00048	U	0.00048	U
HFT - Marine Dock Fire Hose Building 1236	HFT-B1236-1-SO	HFT-B1236-1-SO-061122	06/11/2022	N	0.00050	U	0.00050	U	0.00050	U	0.00050	U	0.00050	U
HFT - Marine Dock Fire Hose Building 1236	HFT-B1236-2-SO	HFT-B1236-2-SO-061122	06/11/2022	N	0.00049	U	0.00049	U	0.00049	U	0.00049	U	0.00049	U
HFT - Tank Farm Fire Foam System	HFT-TFFFS-1-SO	HFT-TFFFS-1-SO-061022	06/10/2022	N	**0.00083**	J	0.00055	U	0.00055	U	0.00055	U	0.00055	U
		HFT-FD-1-SO-SO-061022 / HFT-TFFFS-1-SO-061022	06/10/2022	FD	**0.0010**	J	0.00055	U	0.00055	U	0.00055	U	0.00055	U

AOPI	Location	Sample/ Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)		PFNA (mg/kg)		PFHxS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	0.16		0.25		25		0.25		1.6	
				OSD Residential Risk Screening Level	0.013		0.019		1.9		0.019		0.13	
				Sample Type	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
HFT - Tank Farm Fire Foam System	HFT-TFFFS-2-SO	HFT-TFFFS-2-SO-061022	06/10/2022	N	**0.00055**	J	0.00048	U	0.00048	U	0.00048	U	0.00048	U
	HFT-TFFFS-3-SO	HFT-TFFFS-3-SO-061122	06/11/2022	N	0.00055	U	0.00055	U	0.00055	U	0.00055	U	0.00055	U
HFT - Tank Farm Fire Foam System	HFT-TFFFS-4-SO	HFT-TFFFS-4-SO-061022	06/10/2022	N	0.00050	U	0.00050	U	0.00050	U	0.00050	U	0.00050	U
	HFT-TFFFS-5-SO	HFT-TFFFS-5-SO-061022	06/10/2022	N	**0.0010**		0.00050	U	0.00050	U	0.00050	U	0.00050	U
HFT - Tank Farm Fire Foam	HFT-TFFFS-6-SO	HFT-TFFFS-6-SO-061122	06/11/2022	N	0.00055	U	0.00055	U	0.00055	U	0.00055	U	0.00055	U
TFT - Burn Pit and Soil Piles	TFT-BPSP-1-SO	TFT-BPSP-1-SO-060822	06/08/2022	N	0.00065	U	0.00065	U	0.00065	U	0.00065	U	0.00065	U
		TFT-FD-1-SO-060822 / TFT-BPSP-1-SO-060822	06/08/2022	FD	0.00050	U	0.00050	U	0.00050	U	0.00050	U	0.00050	U
TFT - Burn Pit and Soil Piles	TFT-BPSP-2-SO	TFT-BPSP-2-SO-060822	06/08/2022	N	0.00048	U	0.00048	U	0.00048	U	0.00048	U	**0.0019**	
TFT - Tank Farm Fire Foam	TFT-TFFFS-1-SO	TFT-TFFFS-1-SO-060822	06/08/2022	N	0.00050	U	0.00050	U	0.00050	U	0.00050	U	0.00050	U
TFT - Tank Farm Fire Foam	TFT-TFFFS-2-SO	TFT-TFFFS-2-SO-060822	06/08/2022	N	0.00055	U	0.00055	U	0.00055	U	0.00055	U	0.00055	U
TFT - Tank Farm Fire Foam	TFT-TFFFS-3-SO	TFT-TFFFS-3-SO-060822	06/08/2022	N	0.00055	U	0.00055	U	0.00055	U	0.00055	U	0.00055	U
TFT - Tank Farm Fire Foam	TFT-TFFFS-4-SO	TFT-TFFFS-4-SO-060822	06/08/2022	N	0.00047	U	0.00047	U	0.00047	U	0.00047	U	0.00047	U
TFT - Tank Farm Fire Foam	TFT-TFFFS-5-SO	TFT-TFFFS-5-SO-060822	06/08/2022	N	0.00050	U	0.00050	U	0.00050	U	0.00050	U	0.00050	U

Notes:

1. **Bolded** values indicate the result was detected greater than the limit of detection.
2. Data are compared to the Office of the Secretary of Defense (OSD) risk screening levels for both the residential as well as the industrial/commercial scenarios (OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July). No concentrations of PFOS, PFOA, PFBS, PFNA, or PFHxS exceeded the OSD risk screening levels.

Acronyms/Abbreviations:

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

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

FIGURES

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Wainwright Sub-Installations, AK

Figure 2-1
Site Locations

Fort Wainwright Sub-Installations Addressed in this PA/SI

Haines-Fairbanks Pipeline

PA/SI = preliminary assessment/site inspection

Installations Not Addressed in this PA/SI

Fort Wainwright

Donnelly Training Area

Fort Greely

Data Sources:
Fort Wainwright, GIS Data, 2018
ESRI ArcGIS Online, World Street Map

Coordinate System:
World Mercator

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-1 - Site Locations.mxd

USAEC PFAS
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Fort Wainwright
Sub-Installations, AK

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Figure 2-2a
Site Layout and Topographic Map – Haines Fuel Terminal

Legend

- Sub-Installation Boundary
- Monitoring Well
- Groundwater Flow Direction
- Elevation Contour (feet)

Note:
Groundwater flow direction is as reported by: Bristol and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.

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

Coordinate System:
WGS 1984, UTM Zone 8 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-2a - Haines Site Layout.mxd

USAEC PFAS
Preliminary Assessment/ Site Inspection
Fort Wainwright Sub-Installations, AK

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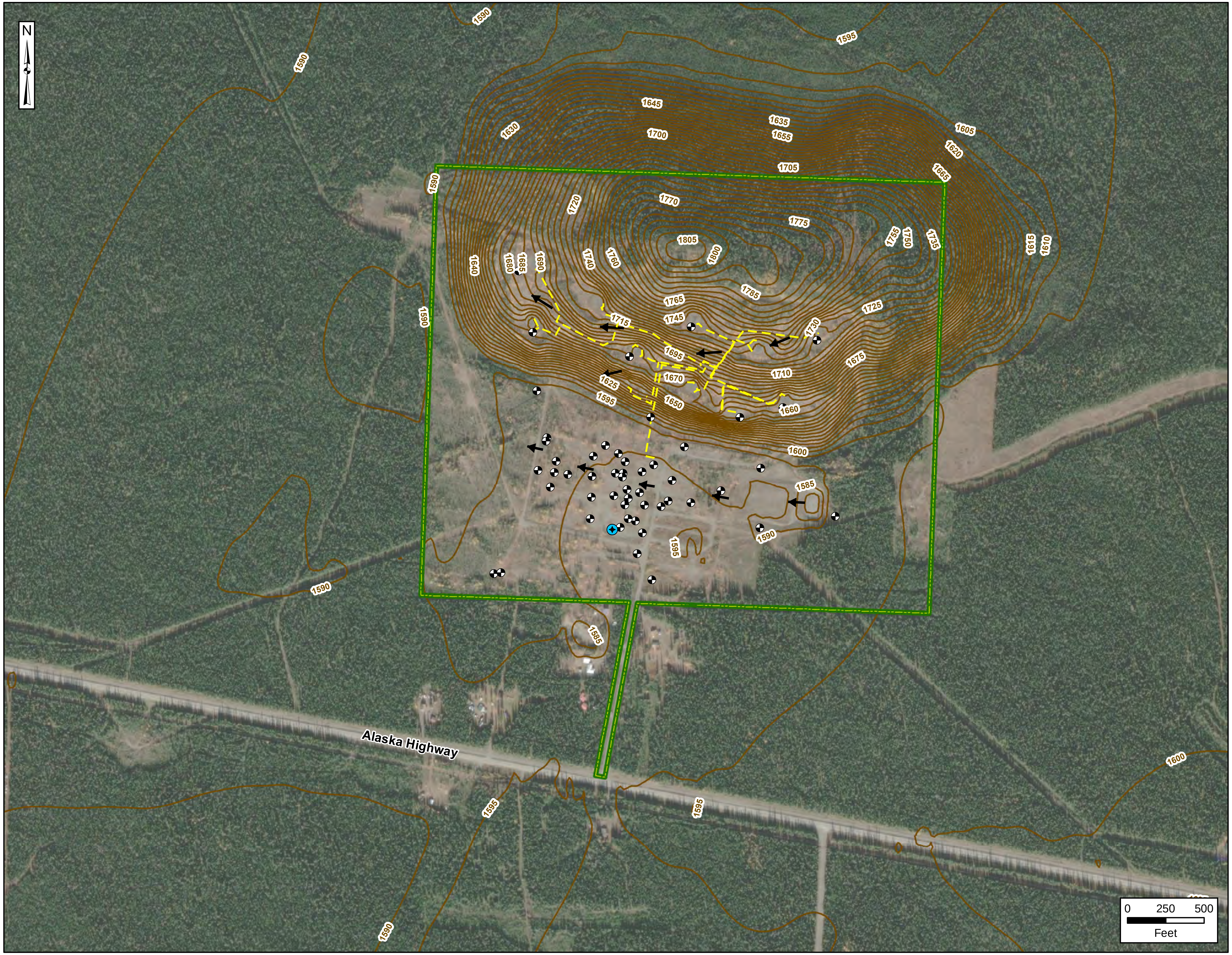
Figure 2-2b
Site Layout and Topographic Map – Tok Fuel Terminal



Legend

- Sub-Installation Boundary
- Water Supply Well
- Monitoring Well
- Former Firefighting Foam Piping
- Groundwater Flow Direction
- Elevation Contour (feet)

Note:
Groundwater flow direction is as reported by: Bristol and FES. 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. June.

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

Coordinate System:
WGS 1984, UTM Zone 7 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-2b - Tok Site Layout.mxd

USAEC PFAS
Preliminary Assessment/
Site Inspection
Fort Wainwright
Sub-Installations, AK

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Figure 2-2c
Site Layout and
Topographic Map –
Sears Creek Pump Station

Legend

- Sub-Installation Boundary
- Monitoring Well
- Water Supply Well
- Groundwater Flow Direction
- Elevation Contour (feet)

Note:
Groundwater flow direction is as reported by: Bristol and FES. 2018. Final Supplemental Remedial Investigation, Sears Creek Pump Station, Revision 3. November.

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

Coordinate System:
WGS 1984, UTM Zone 6 North

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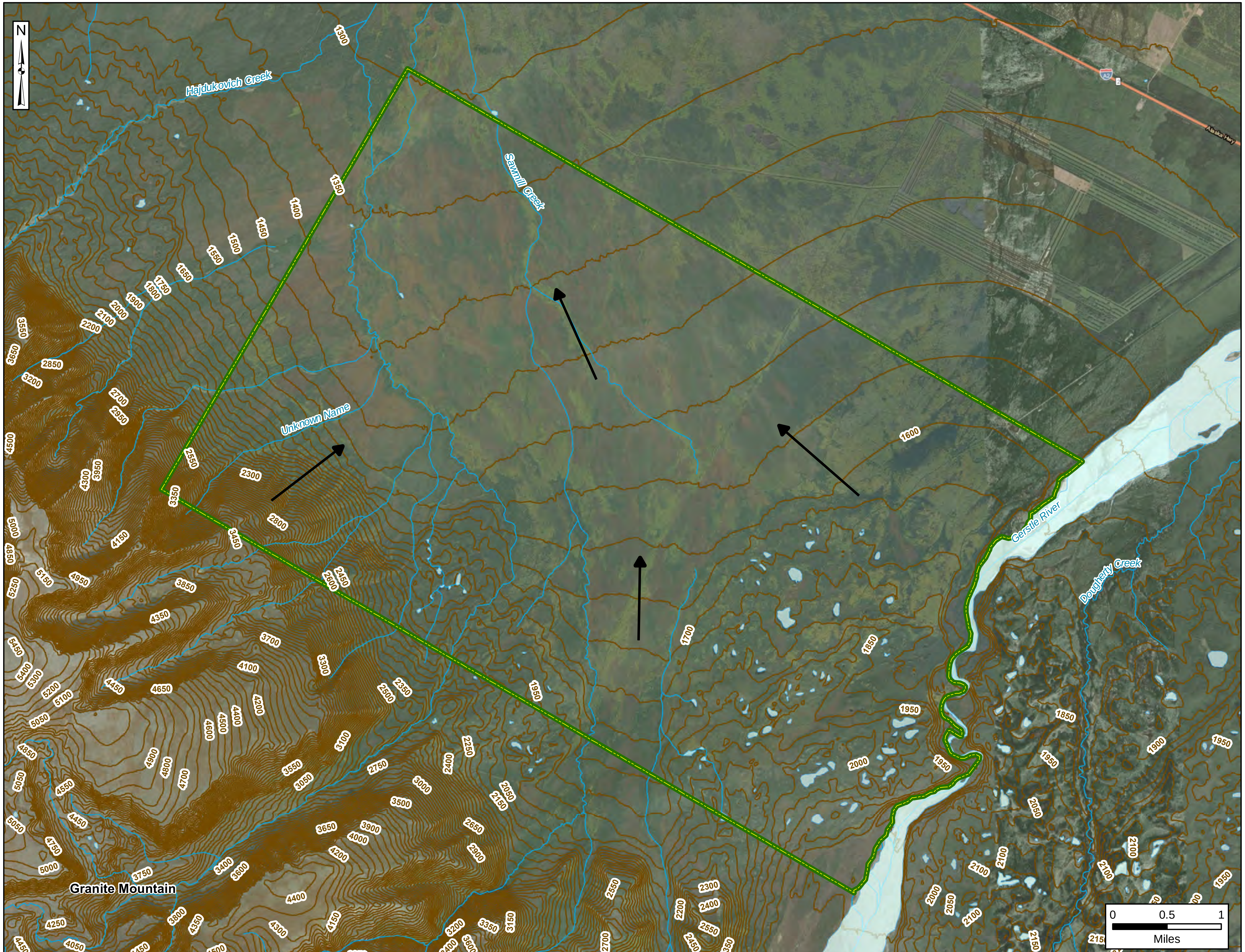

