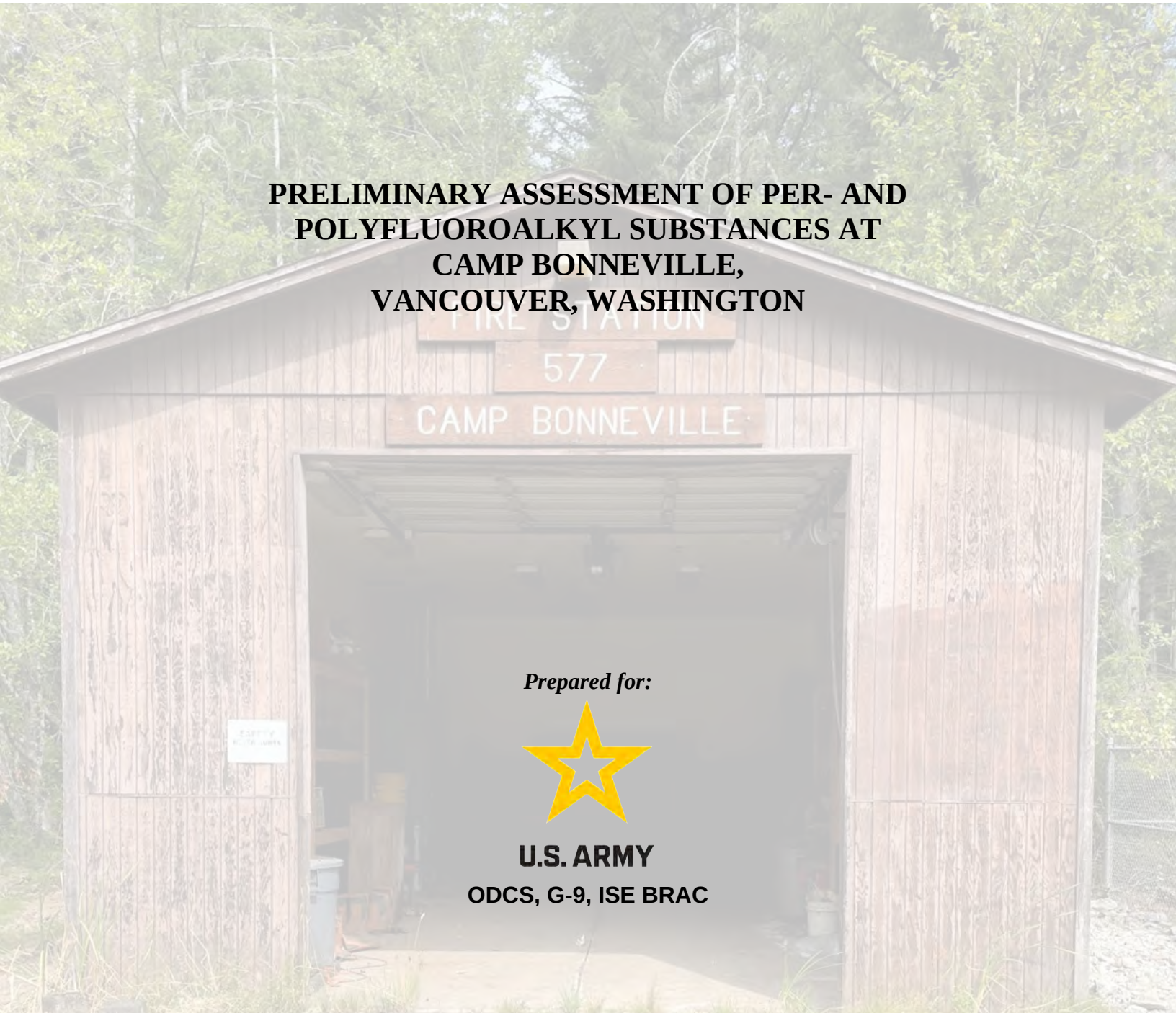
PRELIMINARY ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES AT CAMP BONNEVILLE, VANCOUVER, WASHINGTON



Prepared for:

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ODCS, G-9, ISE BRAC

Final
November 2023

PRELIMINARY ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES AT CAMP BONNEVILLE, VANCOUVER, WASHINGTON

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LIST OF ACRONYMS AND ABBREVIATIONS

2,4-D	2,4-Dichlorophenoxy Acetic Acid
2,4,5-T	2,4,5-Trichlorophenoxy Acetic Acid
AFFF	Aqueous Film-Forming Foam
amsl	Above Mean Sea Level
AOPI	Area of Potential Interest
Army	U.S. Army
BCRRT	Bonneville Conservation Restoration and Renewal Team LLC
BRAC	Base Realignment and Closure
BRAC95	1995 Base Realignment and Closure Commission
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COI	Constituent of Interest
CSM	Conceptual Site Model
DCE	Dichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DERP	Defense Environmental Restoration Program
DNT	Dinitrotoluene
DoD	U.S. Department of Defense
EBS	Environmental Baseline Survey
EDR	Environmental Data Resources, Inc.
ESU	Evolutionary Significant Unit
FBI	Federal Bureau of Investigation
FTA	Fire Training Area
HFPO-DA	Hexafluoropropylene Oxide Dimer Acid
HQ	Hazard Quotient
LHA	Lifetime Health Advisory
LRA	Local Redevelopment Authority
LUC	Land Use Control
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OB/OD	Open Burning/Open Detonation
OSD	Office of the Assistant Secretary of Defense
OWS	Oil/Water Separator
PA	Preliminary Assessment
PCE	Tetrachloroethylene
PFAS	Per- and Polyfluoroalkyl Substances
PFBA	Perfluorobutanoic Acid
PFBS	Perfluorobutane Sulfonate
PFHpA	Perfluoroheptanoic Acid
PFHxA	Perfluorohexanoic Acid
PFHxS	Perfluorohexane Sulfonate
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
RCRA	Resource Conservation and Recovery Act
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RfD	Reference Dose
RI	Remedial Investigation
RSL	Regional Screening Level