USAEC PFAS Preliminary Assessment/ Site Inspection Fort Wainwright Sub-Installations, AK

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Figure 2-2d Site Layout and Topographic Map – Gerstle River Test Site

Legend

- Sub-Installation Boundary
- Estimated Groundwater Flow Direction
- River/Stream
- Water Body
- Elevation Contour (feet)

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

Coordinate System:
WGS 1984, UTM Zone 6 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-2d - Gerstle River Site Layout.mxd

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Sub-Installations, AK

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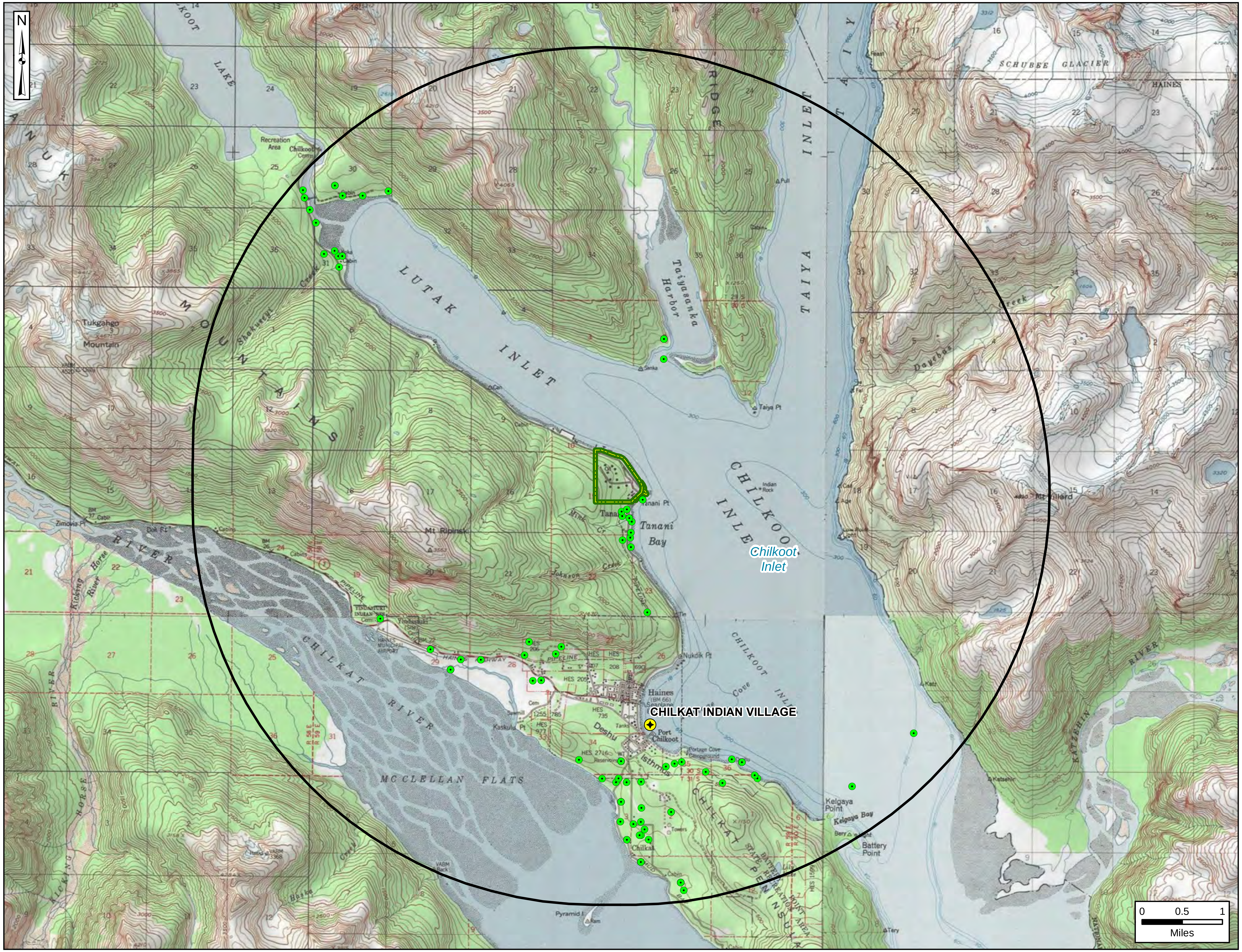


Figure 2-3a
Off-Post Potable Supply Wells – Haines Fuel Terminal

Legend

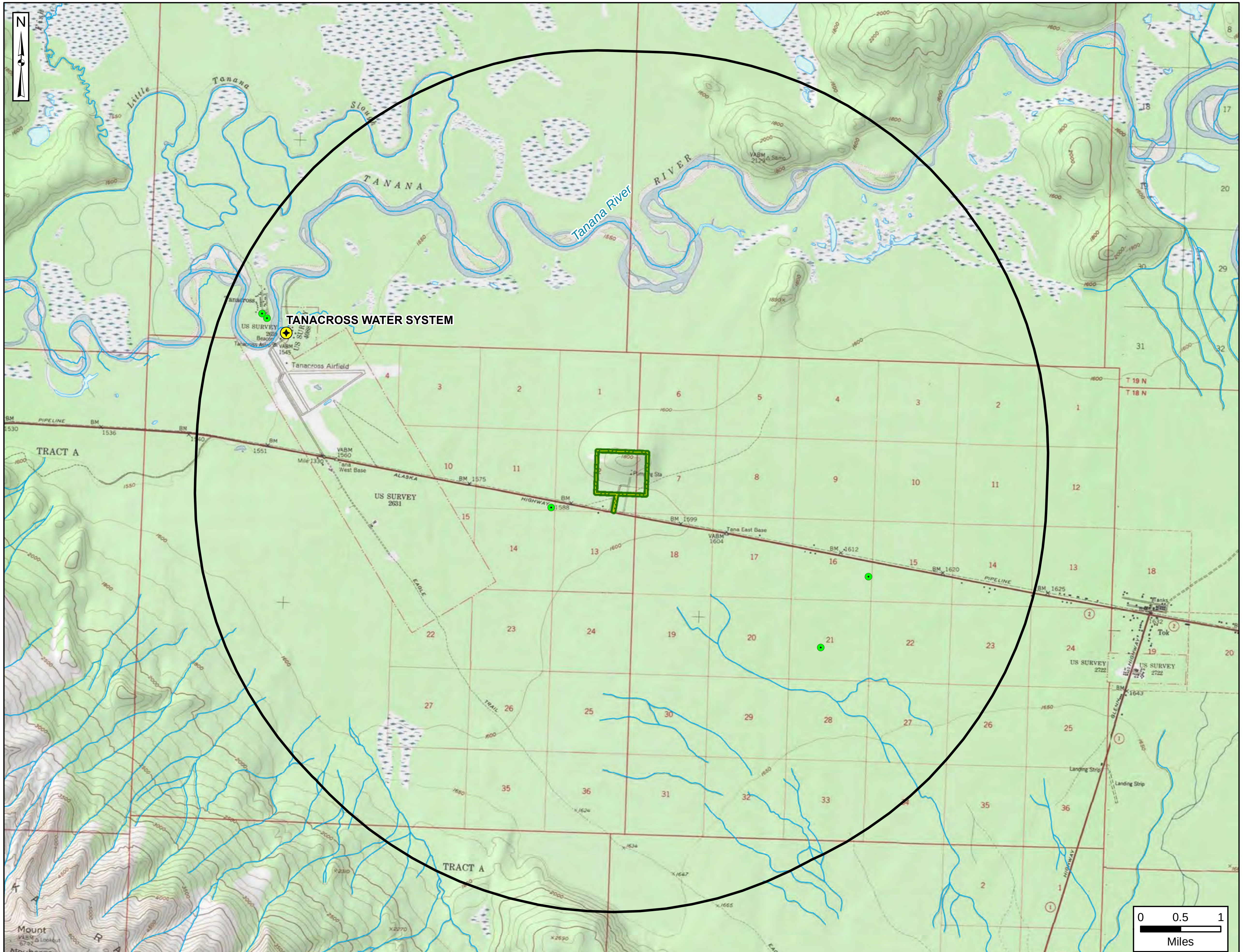
- Sub-Installation Boundary
- 5-Mile Radius
- Public Water Supply System Well
- Alaska DNR Water Well*

*Well data was obtained from Alaska Department of Natural Resources (DNR). Well use designation and status were not provided.

Data Sources:
Fort Wainwright, GIS Data, 2018
EDR, Well Data, 2018
AK DNR, Well Data, 2020
ESRI ArcGIS Online, USA Topo Map

Coordinate System:
WGS 1984, UTM Zone 8 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-3a - Haines Off-Post Wells.mxd



USAEC PFAS Preliminary Assessment/ Site Inspection Fort Wainwright Sub-Installations, AK

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Figure 2-3b Off-Post Potable Supply Wells – Tok Fuel Terminal

Legend

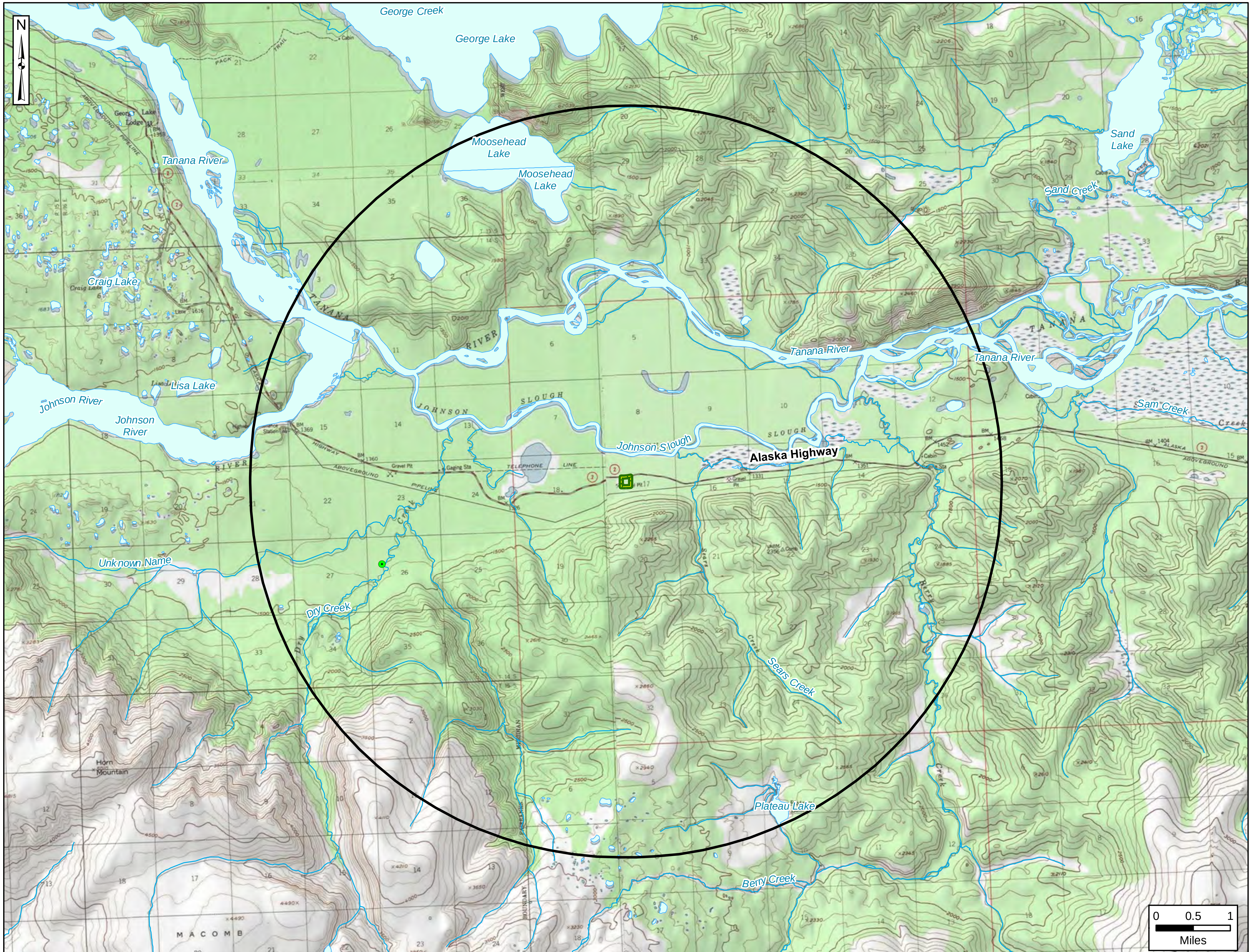
- Sub-Installation Boundary
- 5-Mile Radius
- River/Stream
- Water Body
- Public Water Supply System Well
- Alaska DNR Water Well*

*Well data was obtained from Alaska Department of Natural Resources (DNR). Well use designation and status were not provided.