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SAL	State Action Level
SDWA	Safe Drinking Water Act
SI	Site Inspection
SL	Screening Level
TCA	Trichloroethane
U.S.C.	United States Code
UCMR3	Third Unregulated Contaminant Monitoring Rule
UCMR5	Fifth Unregulated Contaminant Monitoring Rule
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance
WDNR	Washington State Department of Natural Resources
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The objective of a Preliminary Assessment (PA) is to identify areas of potential interest (AOPIs) based on whether use, storage, or disposal of potential per- and polyfluoroalkyl substances (PFAS)-containing materials, including aqueous film-forming foam (AFFF), occurred in accordance with the 2018 U.S. Army (Army) *Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018). A PA for PFAS-containing materials with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanoic acid (PFBA), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexanoic acid (PFHxA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) and its ammonium salt ("GenX" chemicals) was completed for the Base Realignment and Closure (BRAC) property at Camp Bonneville to assess potential PFAS release areas and exposure pathways. The entire Camp Bonneville facility, which is in Clark County, Washington, was selected for closure under BRAC. The completion of this PA included the execution of the following tasks:

- Conducted a kickoff meeting with the BRAC Office and U.S. Army Corps of Engineers (USACE) on June 22, 2022, to present all Parties' preliminary knowledge of Camp Bonneville to provide information to guide the PA and site visit.
- Reviewed available records (e.g., aerial photography, historical maps, technical reports, previous studies, investigations) from online sources (i.e., Internet-based searches), environmental investigations and/or regulatory programs, and internal Army documents from the Administrative Record. In addition, an Environmental Data Resources, Inc. (EDR) Report was generated for Camp Bonneville and included any listed sites within and up to a 2-mile search distance.
- Conducted a 1-day site visit on August 9, 2022, to identify potential sources of PFAS and gather information for developing conceptual site models (CSMs) at AOPIs.
- Interviewed individuals with historical and present-day knowledge of operations on the BRAC property.
- Identified AOPIs and developed preliminary CSMs for pathways of potential PFAS in soil, groundwater, surface water, and sediment.

In conducting the PA of the BRAC property at Camp Bonneville, three AOPIs were identified where a potential for release of PFAS exists resulting from site operational history. AOPIs were identified at potential PFAS-release locations on the BRAC property only.

Based on the potential PFAS releases at the AOPIs, the potential for exposure to PFAS contamination in soil exists. In addition, the potential for off-post exposure in groundwater exists, as on-post groundwater could influence downgradient drinking water sources. Given the findings of this PA, the AOPIs presented warrant further evaluation in a Site Inspection (SI).

1. INTRODUCTION

The U.S. Army (Army) conducted this Preliminary Assessment (PA) to investigate the potential presence of per-and polyfluoroalkyl substances (PFAS) at the former Camp Bonneville, Clark County, Washington, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 United States Code [U.S.C.] §9601 et seq.); the Defense Environmental Restoration Program (DERP, 10 U.S.C. §2701 et seq.); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 Code of Federal Regulations [CFR] Part 300); and guidance documents developed by the U.S. Environmental Protection Agency (USEPA) and the Department of the Army. The former Camp Bonneville is not on the National Priorities List, and the Army is responsible for compliance with CERCLA in accordance with Executive Order 12580, as amended. The purpose of this PFAS PA is to identify locations that are areas of potential interest (AOPIs) on the former Camp Bonneville based on the use, storage and/or disposal of potential PFAS-containing materials in accordance with the *Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances* (U.S. Army 2018). The PA was conducted in general accordance with 40 CFR §300.420(b), the USEPA *Guidance for Performing Preliminary Assessments Under CERCLA* (USEPA 1991), and the Army *Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018). This report presents findings from research conducted to assess past use of PFAS-containing materials and identify areas where these materials were stored, handled, used, or disposed of at the former Camp Bonneville.

The entire former Camp Bonneville property was evaluated, including former Army-owned property as well as property that the Army had formerly leased from the Washington State Department of Natural Resources (WDNR), and will be herein referred to as "Camp Bonneville." Camp Bonneville is in Clark County, Washington, as shown in Figure 1-1.

1.1 PFAS BACKGROUND INFORMATION

PFAS are a group of synthetic compounds that have been manufactured and used extensively worldwide since the 1950s for a variety of purposes. PFAS are stable, man-made fluorinated organic chemicals that repel oil, grease, and water. Common industrial uses of PFAS include paints, varnishes, sealants, hydraulic fluid, surfactants, and firefighting foams. PFAS include both per- and polyfluorinated compounds. Perfluorinated compounds, such as perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanoic acid (PFBA), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexanoic acid (PFHxA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA, or Gen X) are a subset of PFAS with completely fluorinated carbon chains, while polyfluorinated compounds have at least one carbon chain atom that is not fully fluorinated. These eight PFAS together, and for the purposes of this PA, are referred to in this report as "Target PFAS."

Camp Bonneville was evaluated for all potential use, storage, and/or disposal of PFAS-containing materials. A variety of PFAS-containing materials are used in relation to current and historical Army operations. However, the use, storage, and/or disposal of aqueous film-forming foam (AFFF) is the most common potential source of PFAS at U.S. Department of Defense (DoD) facilities. As such, this section is organized to summarize the AFFF-related sources first followed by all of the remaining potential PFAS-containing materials. AFFF is used as a firefighting agent to suppress petroleum hydrocarbon fires and vapors. Firefighting foams like AFFF were developed in the 1960s (ITRC 2020a), but AFFF did not see widespread DoD use until the early 1970s. Older fire training facilities often were unlined and not constructed to prevent infiltration of firefighting foams and combustion products leaching into the subsurface. Large quantities of AFFF have been released into the environment as a result of fire training exercises, fire responses, fire suppression system activations, and tank and pipeline leaks/spills.