Data Sources:
Fort Wainwright, GIS Data, 2018
EDR, Well Data, 2018
AK DNR, Well Data, 2020
USGS, NHD Data, 2021
ESRI ArcGIS Online, USA Topo Map

Coordinate System:
WGS 1984, UTM Zone 7 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-3b - Tok Off-Post Wells.mxd



USAEC PFAS Preliminary Assessment/ Site Inspection Fort Wainwright Sub-Installations, AK

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Figure 2-3c Off-Post Potable Supply Wells – Sears Creek Pump Station

Legend

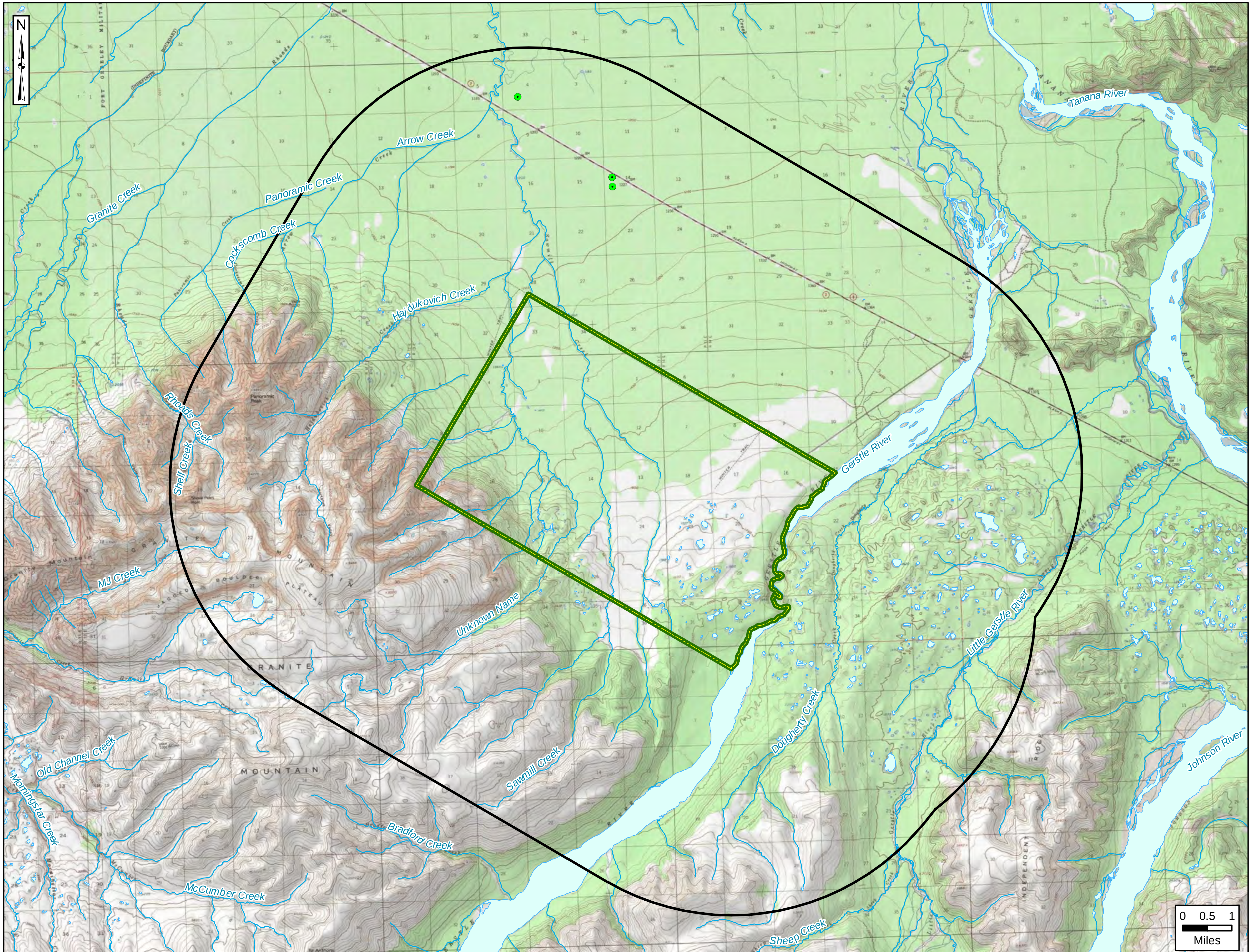
- Sub-Installation Boundary
- 5-Mile Radius
- River/Stream
- Water Body
- Alaska DNR Water Well*

*Well data was obtained from Alaska Department of Natural Resources (DNR). Well use designation and status were not provided.

Data Sources:
Fort Wainwright, GIS Data, 2018
AK DNR, Well Data, 2020
ESRI ArcGIS Online, USA Topo Map

Coordinate System:
WGS 1984, UTM Zone 6 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-3c - Sears Off-Post Wells.mxd



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Fort Wainwright
Sub-Installations, AK

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Figure 2-3d
Off-Post Potable Supply Wells – Gerstle River Test Site

Legend

- Sub-Installation Boundary
- 5-Mile Radius
- River/Stream
- Water Body
- Alaska DNR Water Well*

*Well data was obtained from Alaska Department of Natural Resources (DNR). Well use designation and status were not provided.

Data Sources:
Fort Wainwright, GIS Data, 2018
AK DNR, Well Data, 2020
ESRI ArcGIS Online, USA Topo Map

Coordinate System:
WGS 1984, UTM Zone 6 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-3d - Gerstle River Off-Post Wells.mxd

USAEC PFAS Preliminary Assessment/ Site Inspection Fort Wainwright Sub-Installations, AK

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Figure 2-4a Historical PFOS, PFOA, PFBS, PFNA, and PFHxS Data – Haines Fuel Terminal

16HFTB231SB03S001	
Date	2016
Depth	3.5-4 ft bgs
PFOS	**0.0029**
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15HFTB231SB01S001		
Date	2015	2015
Depth	3-4 ft bgs	3-4 ft bgs
PFOS	ND	ND
PFOA	ND	ND
PFBS	NS	NS
PFNA	NS	NS
PFHxS	NS	NS

15HFTB231SB02S001	
Date	2015
Depth	3-4 ft bgs
PFOS	**0.0055**
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

16HFTLUBPSB03S001	
Date	2016
Depth	12-13 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

Legend

- Sub-Installation Boundary
- Groundwater Flow Direction
- Soil Boring

ft bgs = feet below ground surface
ND = non-detect
NS = not sampled
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

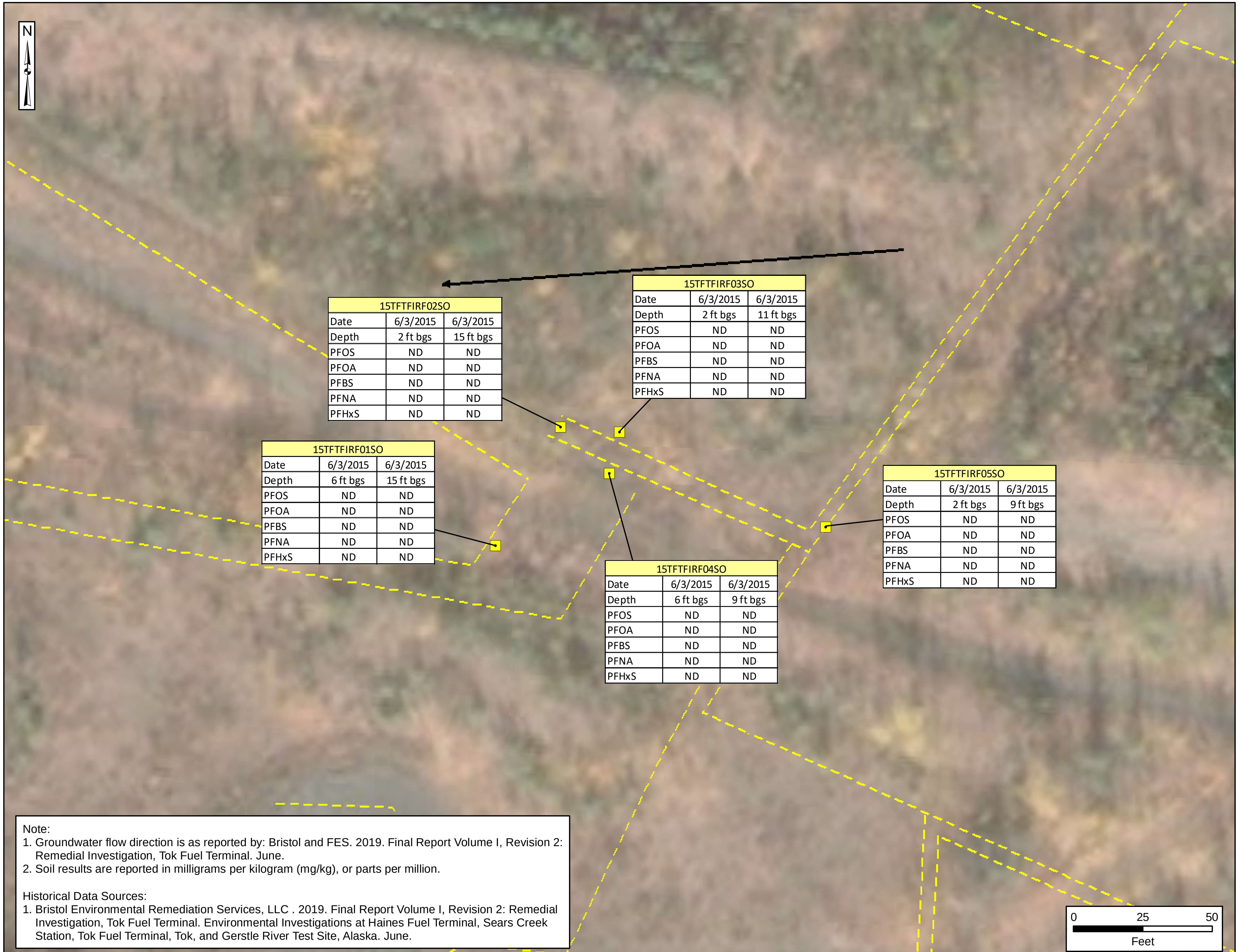
Note:
1. Groundwater flow direction is as reported by: Bristol and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Bolded values indicate exceedances of screening criteria.

Historical Data Sources:
1. Bristol Environmental Remediation Services, LLC, and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.

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

Coordinate System:
WGS 1984, UTM Zone 8 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-4a - Historical PFOS, PFOA, PFBS, PFNA, and PFHxS Data – Haines Fuel Terminal.mxd



15TFTFIRF02SO		
Date	6/3/2015	6/3/2015
Depth	2 ft bgs	15 ft bgs
PFOS	ND	ND
PFOA	ND	ND
PFBS	ND	ND
PFNA	ND	ND
PFHxS	ND	ND

15TFTFIRF03SO		
Date	6/3/2015	6/3/2015
Depth	2 ft bgs	11 ft bgs
PFOS	ND	ND
PFOA	ND	ND
PFBS	ND	ND
PFNA	ND	ND
PFHxS	ND	ND

15TFTFIRF01SO		
Date	6/3/2015	6/3/2015
Depth	6 ft bgs	15 ft bgs
PFOS	ND	ND
PFOA	ND	ND
PFBS	ND	ND
PFNA	ND	ND
PFHxS	ND	ND

15TFTFIRF05SO		
Date	6/3/2015	6/3/2015
Depth	2 ft bgs	9 ft bgs
PFOS	ND	ND
PFOA	ND	ND
PFBS	ND	ND
PFNA	ND	ND
PFHxS	ND	ND

15TFTFIRF04SO		
Date	6/3/2015	6/3/2015
Depth	6 ft bgs	9 ft bgs
PFOS	ND	ND
PFOA	ND	ND
PFBS	ND	ND
PFNA	ND	ND
PFHxS	ND	ND

Note:
1. Groundwater flow direction is as reported by: Bristol and FES. 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. June.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.

Historical Data Sources:
1. Bristol Environmental Remediation Services, LLC . 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. Environmental Investigations at Haines Fuel Terminal, Sears Creek Station, Tok Fuel Terminal, Tok, and Gerstle River Test Site, Alaska. June.

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Figure 2-4b
Historical PFOS, PFOA, PFBS, PFNA, and PFHxS Data – Tok Fuel Terminal (1)

Legend

- Sub-Installation Boundary
- Former Firefighting Foam Piping
- Groundwater Flow Direction
- Soil Boring

ft bgs = feet below ground surface
ND = non-detect
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

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

Coordinate System:
WGS 1984, UTM Zone 8 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-4b - Historical PFOS, PFOA, PFBS, PFNA, and PFHxS Data – Tok Fuel Terminal (Tank Farm Fire Foam System).mxd

USAEC PFAS Preliminary Assessment/ Site Inspection Fort Wainwright Sub-Installations, AK

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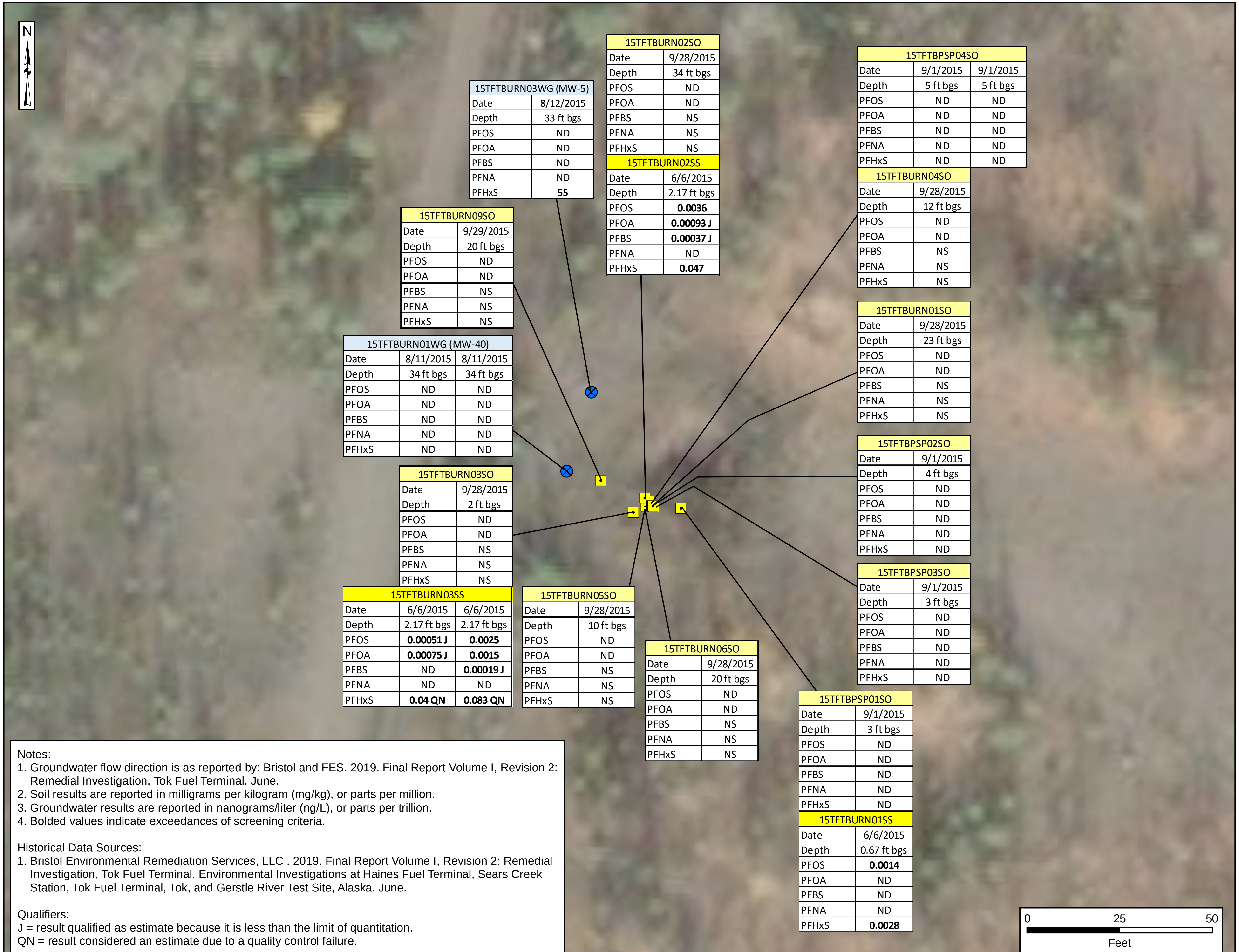
Figure 2-4c
Historical PFOS, PFOA, PFBS, PFNA, and PFHxS Data – Tok Fuel Terminal (2)



15TFTBURN03WG (MW-5)	
Date	8/12/2015
Depth	33 ft bgs
PFOS	ND
PFOA	ND
PFBS	ND
PFNA	ND
PFHxS	**55**

15TFTBURN02SO	
Date	9/28/2015
Depth	34 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTBURN02SS	
Date	6/6/2015
Depth	2.17 ft bgs
PFOS	**0.0036**
PFOA	**0.00093 J**
PFBS	**0.00037 J**
PFNA	ND
PFHxS	**0.047**

15TFTBPSP04SO		
Date	9/1/2015	9/1/2015
Depth	5 ft bgs	5 ft bgs
PFOS	ND	ND
PFOA	ND	ND
PFBS	ND	ND
PFNA	ND	ND
PFHxS	ND	ND

15TFTBURN04SO	
Date	9/28/2015
Depth	12 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTBURN09SO	
Date	9/29/2015
Depth	20 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTBURN01WG (MW-40)		
Date	8/11/2015	8/11/2015
Depth	34 ft bgs	34 ft bgs
PFOS	ND	ND
PFOA	ND	ND
PFBS	ND	ND
PFNA	ND	ND
PFHxS	ND	ND

15TFTBURN01SO	
Date	9/28/2015
Depth	23 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTBPSP02SO	
Date	9/1/2015
Depth	4 ft bgs
PFOS	ND
PFOA	ND
PFBS	ND
PFNA	ND
PFHxS	ND

15TFTBURN03SO	
Date	9/28/2015
Depth	2 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTBPSP03SO	
Date	9/1/2015
Depth	3 ft bgs
PFOS	ND
PFOA	ND
PFBS	ND
PFNA	ND
PFHxS	ND

15TFTBURN03SS		
Date	6/6/2015	6/6/2015
Depth	2.17 ft bgs	2.17 ft bgs
PFOS	**0.00051 J**	**0.0025**
PFOA	**0.00075 J**	**0.0015**
PFBS	ND	**0.00019 J**
PFNA	ND	ND
PFHxS	**0.04 QN**	**0.083 QN**

15TFTBURN05SO	
Date	9/28/2015
Depth	10 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTBURN06SO	
Date	9/28/2015
Depth	20 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTBPSP01SO	
Date	9/1/2015
Depth	3 ft bgs
PFOS	ND
PFOA	ND
PFBS	ND
PFNA	ND
PFHxS	ND

15TFTBURN01SS	
Date	6/6/2015
Depth	0.67 ft bgs
PFOS	**0.0014**
PFOA	ND
PFBS	ND
PFNA	ND
PFHxS	**0.0028**

Notes:
1. Groundwater flow direction is as reported by: Bristol and FES. 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. June.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Groundwater results are reported in nanograms/liter (ng/L), or parts per trillion.
4. Bolded values indicate exceedances of screening criteria.

Historical Data Sources:
1. Bristol Environmental Remediation Services, LLC . 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. Environmental Investigations at Haines Fuel Terminal, Sears Creek Station, Tok Fuel Terminal, Tok, and Gerstle River Test Site, Alaska. June.

Qualifiers:
J = result qualified as estimate because it is less than the limit of quantitation.
QN = result considered an estimate due to a quality control failure.

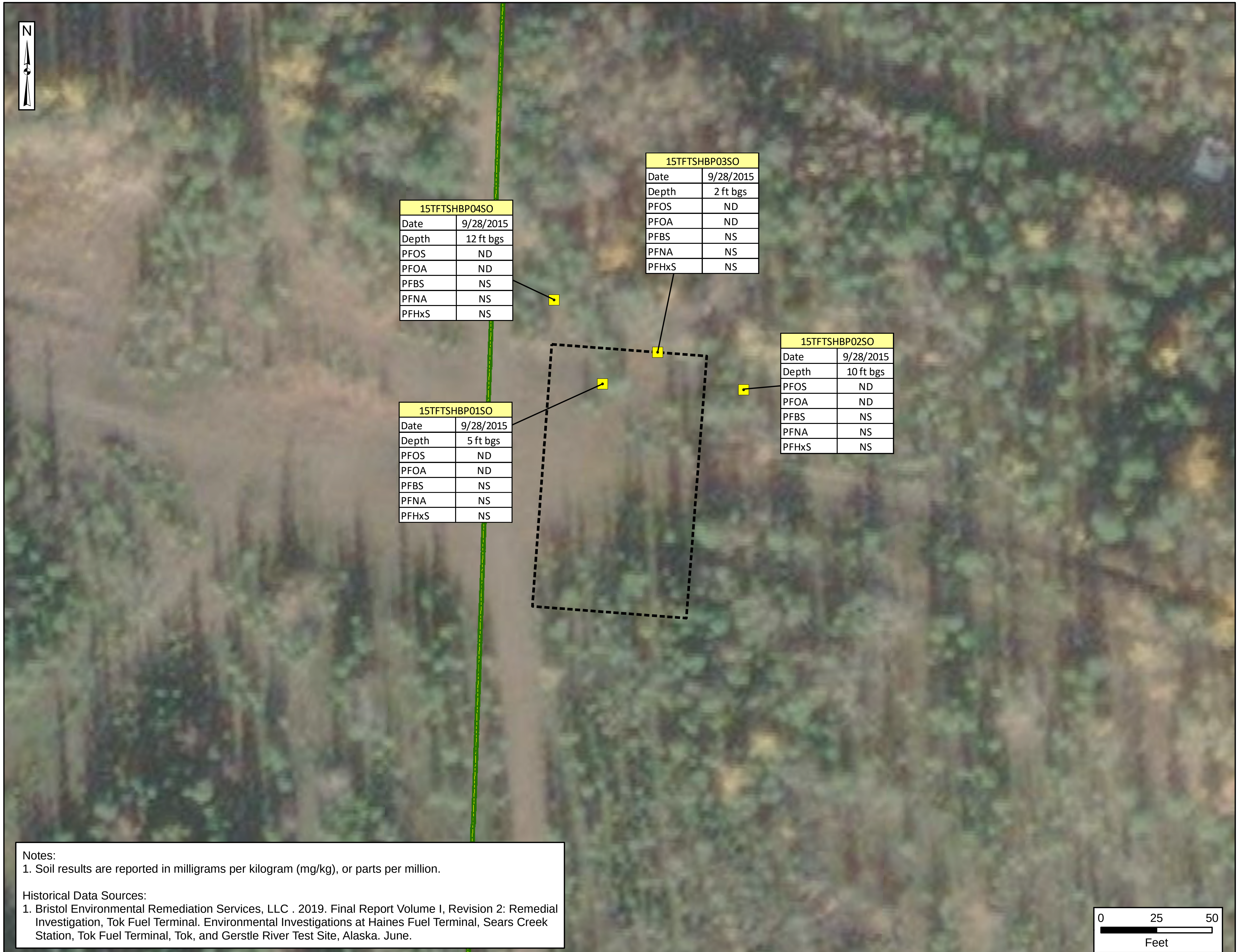
Legend

- Sub-Installation Boundary
- Soil Boring
- Monitoring Well

ft bgs = feet below ground surface
ND = non-detect
NS = not sampled
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

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

Coordinate System:
WGS 1984, UTM Zone 8 North



15TFTSHBP04SO	
Date	9/28/2015
Depth	12 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTSHBP03SO	
Date	9/28/2015
Depth	2 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTSHBP02SO	
Date	9/28/2015
Depth	10 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15TFTSHBP01SO	
Date	9/28/2015
Depth	5 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.

Historical Data Sources:
1. Bristol Environmental Remediation Services, LLC . 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. Environmental Investigations at Haines Fuel Terminal, Sears Creek Station, Tok Fuel Terminal, Tok, and Gerstle River Test Site, Alaska. June.

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Figure 2-4d Historical PFOS, PFOA, PFBS, PFNA, and PFHxS Data – Tok Fuel Terminal (3)

Legend

- Sub-Installation Boundary
- Former Burn Pit
- Soil Boring

ft bgs = feet below ground surface
ND = non-detect
NS = not sampled
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

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

Coordinate System:
WGS 1984, UTM Zone 8 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-4d - Historical PFOS, PFOA, PFBS, PFNA, and PFHxS Data – Tok Fuel Terminal (Potential Ski Hill Burn Pit).mxd