Other potential PFAS sources considered include installation storage warehouses, some pesticide use, automobile maintenance shops, photographic processing facilities, laundry/waterproofing facilities, car washes, stormwater or sanitary sewer components, and biosolid application areas.

Many PFAS are highly soluble in water and have low volatility due to their ionic nature. The specific gravity/relative density for PFOS and PFOA is 1.8 (ITRC 2020b). Long-chain perfluorinated compounds have low vapor pressure and are expected to persist in aquatic environments. These compounds do not readily degrade by most natural processes. They are thermally, chemically, and biologically stable, and are resistant to biodegradation, atmospheric photooxidation, direct photolysis, and hydrolysis. The structure of these compounds increases their resistance to degradation; the carbon-fluorine bond is one of the strongest in nature, and the fluorine atoms shield the carbon backbone.

When PFAS are released to the environment, they can readily migrate into soil, groundwater, surface water, and sediment. Once in the environment, PFAS are persistent and may continue to migrate through airborne transport, surface water, groundwater, and/or biologic uptake. The amount of PFAS entering the environment depends on the type and amount of the PFAS material that may have been released, where and when it was used, the type of soil, and other factors. If private or public wells are located nearby, they potentially could be affected by PFAS. Similarly, surface water features may be impacted and may convey PFAS to downgradient receptors.

Of the thousands of PFAS, some are considered precursor compounds (typically polyfluoroalkyl substances). Precursor compounds can abiotically or biotically transform into PFOS and PFOA. PFOS and PFOA are referred to as terminal PFAS, meaning no further degradation products will form from them (ITRC 2020c).

1.2 PURPOSE AND OBJECTIVES

The purpose of a PA under the NCP is to 1) eliminate from further consideration those sites that pose no threat to public health or the environment; 2) determine if any potential need for removal action exists; 3) set priorities for Site Inspections (SIs); and 4) gather existing data to facilitate evaluation for the release pursuant to the Hazard Ranking System, if warranted (40 CFR §300.420(b)(1)).

The primary objective of the PA is to identify locations at Camp Bonneville where PFAS-containing materials were used, stored, or disposed of, resulting in a potential release of PFAS to the environment, and conduct an initial assessment of possible migration pathways of potential contamination. This PA also includes development of a preliminary conceptual site model (CSM) for AOPIs related to PFAS.

1.3 PFAS REGULATORY OVERVIEW AND SCREENING CRITERIA

In May 2016, USEPA issued lifetime health advisories (LHAs) for PFOA and PFOS under the Safe Drinking Water Act (SDWA). To provide Americans, including the most sensitive populations, with a margin of protection from a lifetime of exposure to PFOS and PFOA in drinking water, USEPA established a health advisory level for PFOS and PFOA (individually or combined) of 70 ng/L (USEPA 2016).

In October 2019, the Office of the Secretary of Defense (OSD) issued guidance on investigating PFOS, PFOA, and PFBS at DoD restoration sites. The OSD guidance provided risk screening levels (SLs) for PFOS, PFOA, and PFBS in groundwater, tap water, and soil, based on the USEPA regional screening level (RSL) calculator for residential and industrial reuse and using the oral reference dose of 2E-05 mg/kg-day. These SLs are used during an SI to determine if further investigation in a Remedial Investigation (RI) is warranted.

In April 2021, USEPA issued an updated toxicity assessment for PFBS. USEPA developed chronic (0.0003 mg/kg-day) and subchronic (0.001 mg/kg-day) oral reference doses (RfDs) for PFBS as part of

USEPA's toxicity assessment. The RSL for PFBS was previously calculated using the RfD of 0.02 mg/kg-day. New toxicity values resulted in revisions to the RSLs for PFBS in May 2021 (USEPA 2021).

In September 2021, OSD issued a revision to *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program* (DoD 2021). The revised memorandum accounts for the updated PFBS SLs attributable to USEPA's reassessment of PFBS toxicity in 2021. Based on USEPA research, the RSLs for PFOS and PFOA are calculated using an RfD of 2E-05 mg/kg-day. The RSL for PFBS is calculated using an RfD of 3E-04 mg/kg-day. When multiple PFAS are encountered at a site, a 0.1 factor is applied to the SL when it is based on noncarcinogenic endpoints.

In May 2022, based on continued evaluation of Target PFAS by the Agency for Toxic Substances and Disease Registry and the USEPA Office of Water, USEPA provided new SLs for PFOA, PFOS, PFNA, PFHxS, and HFPO-DA.

In July 2022, OSD issued a policy memorandum adopting these new SLs to be used during the SI phase to determine whether further investigation in an RI is warranted. This revised guidance was in effect as of July 2022 and was applicable to investigating PFOS, PFOA, PFBS, PFNA, PFHxS, and HFPO-DA at DoD restoration sites, including Base Realignment and Closure (BRAC) sites (DoD 2022). In August 2023, OSD issued a memorandum to account for the May 2023 USEPA RSLs for PFBA and PFHxA in addition to the RSLs for the other six PFAS (DoD 2023). The SLs for Target PFAS are listed in Table 1-1. Currently, no legally enforceable Federal standards exist for PFAS in groundwater, surface water, soil, or sediment.

Table 1-1. Screening Levels from the 2023 OSD Memorandum

Chemical	Residential Tap Water HQ = 0.1 (ng/L or ppt)	Residential Soil HQ = 0.1 (µg/kg or ppb)
HFPO-DA (GenX)	6	23
PFBA	1,800	7,800
PFBS	600	1,900
PFHxA	990	3,200
PFHxS	39	130
PFNA	5.9	19
PFOA	6	19
PFOS	4	13

Note: The Residential Tap Water Screening Levels are used to evaluate groundwater and surface water data. The Residential Soil Screening Levels are used to evaluate soil and sediment data.

The Army's strategy is to continue to assess and investigate potential releases and implement necessary response actions in accordance with CERCLA to ensure that no human health-based exposures are above the CERCLA risk-based values in drinking water. Therefore, sites where human exposure to contaminated drinking water exists will be addressed first and as quickly as possible to eliminate the exposure, and then other sites will be subsequently prioritized and sequenced to conduct the investigations and response actions necessary to characterize and, if necessary, remediate the source of PFAS contamination (U.S. Army 2018).

1.4 PA METHODOLOGY

The PA for Camp Bonneville included a site visit, aerial photographic analysis, records review, and interviews that were conducted in accordance with the methods detailed in the Programmatic PA Work Plan (Leidos 2021). The Programmatic PA Work Plan outlines the approach and methodology for conducting the PFAS PA. As detailed in the Programmatic PA Work Plan, the PA activities focused on ascertaining and documenting the following information regarding PFAS history and use, storage, or disposal at Camp Bonneville:

- On-post fire training activities

- Use of PFAS-based AFFF in fire suppression systems or other systems
- AFFF stored, used, and/or disposed of at buildings and crash sites
- Activities or use of materials that are likely to contain PFAS, such as metal plating operations
- Wastewater treatment plants (WWTPs) and landfills that may have received PFAS-containing materials
- Studies conducted to assess environmental impacts at the facility
- Potential PFAS use at parcels post transfer
- Potential off-post sources that may impact Camp Bonneville

The data gathered during PA activities are summarized in Section 3.

1.5 REPORT ORGANIZATION

The contents of this PA Report are summarized below:

- ***Section 2. Site Background***—This section presents site-specific information related to site operational history and discusses the environmental setting. Demographics, land use, topography, geology, hydrogeology, hydrology, groundwater, potable wells, ecological receptors, and climate are described.
- ***Section 3. PA Analysis***—This section provides observations and results from the PA site visit, aerial photographic analysis, records review, and interviews.
- ***Section 4. Summary of PA Data***—This section provides an overview of the data collected during the PA for the different potential PFAS sources.
- ***Sections 5. Summary of PA Results***—This section synthesizes all the data gathered during the PA activities and determines whether each area evaluated during the PA is an AOPI or was not retained as an AOPI
- ***Section 6. Conclusions***—This section presents conclusions of the PA.
- ***Section 7. References—***This section lists the references that were used in the preparation of this report.
- ***Appendices***—Appendices A through F include data from field activities or related assessments:
  - Appendix A. Final Camp Bonneville Kickoff Meeting Minutes
  - Appendix B. Documents/Sources Reviewed During PA
  - Appendix C. Aerial Photographs
  - Appendix D. Site Visit Photographs
  - Appendix E. Questionnaire Responses and Interview Notes
  - Appendix F. Environmental Data Resources, Inc. (EDR) Report.

2. SITE BACKGROUND

2.1 SITE LOCATION

Camp Bonneville is a former Army facility in Clark County, Washington, approximately 12 miles east of Vancouver, Washington (Figure 1-1). While in operation, Camp Bonneville was composed of 3,020 acres and leased an additional 820 acres from WDNR. It is located on the western slope of the Cascade Mountains in the Lacamas Creek Valley. The installation is mostly forested, except for the approximately 30 acres that comprise the Bonneville and Killpack cantonment areas near the installation's former main entrance. The property surrounding Camp Bonneville is zoned for agriculture, rural residential, and forestry uses (LRA 2005). Camp Bonneville is bounded to the northeast by the WDNR-managed Yacolt Burn State Forest, and the Livingston Quarry gravel mining operation is located along the southern boundary of the site. Figure 2-1 depicts the Camp Bonneville site features.

2.2 SITE OPERATIONAL HISTORY

Camp Bonneville was established with 309 leased acres in 1909 as a drill field and rifle range for Vancouver Barracks (Woodward-Clyde 1997). In 1912, the facilities were expanded to include a target range and a road leading to the installation. Use of the facility continued until 1915 when the lease expired, and the Army moved their training activities to Oregon (USACE 1997). In 1918, the Army returned to Camp Bonneville and obtained the original 309 acres, along with an additional 2,711 acres through purchase and condemnation. The Bonneville cantonment was established in the late 1920s and used primarily as barracks facilities (EEI 2010). The Killpack cantonment was built and occupied by the Civilian Conservation Corps in 1935. In 1955, the Army arranged to lease an additional 840 acres, in two separate parcels, from WDNR to expand the training facilities at Camp Bonneville. The Army returned 20 acres of the leased land to WDNR in 1957 (Woodward-Clyde 1997). In 1959, the responsibility for Camp Bonneville changed from Vancouver Barracks to Fort Lewis, when the former became a sub-installation of the latter (URS 2000).

The mission of Camp Bonneville was to provide a training camp for active U.S. Army, U.S. Army Reserve, U.S. National Guard, U.S. Marine Corps Reserve, U.S. Navy Reserve, U.S. Coast Guard Reserve units, and other DoD Reserve personnel (Woodward-Clyde 1997). Military training activities at Camp Bonneville have varied depending on the unit using the facility but generally have included the use of the various firing ranges and training areas. Other military training activities conducted at Camp Bonneville have involved troop maneuvers, encampments, field tactical training, and vehicle support. The facility also was used to house Italian prisoners of war during World War II. When it was not needed for military training activities, Camp Bonneville was used until the 1980s by local civic and nonprofit organizations for retreats and picnics, as a Boy Scout camp, and as a location for high school environmental studies (Woodward-Clyde 1997). Until the mid-1990s, Camp Bonneville also was used by Federal, state, and local law enforcement agencies for firearms training and practice, and general training purposes (URS 2000). The Federal Bureau of Investigation (FBI) currently owns and manages training facilities that they constructed at Camp Bonneville in 1995.

Camp Bonneville was placed on the list of facilities scheduled for closure under the 1995 Base Realignment and Closure Commission (BRAC95). In 1996, all active military training units ceased operations at the camp. All out-grants for use of the facilities were canceled except for the FBI firing range (EEI 2010).