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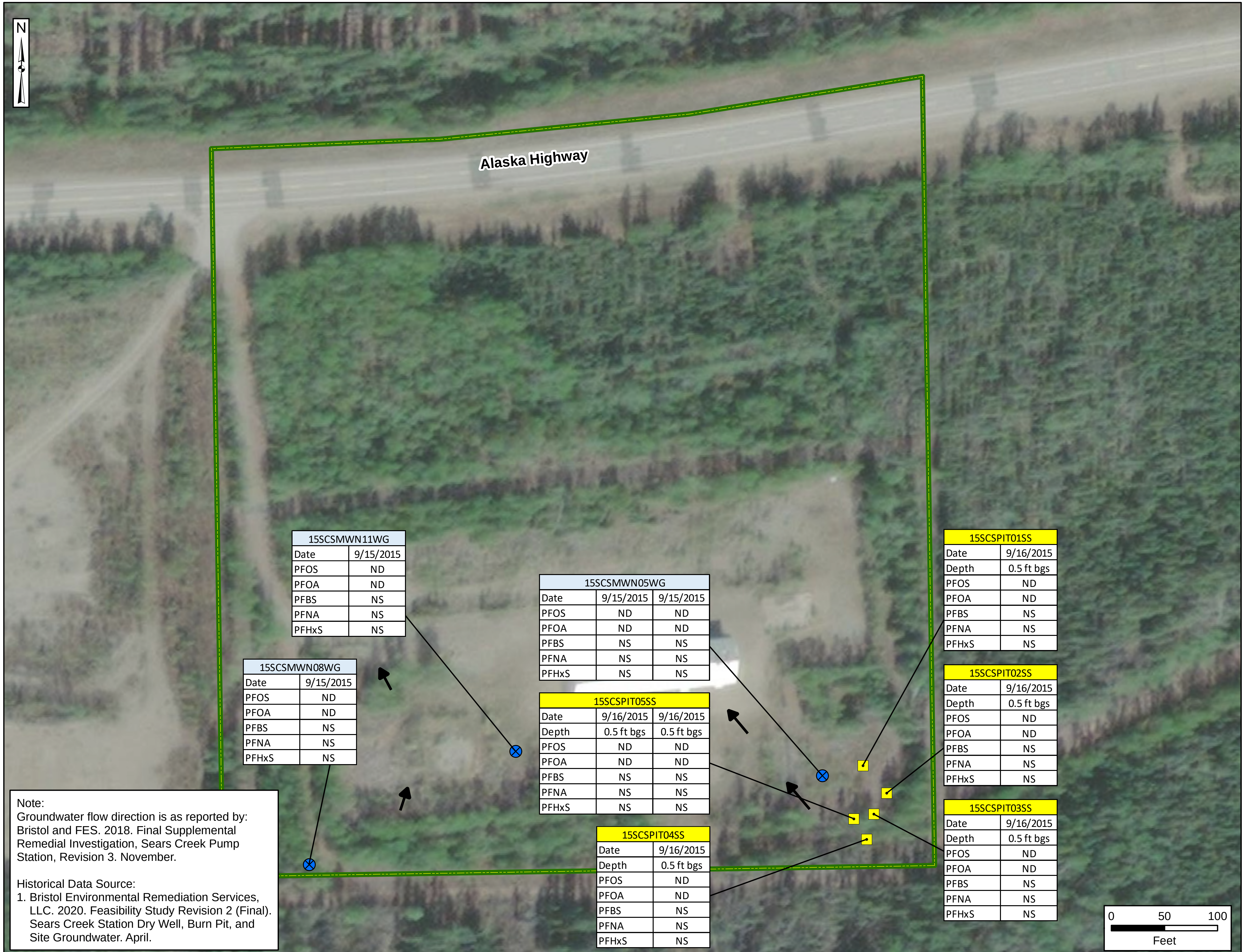
Figure 2-4e
Historical PFOS, PFOA, PFBS, PFNA, and PFHxS Data – Sears Creek Pump Station



15SCSMWN11WG	
Date	9/15/2015
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15SCSMWN08WG	
Date	9/15/2015
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15SCSMWN05WG		
Date	9/15/2015	9/15/2015
PFOS	ND	ND
PFOA	ND	ND
PFBS	NS	NS
PFNA	NS	NS
PFHxS	NS	NS

15SCSPIT05SS		
Date	9/16/2015	9/16/2015
Depth	0.5 ft bgs	0.5 ft bgs
PFOS	ND	ND
PFOA	ND	ND
PFBS	NS	NS
PFNA	NS	NS
PFHxS	NS	NS

15SCSPIT04SS	
Date	9/16/2015
Depth	0.5 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15SCSPIT01SS	
Date	9/16/2015
Depth	0.5 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15SCSPIT02SS	
Date	9/16/2015
Depth	0.5 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

15SCSPIT03SS	
Date	9/16/2015
Depth	0.5 ft bgs
PFOS	ND
PFOA	ND
PFBS	NS
PFNA	NS
PFHxS	NS

Note:
Groundwater flow direction is as reported by: Bristol and FES. 2018. Final Supplemental Remedial Investigation, Sears Creek Pump Station, Revision 3. November.

Historical Data Source:
1. Bristol Environmental Remediation Services, LLC. 2020. Feasibility Study Revision 2 (Final). Sears Creek Station Dry Well, Burn Pit, and Site Groundwater. April.

Legend

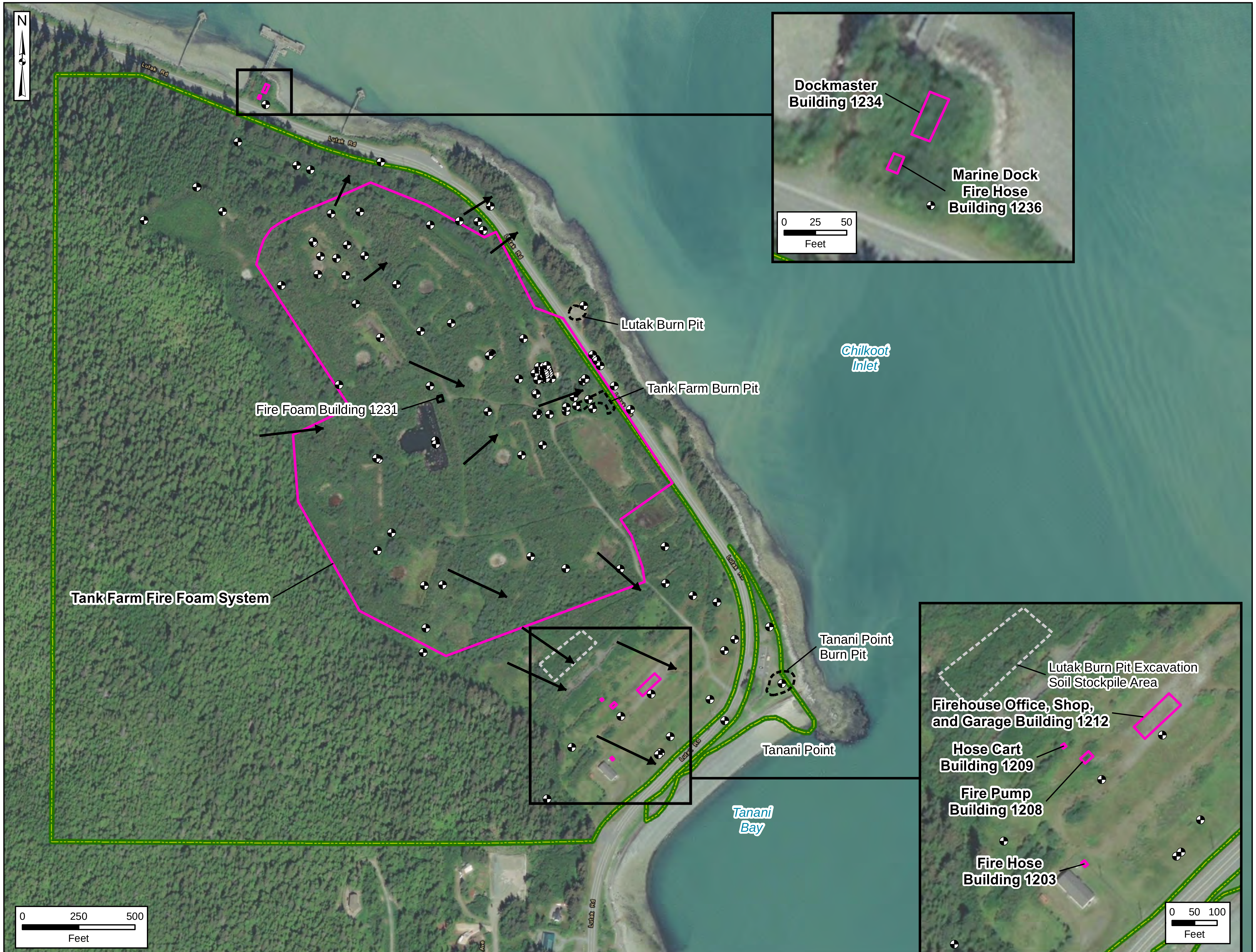
- Sub-Installation Boundary
- Groundwater Flow Direction
- Soil Boring
- Groundwater Monitoring Well

ft bgs = feet below ground surface
ND = non-detect
NS = not sampled
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

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

Coordinate System:
WGS 1984, UTM Zone 8 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 2-4e - Historical PFOS, PFOA, PFBS, PFNA, and PFHxS Data – Sears Creek Pump Station.mxd



Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 5-2a - Haines AOPI Locations.mxd

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Figure 5-2a
AOPI Locations - Haines Fuel Terminal

Legend

- Sub-Installation Boundary
- AOPI
- Former Building
- Former Burn Pit
- Former Soil Stockpile Area
- Monitoring Well
- Groundwater Flow Direction

AOPI = area of potential interest

Note:
Groundwater flow direction is as reported by: Bristol and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.

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

Coordinate System:
WGS 1984, UTM Zone 8 North

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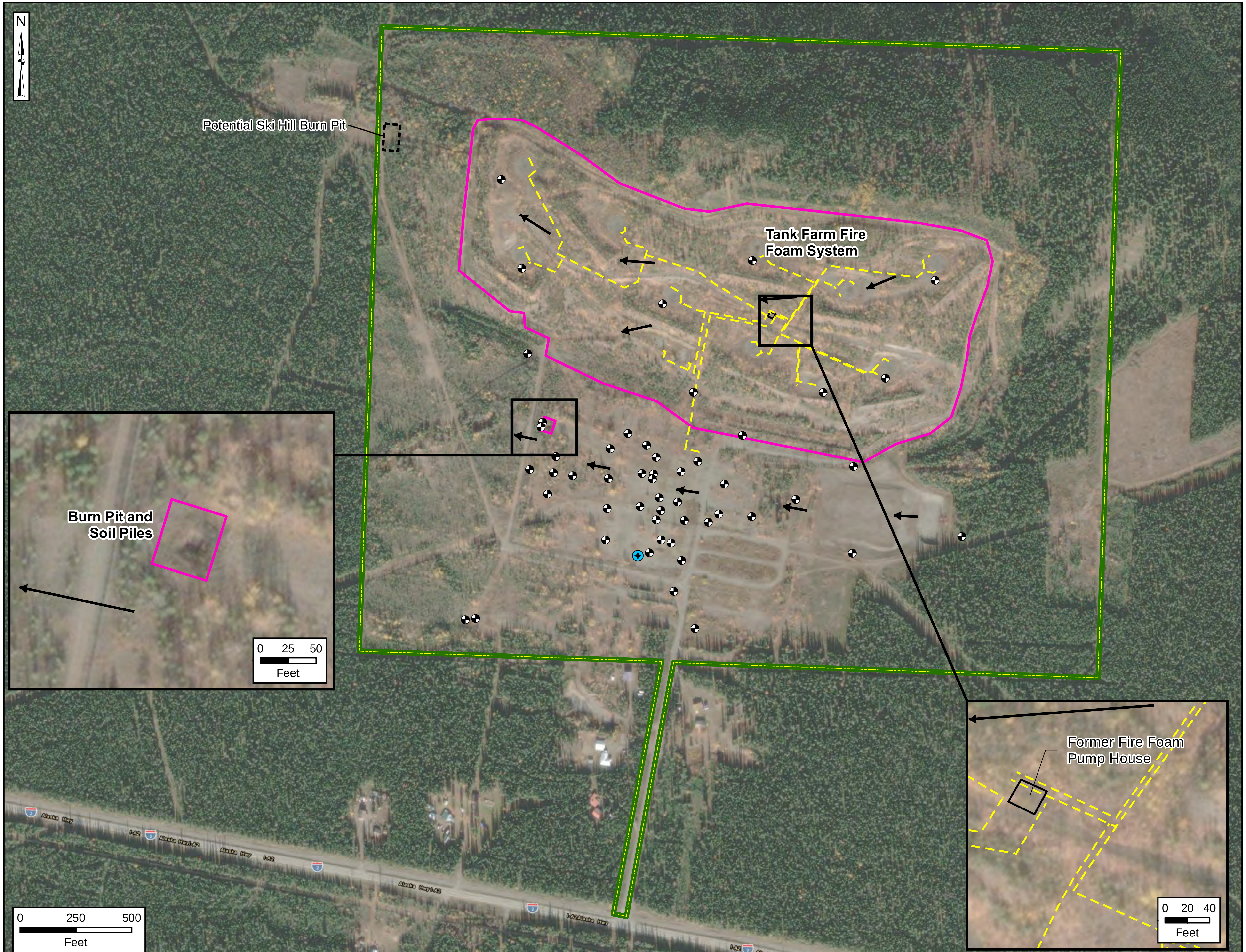
Figure 5-2b
AOPI Locations - Tok Fuel Terminal



Legend

- Sub-Installation Boundary
- AOPI
- Former Building
- Former Burn Pit
- Former Firefighting Foam Piping
- Groundwater Flow Direction
- Water Supply Well
- Monitoring Well