2.3 DEMOGRAPHICS, PROPERTY TRANSFER, AND LAND USE

Camp Bonneville is approximately 12 miles east of Vancouver, in rural Clark County. The smaller cities of Camas and Washougal are approximately 6 miles to the south of the installation. Clark County is the fastest growing county in Washington, with a 2020 estimated population of 503,311 (U.S. Census Bureau 2020). In 2020, the U.S. Census reported a population 190,915 for the city of Vancouver, with

approximately 26,065 people residing in Camas and 17,039 in Washougal (U.S. Census Bureau 2020). The nearest town is the unincorporated community of Proebstel, which is approximately 2 miles west of the installation.

In 1995, Camp Bonneville was placed on the list of facilities scheduled for realignment under the BRAC program. The three parcels that comprise the BRAC property at Camp Bonneville were transferred via a conservation conveyance. In September 2006, the Army transferred ownership of the 3,020-acre Early Transfer Parcel to Clark County (U.S. Army 2012). This initial transfer did not include the remaining 820 acres of Camp Bonneville that were owned by WDNR and leased to the Army. The WDNR parcels were conveyed to Clark County in June 2009. In both cases, Clark County immediately transferred ownership of the land by quitclaim deed to the Bonneville Conservation Restoration and Renewal Team LLC (BCRRT) for the management of remedial actions at the site, including removal of hazardous wastes and unexploded ordnance (UXO) (BCRRT 2007). Clark County subsequently took over site management and cleanup obligations when BCRRT conveyed ownership of the land by quitclaim deed to Clark County in December 2011 (U.S. Army 2012). Camp Bonneville transferred property, and the property recipients are shown in Figure 2-2.

Camp Bonneville is currently closed to the public until remedial actions at the site are complete. As the authorized local redevelopment authority (LRA), Clark County plans to reuse the site for recreation. The County's reuse plan has nine specific components: regional park, law enforcement training center, rustic retreat center/outdoor school, Native American culture center, Clark College environmental education, trails and nature area, FBI firing range, timber resource management area, and habitat restoration (LRA 2005).

Clark County has an interlocal, short-term lease agreement with WDNR, which establishes a forward operating base for helicopter operations. WDNR's helicopter operations at Camp Bonneville assist its efforts to mitigate and improve response times for wildfires in the area. WDNR has been using Camp Bonneville to conduct these operations since 2019 (CCPW 2022a). The agreement includes adequate space for a helicopter, fuel truck, and Building T-1980 to house crew members and limits WDNR's access of Camp Bonneville to only the barracks, parking area, and airfield near the main camp entrance (CCPW 2022a).

The land use surrounding Camp Bonneville is predominantly agricultural farming, rural residential, and forestry. Although the current zoning of neighboring properties requires a minimum 5-acre lot size, many of the residences near the facility were approved on much smaller lots prior to the adoption of the current standards (LRA 2005).

2.4 TOPOGRAPHY

Camp Bonneville is located on the western slope of the Cascade Mountains in the Lacamas Creek Valley, where the terrain is generally covered with undergrowth and large stands of coniferous timber (Woodward-Clyde 1997). The western portion of Camp Bonneville consists of low hills and low plains of the Lacamas Creek valley. Elevations range from about 300 feet above mean sea level (amsl) in Lacamas Creek at the southwestern corner of the site to 1,000 and 1,700 feet amsl along the moderately steep ridges within the installation boundary to the northwest and southeast, respectively (U.S. Geological Survey National Elevation Dataset, as depicted in Figure 2-1).

2.5 GEOLOGY

Camp Bonneville is located along the structural and physiographic margin between the western foothills of the southern Cascade Mountains and the Portland-Vancouver Basin. The geology in the vicinity of Camp Bonneville is primarily known from geologic mapping performed by Mundorff (1964), Phillips (1987), and Evarts (2006).

The geology at Camp Bonneville can be divided into three general areas that correspond approximately to topographic divisions. The area west of Lacamas Creek is composed of a series of predominantly gravel and semi-consolidated conglomerate with scattered lenses and stringers of sand (Upper Troutdale Formation). Underlying the Troutdale Formation and comprising the area to the north and east of Lacamas Creek are folded and faulted basalt flows, flow breccia, and pyroclastic and andesitic rocks that are folded and faulted. The bottomland along Lacamas Creek is composed of unconsolidated silt, sand, gravel valley fill, with some clay (Mundorff 1964, Phillips 1987).

The Troutdale Formation underlying the western portions of Camp Bonneville is the result of deposition of western flowing streams that crossed the Cascade Range, including the ancestral Columbia River (Evarts 2006). Considerable variation exists in the lithology and thickness of the Troutdale Formation. According to regional logs, the Upper Troutdale Formation in the vicinity of the installation is approximately 150 feet thick and consists of cemented sand, gravel, sandy clay, and boulders. It is underlain by up to 150 feet of the Lower Troutdale Formation, which contains considerably more clay interspersed with sandy and gravelly layers (URS 2000). The bedrock that underlies the alluvial deposits and Troutdale Formation is exposed at the surface in the northern and eastern regions of Camp Bonneville.

2.6 HYDROGEOLOGY

Camp Bonneville lies within the Portland Basin, which is defined as the area bounded by the Tualatin Mountains to the west, the Lewis River to the north, the foothills of the Cascade Range to the east, and the Clackamas River to the south. The Columbia and Willamette Rivers flow through the area and are major discharge areas for the groundwater system (McFarland and Morgan 1996). The following eight hydrogeologic units comprise the Portland Basin aquifer system:

- Unconsolidated sedimentary aquifer
- Troutdale gravel aquifer
- Confining unit 1
- Troutdale sandstone aquifer
- Confining unit 2
- Sand and gravel aquifer
- Older rocks
- An undifferentiated fine-grained unit that occurs where the Troutdale sandstone and the sand and gravel aquifer are absent.