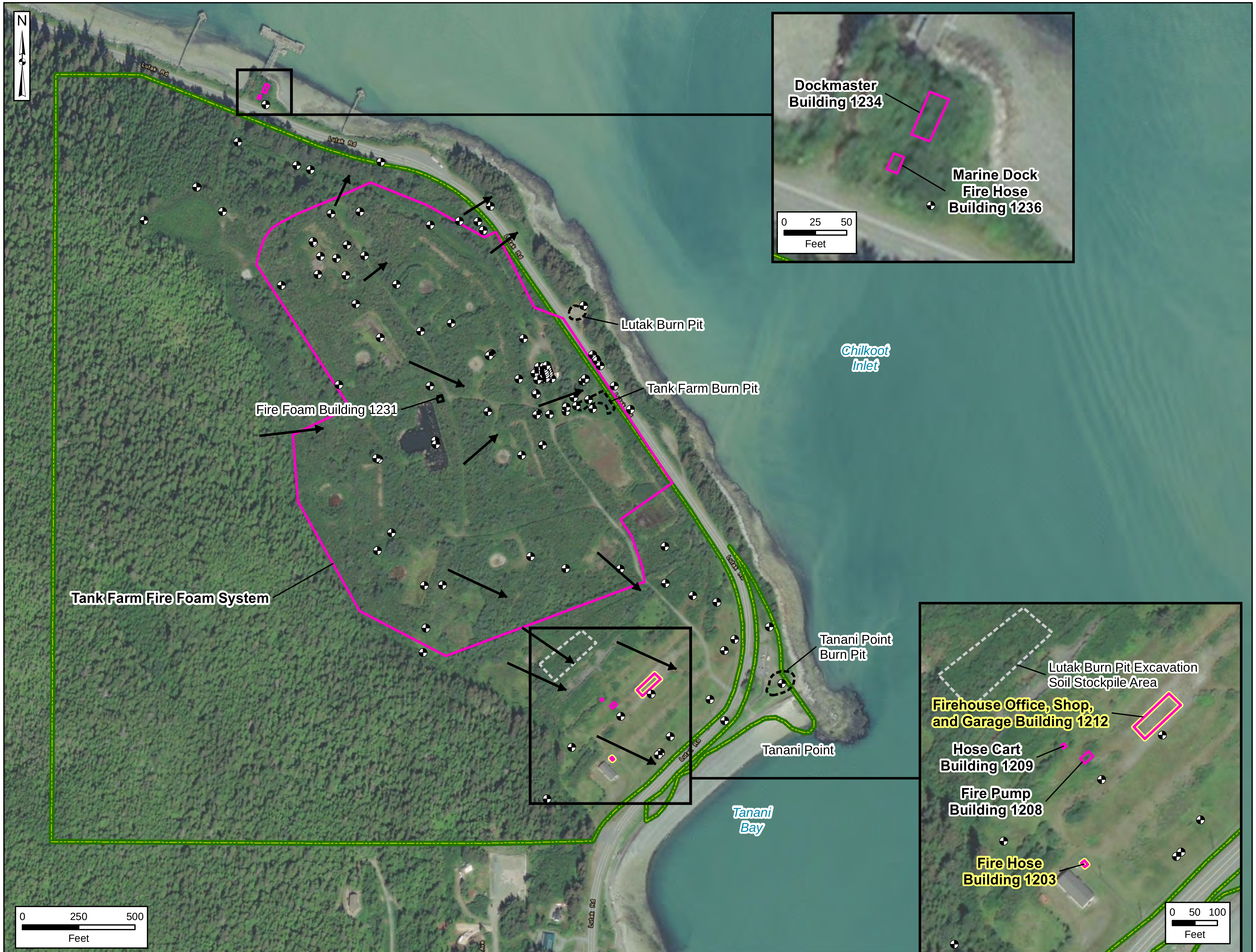
AOPI = area of potential interest

Note:
Groundwater flow direction is as reported by: Bristol and FES. 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. June.

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

Coordinate System:
WGS 1984, UTM Zone 7 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 5-2b - Tok AOPI Locations.mxd



Document Path: \\arcadis-us.com\app\GIS\Processing_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 7-1a - Haines AOPI Locations and OSD Exceedances_v2.mxd

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Figure 7-1a
AOPI Locations and
OSD Risk Screening Level
Exceedances –
Haines Fuel Terminal

Legend

- Sub-Installation Boundary
- AOPI
- AOPI with OSD Risk Screening Level Exceedance
- Former Building
- Former Burn Pit
- Former Soil Stockpile Area
- Monitoring Well
- Groundwater Flow Direction

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

Note:
Groundwater flow direction is as reported by: Bristol and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.

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

Coordinate System:
WGS 1984, UTM Zone 8 North

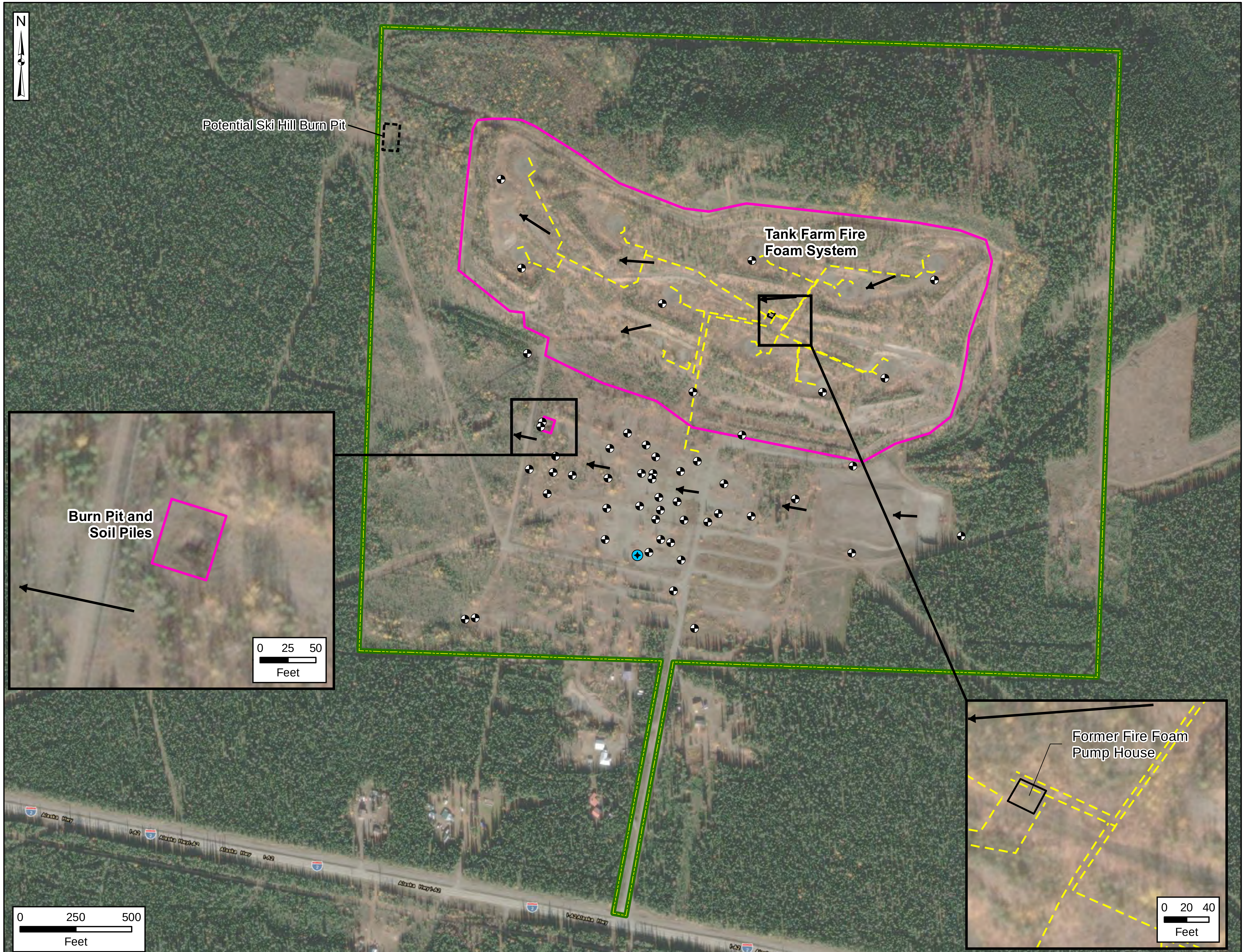

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Figure 7-1b
AOPI Locations and OSD Risk Screening Level Exceedances – Tok Fuel Terminal

Legend

- Sub-Installation Boundary
- AOPI
- Former Building
- Former Burn Pit
- Former Firefighting Foam Piping
- Groundwater Flow Direction
- Water Supply Well
- Monitoring Well

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

Note:
Groundwater flow direction is as reported by: Bristol and FES. 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. June.

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

Coordinate System:
WGS 1984, UTM Zone 7 North

Document Path: \\arcadis-us.com\app\GIS\Processing_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 7-1b - Tok AOPI Locations and OSD Exceedances_v2.mxd

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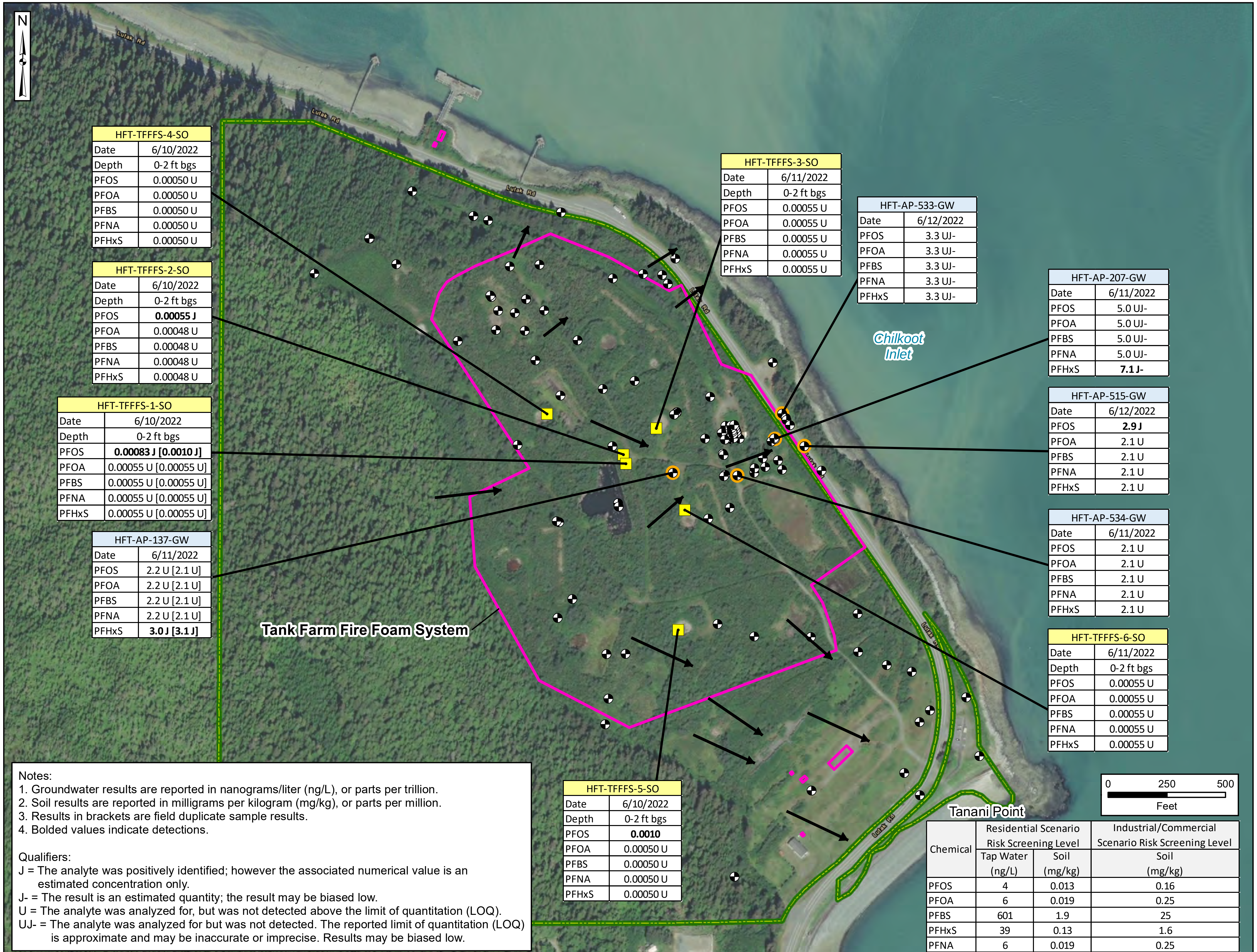
Figure 7-2a PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results – Haines Fuel Terminal (1)



HFT-TFFFS-4-SO	
Date	6/10/2022
Depth	0-2 ft bgs
PFOS	0.00050 U
PFOA	0.00050 U
PFBS	0.00050 U
PFNA	0.00050 U
PFHxS	0.00050 U

HFT-TFFFS-2-SO	
Date	6/10/2022
Depth	0-2 ft bgs
PFOS	**0.00055 J**
PFOA	0.00048 U
PFBS	0.00048 U
PFNA	0.00048 U
PFHxS	0.00048 U

HFT-TFFFS-1-SO	
Date	6/10/2022
Depth	0-2 ft bgs
PFOS	**0.00083 J [0.0010 J]**
PFOA	0.00055 U [0.00055 U]
PFBS	0.00055 U [0.00055 U]
PFNA	0.00055 U [0.00055 U]
PFHxS	0.00055 U [0.00055 U]

HFT-AP-137-GW	
Date	6/11/2022
PFOS	2.2 U [2.1 U]
PFOA	2.2 U [2.1 U]
PFBS	2.2 U [2.1 U]
PFNA	2.2 U [2.1 U]
PFHxS	**3.0 J [3.1 J]**

HFT-TFFFS-3-SO	
Date	6/11/2022
Depth	0-2 ft bgs
PFOS	0.00055 U
PFOA	0.00055 U
PFBS	0.00055 U
PFNA	0.00055 U
PFHxS	0.00055 U

HFT-AP-533-GW	
Date	6/12/2022
PFOS	3.3 UJ-
PFOA	3.3 UJ-
PFBS	3.3 UJ-
PFNA	3.3 UJ-
PFHxS	3.3 UJ-

HFT-AP-207-GW	
Date	6/11/2022
PFOS	5.0 UJ-
PFOA	5.0 UJ-
PFBS	5.0 UJ-
PFNA	5.0 UJ-
PFHxS	**7.1 J-**

HFT-AP-515-GW	
Date	6/12/2022
PFOS	**2.9 J**
PFOA	2.1 U
PFBS	2.1 U
PFNA	2.1 U
PFHxS	2.1 U

HFT-AP-534-GW	
Date	6/11/2022
PFOS	2.1 U
PFOA	2.1 U
PFBS	2.1 U
PFNA	2.1 U
PFHxS	2.1 U

HFT-TFFFS-6-SO	
Date	6/11/2022
Depth	0-2 ft bgs
PFOS	0.00055 U
PFOA	0.00055 U
PFBS	0.00055 U
PFNA	0.00055 U
PFHxS	0.00055 U

HFT-TFFFS-5-SO	
Date	6/10/2022
Depth	0-2 ft bgs
PFOS	**0.0010**
PFOA	0.00050 U
PFBS	0.00050 U
PFNA	0.00050 U
PFHxS	0.00050 U

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

Qualifiers:
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
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).
UJ- = The analyte was analyzed for but was not detected. The reported limit of quantitation (LOQ) is approximate and may be inaccurate or imprecise. Results may be biased low.

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

Legend

- Sub-Installation Boundary
- AOPI
- Groundwater Flow Direction
- Monitoring Well
- Soil Sampling Location
- Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Note:
Groundwater flow direction is as reported by: Bristol and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.

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

Coordinate System:
WGS 1984, UTM Zone 8 North

Document Path: T:_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 7-2a - PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results – Haines Fuel Terminal (1).mxd

USAEC PFAS Preliminary Assessment/ Site Inspection Fort Wainwright Sub-Installations, AK

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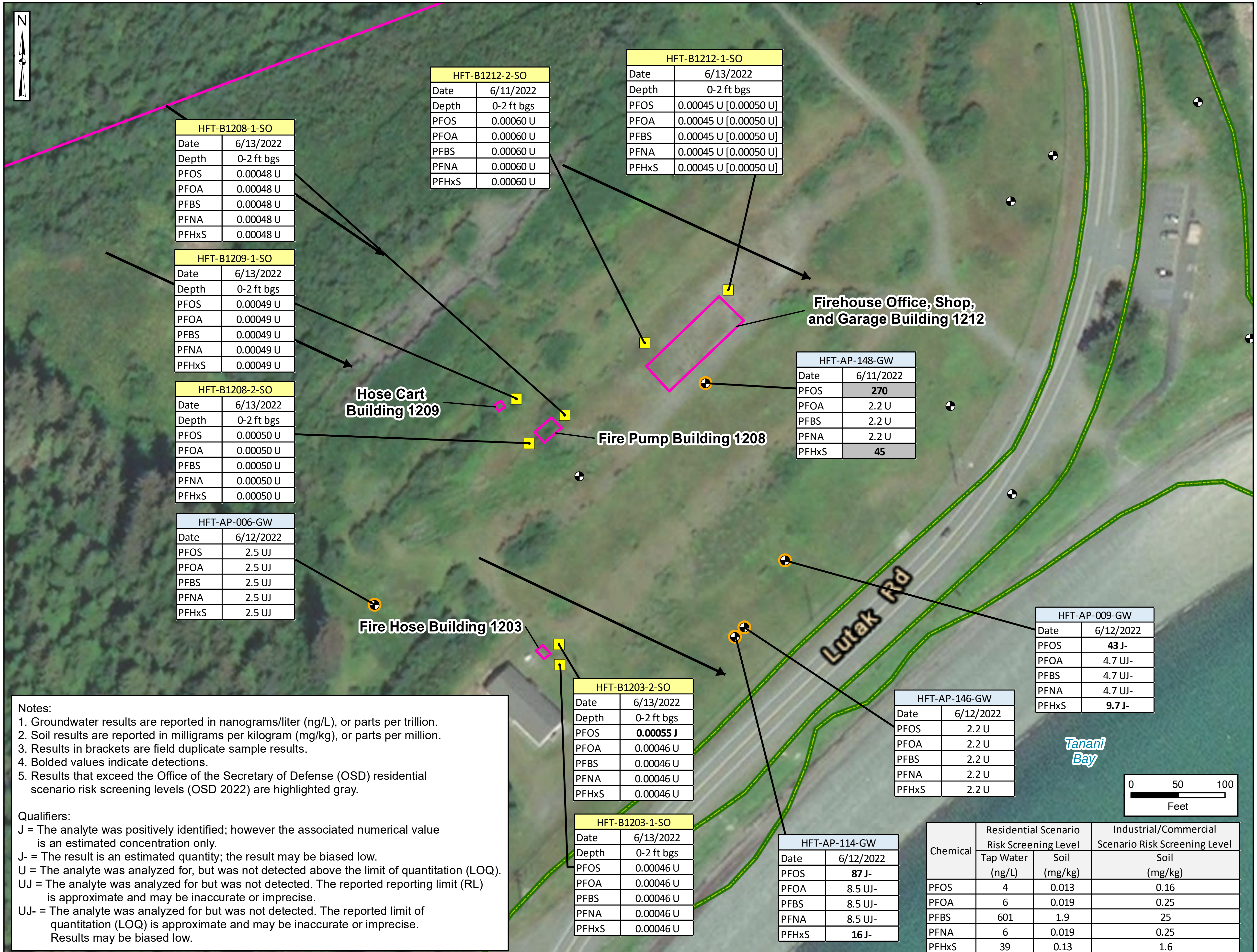
Figure 7-2b PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results – Haines Fuel Terminal (2)



HFT-B1208-1-SO	
Date	6/13/2022
Depth	0-2 ft bgs
PFOS	0.00048 U
PFOA	0.00048 U
PFBS	0.00048 U
PFNA	0.00048 U
PFHxS	0.00048 U

HFT-B1209-1-SO	
Date	6/13/2022
Depth	0-2 ft bgs
PFOS	0.00049 U
PFOA	0.00049 U
PFBS	0.00049 U
PFNA	0.00049 U
PFHxS	0.00049 U

HFT-B1208-2-SO	
Date	6/13/2022
Depth	0-2 ft bgs
PFOS	0.00050 U
PFOA	0.00050 U
PFBS	0.00050 U
PFNA	0.00050 U
PFHxS	0.00050 U

HFT-AP-006-GW	
Date	6/12/2022
PFOS	2.5 UJ
PFOA	2.5 UJ
PFBS	2.5 UJ
PFNA	2.5 UJ
PFHxS	2.5 UJ

HFT-B1212-2-SO	
Date	6/11/2022
Depth	0-2 ft bgs
PFOS	0.00060 U
PFOA	0.00060 U
PFBS	0.00060 U
PFNA	0.00060 U
PFHxS	0.00060 U

HFT-B1212-1-SO	
Date	6/13/2022
Depth	0-2 ft bgs
PFOS	0.00045 U [0.00050 U]
PFOA	0.00045 U [0.00050 U]
PFBS	0.00045 U [0.00050 U]
PFNA	0.00045 U [0.00050 U]
PFHxS	0.00045 U [0.00050 U]

HFT-AP-148-GW	
Date	6/11/2022
PFOS	**270**
PFOA	2.2 U
PFBS	2.2 U
PFNA	2.2 U
PFHxS	**45**

HFT-B1203-2-SO	
Date	6/13/2022
Depth	0-2 ft bgs
PFOS	**0.00055 J**
PFOA	0.00046 U
PFBS	0.00046 U
PFNA	0.00046 U
PFHxS	0.00046 U

HFT-B1203-1-SO	
Date	6/13/2022
Depth	0-2 ft bgs
PFOS	0.00046 U
PFOA	0.00046 U
PFBS	0.00046 U
PFNA	0.00046 U
PFHxS	0.00046 U

HFT-AP-114-GW	
Date	6/12/2022
PFOS	**87 J-**
PFOA	8.5 UJ-
PFBS	8.5 UJ-
PFNA	8.5 UJ-
PFHxS	**16 J-**

HFT-AP-146-GW	
Date	6/12/2022
PFOS	2.2 U
PFOA	2.2 U
PFBS	2.2 U
PFNA	2.2 U
PFHxS	2.2 U

HFT-AP-009-GW	
Date	6/12/2022
PFOS	**43 J-**
PFOA	4.7 UJ-
PFBS	4.7 UJ-
PFNA	4.7 UJ-
PFHxS	**9.7 J-**

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

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

Qualifiers:
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
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).
UJ = The analyte was analyzed for but was not detected. The reported reporting limit (RL) is approximate and may be inaccurate or imprecise.
UJ- = The analyte was analyzed for but was not detected. The reported limit of quantitation (LOQ) is approximate and may be inaccurate or imprecise. Results may be biased low.

Legend

- Sub-Installation Boundary
- AOPI
- Groundwater Flow Direction
- Monitoring Well
- Soil Sampling Location
- Groundwater Sampling Location (Existing Well)

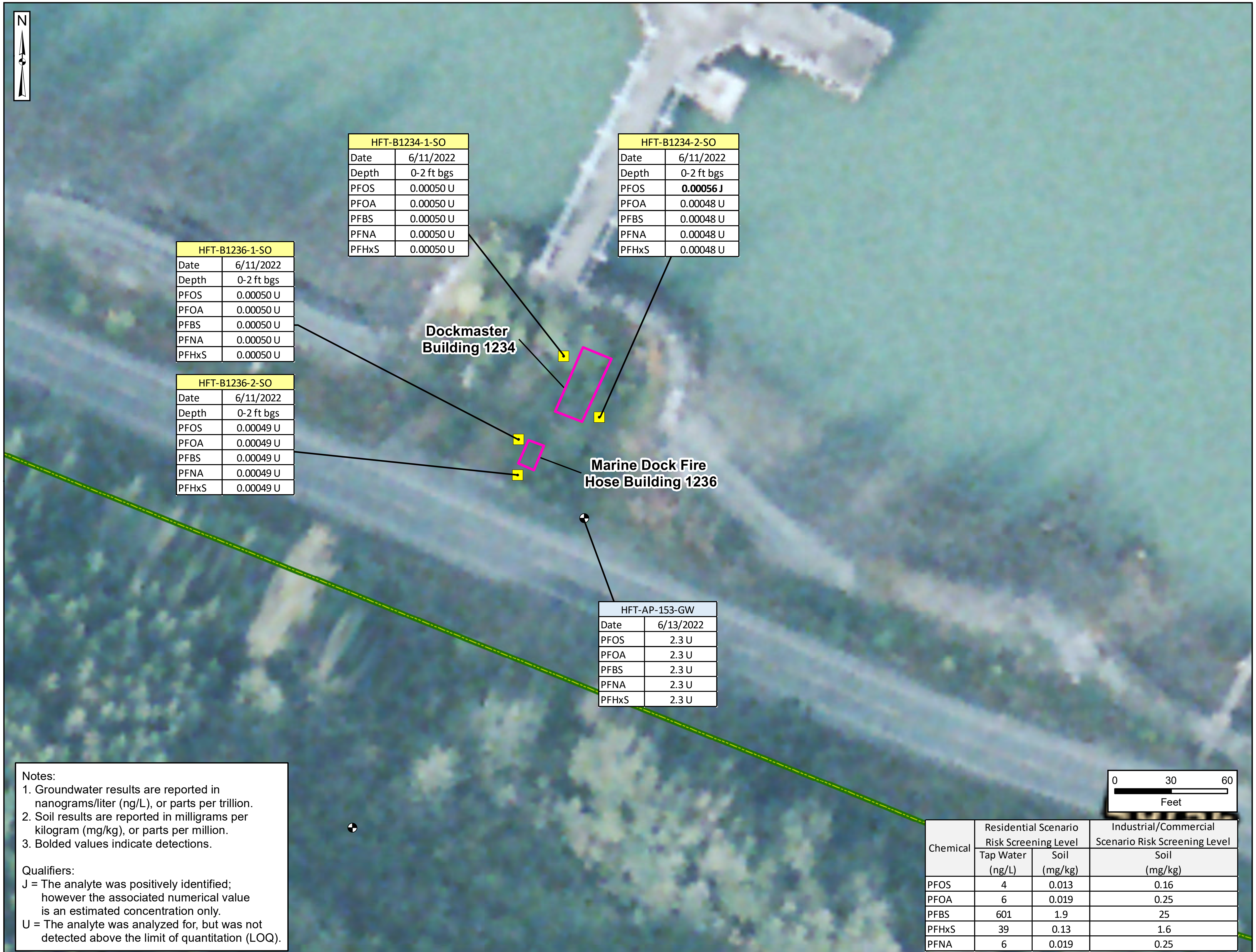
AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Note:
Groundwater flow direction is as reported by: Bristol and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.