The Troutdale gravel aquifer that underlies the western portion of Camp Bonneville is generally considered an important and productive aquifer in the Portland Basin and commonly serves as source water for municipal, industrial, and irrigation supplies (McFarland and Morgan 1996). USEPA has designated the Troutdale aquifer a “sole source aquifer” (USEPA 2006). USEPA defines a sole or principal source as an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer and for which no alternative source or combination of alternative drinking water sources exist that could physically, legally, and economically supply those dependent upon the aquifer. The Troutdale aquifer system provides approximately 99.4 percent of the available drinking water to the residents living within its area, and no other drinking water sources are available that would be economically feasible to supply these residents (USEPA 2006).

Groundwater recharge within the Portland Basin primarily comes from precipitation and streamflow (McFarland and Morgan 1996). Water also enters the system at significant rates in more urban areas from runoff into dry wells and on-post waste disposal systems. Groundwater movement within the Portland Basin is generally controlled by topography (Mundorff 1964), with groundwater flow moving from upland

areas downgradient to local, intermediate, or regional discharge areas, such as streams and springs (McFarland and Morgan 1996). The groundwater at Camp Bonneville typically follows the local topography and flows from higher elevations toward Lacamas Creek, with discharges to Lacamas Creek and its tributaries (EEI 2012).

2.7 SURFACE WATER HYDROLOGY

Camp Bonneville lies within the Lacamas Creek watershed and drainage basin. The principal surface water feature is Lacamas Creek, which flows southward from the confluence of the North and East Forks in the north-central part of Camp Bonneville. The creek also is fed by David and Buck Creeks, which drain the southeastern portion of the installation. Lacamas Creek exits the site in the southwestern corner, discharging to Lacamas Lake, which in turn drains into the Columbia River near Camas, Washington (Hart Crowser 1999). Two artificial impoundments of Lacamas Creek, with a total surface area of less than 4,600 ft^2, were created to support a trout sports fishery. Since base closure, the impoundments have been drained (Calibre 2005).

2.8 WATER USAGE

Camp Bonneville currently has two non-potable supply wells: a 385-foot well at the Bonneville cantonment and a 193-foot well at the Killpack cantonment (ESE 1983). Use of these supply wells is subject to a deed restriction that limits the use of groundwater from the existing water systems at the Bonneville cantonment, the Killpack cantonment, and the Caretaker's building to providing only non-potable water to these facilities (BCRRT 2011). An additional well with a depth of 516 feet also may have been present historically at the Killpack cantonment (Mundorff 1964). Well water is pumped, chlorinated, and stored in reservoirs for distribution at the cantonments to provide non-potable water only. An additional non-potable well was reportedly drilled at the FBI range in 1998, extending to a depth of 105 feet (BCRRT 2007). The on-post water systems drawn from four deep wells are restricted from potable use due to potential hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), 2,4-dinitrotoluene (DNT), perchlorate, dichlorofluoromethane, 1,1,1-trichloroethane (TCA), 1,1-dichloroethylene (DCE), and tetrachloroethylene (PCE) contamination in groundwater potentially underlying Demolition Area/Landfill 1 (U.S. Army 2006). Deed restrictions also are in place that prohibit groundwater use at Landfill 4/Demolition Area 1 (BCRRT 2011). The locations of non-potable wells are shown in Figure 2-1. According to personnel interviews, potable water for the installation is carried in as needed.

Groundwater at Camp Bonneville typically follows the local topography and flows from higher elevations toward Lacamas Creek. According to regional information (Mundorff 1964) and the depths of wells at the property, local water supply wells typically extend into the Troutdale Formation or underlying bedrock and obtain groundwater from depths 150 to 500 feet below ground surface (bgs). Figure 2-3 depicts the potable wells within 4 miles of Camp Bonneville. A search of the Clark County Geographic Information Services water well database (https://gis.clark.wa.gov/gishome/) resulted in 2,267 domestic water wells located within 4 miles of the installation boundary. The wells within 4 miles of Camp Bonneville include 9 Group A public water system wells; 205 Group B public water system wells; 57 irrigation wells; 858 individual water system wells; and 1,138 unclassified water system wells.

2.9 ECOLOGICAL PROFILE

Flora – The Lacamas Creek valley floor consists of open grassy fields, light to densely vegetated areas, and wetland plants near areas with small drainages and depressions in the floodplain of Lacamas Creek (LRA 2005). The existing vegetation around Camp Bonneville is primarily young conifer forest, although patches of mature conifer and a mix of conifer and deciduous forest also are found within the boundaries of the installation. The installation is located at the edge of a prairie that extends into the foothills of the south Cascade Mountains, although no undisturbed tracts of this habitat remain (LRA 2005).

Douglas fir (*Pseudotsuga menziesii*) stands predominate the coniferous forest habitat, and individual western red cedars (*Thuja plicata)* and hemlock (*Conium maculatum*) trees are scattered in drainage locations throughout, with understory species such as vine maple (*Acer circinatum*), salmon berry (*Rubus spectabilis*), elderberry (*Sambucus nigra*), hazelnut (*Corylus avellana*), salal (*Gaultheria shallon*), and sword fern (*Polystichum munitum*) (LRA 2005). Mixed habitat communities of coniferous and deciduous trees are within the area and contain patches of Garry oak (*Quercus garryana*) from the former woodland communities and tree species such as cottonwood (*Populus deltoides*), crabapple (*Malus sylvestris)*, red alder (*Alnus rubra*), Oregon ash (*Fraxinus latifolia)*, Douglas fir (*Pseudotsuga menziesii*), big leaf maple (*Acer macrophyllum*), and willow (*Salix spp*.) (Pentec 1995, as cited in EEI 2010). These mixed habitats have understory species such as Indian plum (*Oemleria cerasiformis*), snowberry (*Symphoricarpos albus*), vine maple (*Acer circinatum*), and lady fern (*Athyrium filix-femina*) (LRA 2005, Parsons 2004)

The state-listed threatened hairy-stemmed checker-mallow (*Sidalcea hirtipes*) has been identified on-post (Pentec 1995, as cited in EEI 2010). In addition, dense sedge (*Carex densa*), Hall's aster (*Symphyotrichum hallii*), Oregon coyote-thistle (*Eryngium petiolatum*), and Western wahoo (*Euonymus occidentalis*) are present along Lacamas Creek (EEI 2010) and are identified as sensitive, vulnerable, or declining plants that could become threatened or endangered in Washington (WDNR 2021).