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

Coordinate System:
WGS 1984, UTM Zone 8 North

Document Path: \\arcadis-us.com\app\GIS\Processing_ENV\Fort_Wainwright\PFAS\MXDs\PA_SI_Report_Subs\Figure 7-2b - PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results – Haines Fuel Terminal (2)_v2.mxd



HFT-B1234-1-SO	
Date	6/11/2022
Depth	0-2 ft bgs
PFOS	0.00050 U
PFOA	0.00050 U
PFBS	0.00050 U
PFNA	0.00050 U
PFHxS	0.00050 U

HFT-B1234-2-SO	
Date	6/11/2022
Depth	0-2 ft bgs
PFOS	**0.00056 J**
PFOA	0.00048 U
PFBS	0.00048 U
PFNA	0.00048 U
PFHxS	0.00048 U

HFT-B1236-1-SO	
Date	6/11/2022
Depth	0-2 ft bgs
PFOS	0.00050 U
PFOA	0.00050 U
PFBS	0.00050 U
PFNA	0.00050 U
PFHxS	0.00050 U

HFT-B1236-2-SO	
Date	6/11/2022
Depth	0-2 ft bgs
PFOS	0.00049 U
PFOA	0.00049 U
PFBS	0.00049 U
PFNA	0.00049 U
PFHxS	0.00049 U

HFT-AP-153-GW	
Date	6/13/2022
PFOS	2.3 U
PFOA	2.3 U
PFBS	2.3 U
PFNA	2.3 U
PFHxS	2.3 U

Notes:
1. Groundwater results are reported in nanograms/liter (ng/L), or parts per trillion.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
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 30 60
Feet

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

USAEC PFAS Preliminary Assessment/ Site Inspection Fort Wainwright Sub-Installations, AK

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Figure 7-2c PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results – Haines Fuel Terminal (3)

Legend

- Sub-Installation Boundary
- AOPI
- Groundwater Flow Direction
- Monitoring Well
- Soil Sampling Location

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Note:
Groundwater flow direction is as reported by: Bristol and North Wind, Inc. 2020. Final Report, Former Haines Fuel Terminal Remedial Investigation. June.

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

Coordinate System:
WGS 1984, UTM Zone 8 North

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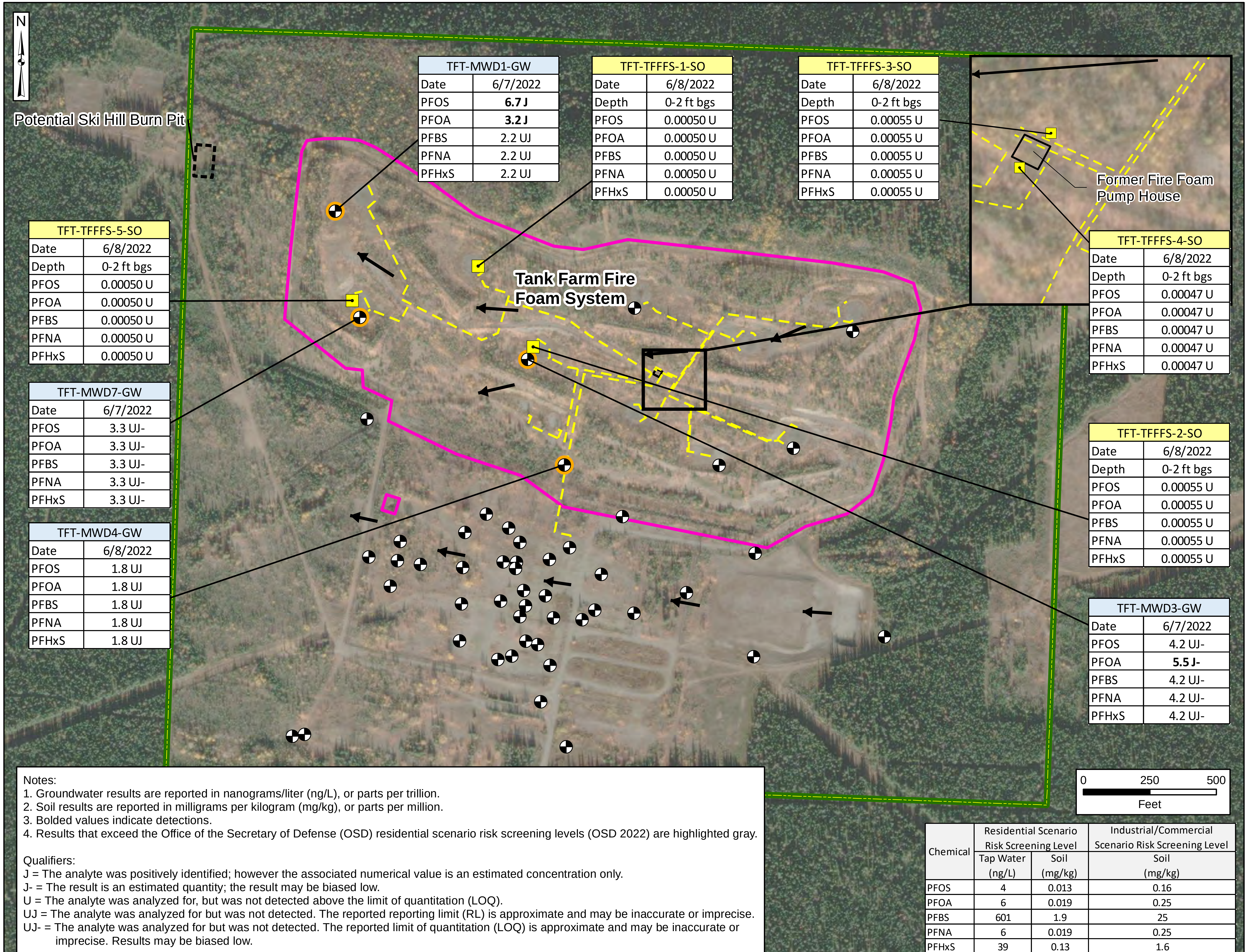
Figure 7-2d
PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results - Tok Fuel Terminal (1)



TFT-MWD1-GW	
Date	6/7/2022
PFOS	**6.7 J**
PFOA	**3.2 J**
PFBS	2.2 UJ
PFNA	2.2 UJ
PFHxS	2.2 UJ

TFT-TFFFS-1-SO	
Date	6/8/2022
Depth	0-2 ft bgs
PFOS	0.00050 U
PFOA	0.00050 U
PFBS	0.00050 U
PFNA	0.00050 U
PFHxS	0.00050 U

TFT-TFFFS-3-SO	
Date	6/8/2022
Depth	0-2 ft bgs
PFOS	0.00055 U
PFOA	0.00055 U
PFBS	0.00055 U
PFNA	0.00055 U
PFHxS	0.00055 U

TFT-TFFFS-5-SO	
Date	6/8/2022
Depth	0-2 ft bgs
PFOS	0.00050 U
PFOA	0.00050 U
PFBS	0.00050 U
PFNA	0.00050 U
PFHxS	0.00050 U

TFT-MWD7-GW	
Date	6/7/2022
PFOS	3.3 UJ-
PFOA	3.3 UJ-
PFBS	3.3 UJ-
PFNA	3.3 UJ-
PFHxS	3.3 UJ-

TFT-MWD4-GW	
Date	6/8/2022
PFOS	1.8 UJ
PFOA	1.8 UJ
PFBS	1.8 UJ
PFNA	1.8 UJ
PFHxS	1.8 UJ

TFT-TFFFS-4-SO	
Date	6/8/2022
Depth	0-2 ft bgs
PFOS	0.00047 U
PFOA	0.00047 U
PFBS	0.00047 U
PFNA	0.00047 U
PFHxS	0.00047 U

TFT-TFFFS-2-SO	
Date	6/8/2022
Depth	0-2 ft bgs
PFOS	0.00055 U
PFOA	0.00055 U
PFBS	0.00055 U
PFNA	0.00055 U
PFHxS	0.00055 U

TFT-MWD3-GW	
Date	6/7/2022
PFOS	4.2 UJ-
PFOA	**5.5 J-**
PFBS	4.2 UJ-
PFNA	4.2 UJ-
PFHxS	4.2 UJ-

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

Qualifiers:
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
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).
UJ = The analyte was analyzed for but was not detected. The reported reporting limit (RL) is approximate and may be inaccurate or imprecise.
UJ- = The analyte was analyzed for but was not detected. The reported limit of quantitation (LOQ) is approximate and may be inaccurate or imprecise. Results may be biased low.

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

Legend

- Sub-Installation Boundary
- AOPI
- Former Building
- Former Burn Pit
- Former Firefighting Foam Piping
- Groundwater Flow Direction
- Monitoring Well
- Soil Sampling Location
- Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Note:
Groundwater flow direction is as reported by: Bristol and FES. 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. June.

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

Coordinate System:
WGS 1984, UTM Zone 7 North

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Fort Wainwright
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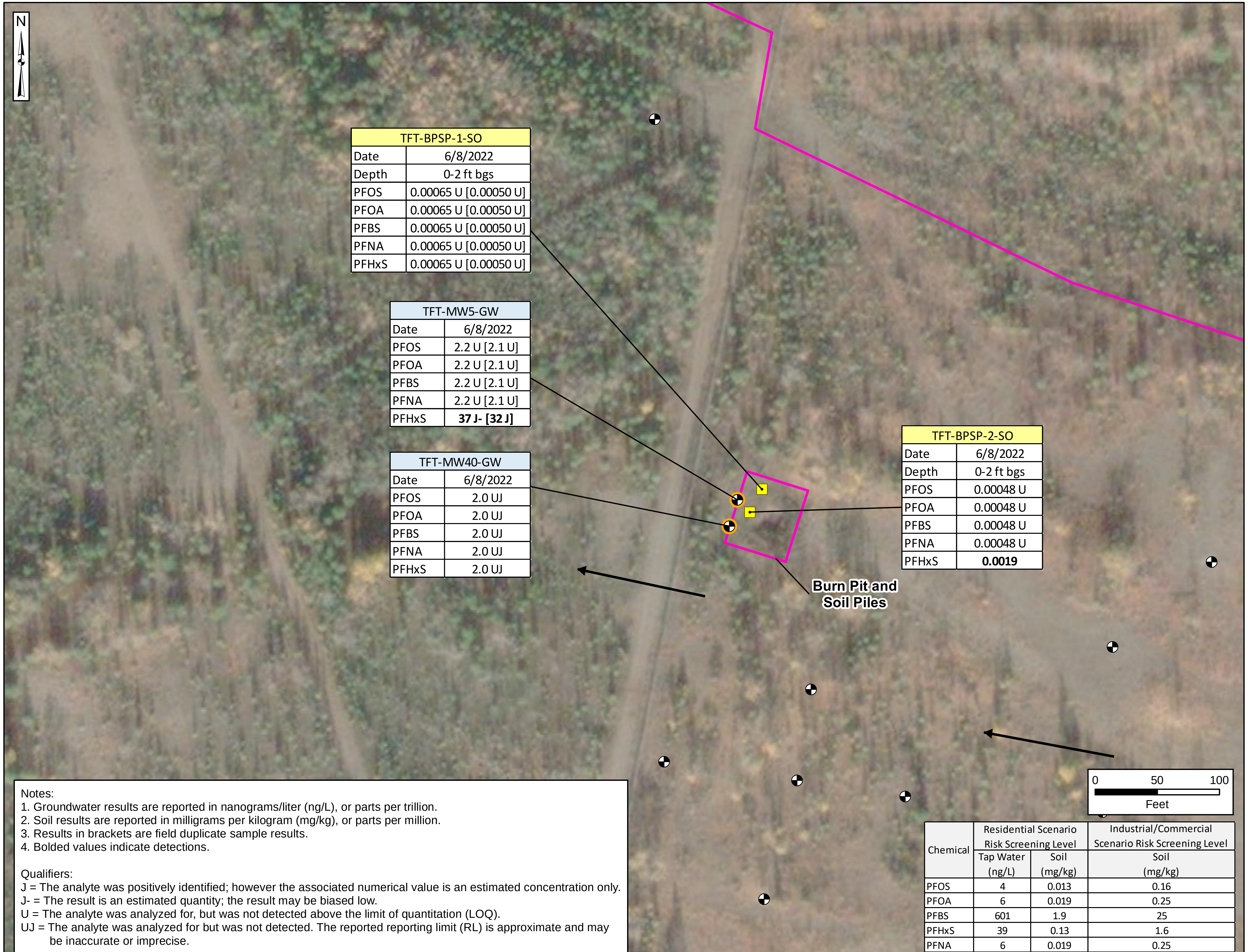
Figure 7-2e
PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results - Tok Fuel Terminal (2)



TFT-BPSP-1-SO	
Date	6/8/2022
Depth	0-2 ft bgs
PFOS	0.00065 U [0.00050 U]
PFOA	0.00065 U [0.00050 U]
PFBS	0.00065 U [0.00050 U]
PFNA	0.00065 U [0.00050 U]
PFHxS	0.00065 U [0.00050 U]

TFT-MW5-GW	
Date	6/8/2022
PFOS	2.2 U [2.1 U]
PFOA	2.2 U [2.1 U]
PFBS	2.2 U [2.1 U]
PFNA	2.2 U [2.1 U]
PFHxS	**37 J- [32 J]**

TFT-MW40-GW	
Date	6/8/2022
PFOS	2.0 UJ
PFOA	2.0 UJ
PFBS	2.0 UJ
PFNA	2.0 UJ
PFHxS	2.0 UJ

TFT-BPSP-2-SO	
Date	6/8/2022
Depth	0-2 ft bgs
PFOS	0.00048 U
PFOA	0.00048 U
PFBS	0.00048 U
PFNA	0.00048 U
PFHxS	**0.0019**

Legend

- Sub-Installation Boundary
- AOPI
- Former Building
- Former Burn Pit
- Former Firefighting Foam Piping
- Groundwater Flow Direction
- Monitoring Well
- Soil Sampling Location
- Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Note:
Groundwater flow direction is as reported by: Bristol and FES. 2019. Final Report Volume I, Revision 2: Remedial Investigation, Tok Fuel Terminal. June.

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

Qualifiers:
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
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).
UJ = The analyte was analyzed for but was not detected. The reported reporting limit (RL) is approximate and may be inaccurate or imprecise.

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

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

Coordinate System:
WGS 1984, UTM Zone 7 North

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