The county is currently working effectively to manage Camp Bonneville's forests to support a diversity of plants and animals. As part of this program, the county is working to control many non-native species at the installation, including bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense)*, Herb Robert (*Geranium robertianum*), meadow knapweed (*Centaurea xmoncktonii*), mouse-ear hawkweed (*Hieracium pilosella*), non-native blackberry (*Rubus spp.*), Queen Anne's lace (*Daucus carota)*, Scots broom (*Cytisus scoparius*), and tansy ragwort (*Jacobaea vulgaris*) (CCPW 2022b).

Fauna – In 1994, a partial baseline survey was conducted for nesting raptors, which found 33 raptors, including red-tail hawks (*Buteo jamaicensis*), northern harriers (*Circus cyaneus*), great horned owls (*Bubo virginianus*), turkey vultures (*Cathartes aura*), and a raven (*Corvus corax*) (BCRRT 2007). A 1995 endangered species survey identified priority species of the brush prairie or northern pocket gopher (*Thomomys talpoides*) at Camp Bonneville (Pentec 1995, as cited in EEI 2010). This gopher is an imperiled species of greatest conservation need for Washington (WDNR 2015).

The federally listed threatened Lower Columbia River Evolutionarily Significant Unit (ESU) steelhead trout (*Oncorhynchus mykiss*), the Lower Columbia River ESU Chinook salmon (*Oncorhynchus tshawytscha*), and the Lower Columbia River ESU chum salmon (*Oncorhynchus keta*) are present within Lacamas Creek (EEI 2012). Other endangered species, while not observed, are considered to potentially reside within Clark County and Camp Bonneville. The U.S. Fish and Wildlife Service (USFWS) Environmental Conservation Online System identifies the following four federally threatened bird, fish, and vascular plant species as potentially occurring on or near Camp Bonneville: northern spotted owl (*Strix occidentalis caurina*), yellow-billed cuckoo (*Coccyzus americanus*), bull trout (*Salvelinus confluentus*), and Nelson's checker-mallow (*Sidalcea nelsoniana*) (USFWS 2022). In addition, the monarch butterfly (*Danaus plexippus*) is listed as a candidate species under the Endangered Species Act and is expected to be on or near Camp Bonneville (USFWS 2022). The potential for these threatened and endangered and candidate species to occur does not mean the species are present at Camp Bonneville.

2.10 CLIMATE

The closest major city to Camp Bonneville is Vancouver, Washington, where the summers are short, warm, dry, and clear while the winters are cold, wet, and overcast. Humidity in this area is rare, with the highest chance of a muggy day being in August. The windier part of the year, late October to mid-March, lasts about 4.6 months with the average wind speed being 5 miles per hour (Weather Spark 2022). July, August, and September are the warmest months of the year in Vancouver, with the highest temperature occurring in August at a monthly average temperature of 68.5°F (Table 2-1). However, the humidity levels are low

and relatively constant year-round. The coldest period in Vancouver occurs in January, with an average temperature of 39.6°F.

Most precipitation in the area is caused by the passage of low-pressure zones along a path from the Northern Pacific Ocean eastward over the state during the winter and spring. The rainy period of the year lasts for 7 months (mid-May through mid-October) and typically experiences the most rainfall in November, with an average of 9.1 inches of rain (Weather Spark 2022). Snowfall typically occurs from December to mid-February and averages a monthly high of 2.7 inches in January. The average hourly wind speed in Vancouver varies seasonally, but the windier part of the year typically occurs from late October to mid-March. The highest wind speeds occur in December, with an average hourly wind speed of 5.9 miles per hour (Weather Spark 2022).

Table 2-1. High, Mean, and Low Temperatures for Vancouver, Washington

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max Temp (°F)	46.7	49.6	54.5	59.8	67.0	72.9	82.1	83.0	75.9	63.1	51.8	45.3	62.6
Mean Temp (°F)	39.6	41.0	44.9	49.2	55.7	61.0	67.7	68.5	62.8	53.3	44.7	39.2	52.3
Min Temp (°F)	35.0	35.3	38.3	41.7	47.3	52.0	56.5	57.8	53.6	46.8	39.8	35.0	44.9

Source: https://en.climate-data.org/north-america/united-states-of-america/washington/vancouver-934/

3. PA ANALYSIS

The primary components of the PA are records reviews, analysis of aerial photographs, a site visit, and interviews. The following sections summarize the methods used and activities conducted for the Camp Bonneville PA. The references to "on-post" refer to property that has been owned or leased by the Army. Any references to "off-post" refer to areas that have never been owned or leased by the Army.

3.1 RECORDS REVIEW

Prior to the records review, site visit, and interviews, a kickoff meeting was held between BRAC, USACE, and the PA team on June 22, 2022. The purpose of the kickoff meeting was to present all parties' preliminary knowledge of Camp Bonneville and provide information to guide the PFAS PA and site visit. The final kickoff meeting minutes are presented in Appendix A.

Preliminary research was conducted prior to the site visit to determine if any of the following activities were conducted, which may indicate whether there was use, storage or disposal of PFAS-containing materials during operations at Camp Bonneville:

- On-post fire training
- Use of PFAS-based AFFF in fire suppression systems or other systems
- AFFF used, stored, or disposed of at buildings and emergency response sites
- Activities or materials used that are likely to include PFAS-containing materials
- Studies conducted to assess the environmental impacts of PFAS-containing materials
- Review of potential off-post sources.

The records review included a combination of Internet-based searches and reviews of aerial photography, historical maps, technical reports, previous studies, and investigations available online. In addition, an EDR report was generated and is included in Appendix F. An EDR report includes search results from a variety of environmental, state, city, and other publicly available databases for up to 2 miles surrounding a referenced property (EDR 2022).

As part of the records review, a search was conducted of the Washington Ecology online document database website (https://apps.ecology.wa.gov/cleanupsearch/), which provides digital copies of cleanup action reports, regulatory activities, environmental data, maps, and other documents. The records review also evaluated available environmental investigations conducted under CERCLA and the Resource Conservation and Recovery Act (RCRA). Additional documents discovered in the Administrative Record managed by the Vancouver Public Library also were reviewed, which included hard copies of installation maps and drawings, inspection reports, well completion reports, and regulatory correspondence. Table 3-1 lists the documents reviewed that are relevant to the evaluation of AOPIs in this PA. A complete list of documents reviewed is included in Appendix B.

Table 3-1. Summary of Relevant Records Reviewed

Document Title	Author	Date	Relevance
Base Realignment Closure Cleanup Plan for Camp Bonneville	Woodward-Clyde	1995	Information for AOPIs, background information
U.S. Army Base Realignment and Closure 95 Program, Environmental Baseline Survey Report, Camp Bonneville, Washington	Woodward-Clyde	January 1997	Information for AOPIs, background information
U.S. Department of Defense Program Base Realignment and Closure, Ordnance, Ammunition and Explosives, Final Archives Search Report Findings, Camp Bonneville, Clark County Washington	USACE	July 1997	Site operational history

Table 3-1. Summary of Relevant Records Reviewed (Continued)

Document Title	Author	Date	Relevance
Supplemental Site Investigation Report, Ammunition Storage Magazines and Pesticide Storage Area, Camp Bonneville, Washington	URS	December 2000	Information for AOPIs, background information
Final Site Investigation Report Demolition Areas 2 and 3 Camp Bonneville, Vancouver, Washington	Calibre	March 2005	Information for AOPIs, background information
Camp Bonneville Reuse Plan, 2nd revision	Camp Bonneville LRA	November 2005	Background information land use
Final Remedial Investigation/Feasibility Study Report, Small Arms Ranges (RAU 2A)	BCRRT	August 2007	Background information (property transfer, demographics)
Camp Bonneville Preliminary Assessment, Vancouver, Washington	EEI	February 2010	Information for AOPIs, background information
Camp Bonneville Expanded Site Inspection, Vancouver, Washington	EEI	May 2012	Information for AOPIs, background information
Amended Prospective Purchaser Consent Decree for Camp Bonneville Military Reservation	U.S. Army	December 2012	Land parcels, LUCs, deed restrictions
2020 U.S. Census, Clark County, Washington	U.S. Census Bureau	Accessed on October 20, 2022	Demographics
Vancouver, Washington Weather	Weather Spark	Accessed on November 2, 2022	Climate information

Information gathered during the records reviews helped identify data gaps and enabled elimination of several areas based on their historical use. Data gaps associated with facility operations; PFAS-containing material use, storage or disposal; and current exposure receptors at Camp Bonneville contributed to a conservative approach for identifying AOPIs. However, areas with little potential to result in a PFAS release, such as residential buildings, hospitals, cafeterias, and recreational areas, were eliminated from further evaluation early in the PA process.

Areas identified to have potentially used, stored, or disposed of, or had recorded the potential for a release of PFAS-containing materials, including AFFF, were further evaluated.

3.2 AERIAL PHOTOGRAPHIC ANALYSIS

The PA included review of 23 historical aerial photographs spanning from 1951 to 2019, as presented in the EDR (2022) report, historicaerials.com, and earthexplorer.usgs.gov. The aerial photographs were analyzed to identify potential activities or developments that may suggest the potential use, storage, or disposal of PFAS-containing materials, including AFFF (e.g., evidence of fire training activities, such as fire pits or burn scars); however, no conclusions on AFFF use or storage were drawn from the aerial photograph review. The EDR aerial photographs are included in Appendix C. The aerial photographic analysis is summarized as follows:

- **1951 and 1952 –** A long ground scar is present parallel to the road from the main entrance to the Killpack cantonment in the 1951 and 1952 aerial photographs. The scar is approximately 40 feet wide and in the area identified as an airstrip on a 1958 map. The cantonments are present along the main road into Camp Bonneville. The Killpack cantonment consists of approximately 20 barracks and support buildings. Buildings 4475 and 4483 are visible parallel to the road within the Camp Killpack shop office area. The Bonneville cantonment consists of several barracks and a support building, with a tent area to the north. Building 1864 is already present on the western side of the Bonneville cantonment.

- **1960 –** The Killpack and Bonneville cantonments remain the same as they appear in the 1951 and 1952 photographs. The airstrip has been expanded and is now wider toward the northeastern end. A new building has been constructed across the road from the Camp Killpack shop office area. An area of ground disturbance or grading appears to the northeast of the shop area, and an unimproved road now leads west from the shop area to the north of the main roadway.
- **1970 –** The Killpack and Bonneville cantonments remain the same as they appear in previous years. The airstrip extends from the main gate to the Killpack cantonment and is approximately 100 feet wide. Stockpiling of equipment and vehicles can be seen north of the original Building 4483 in the Camp Killpack shop office area.
- **1975 –** The Killpack and Bonneville cantonments remain the same as they appear in the 1970 photograph.
- **1981 –** A ridge appears down the center of the airstrip that narrows to approximately 50 feet wide. The eastern end of the original Building 4483 appears to have been demolished, and Wash Rack 1 can be seen to the west of Building 4475. The clearing to the northeast of the Camp Killpack shop office area is beginning to fill in with trees.
- **1990 –** The original Building 4483 has been completely removed, and stockpiling of equipment and vehicles continues to the north of the former building footprint. Trees continue to fill in the clearing to the northeast of the Camp Killpack shop office area.
- **2002 –** The relocated Building 4483 Fire Station has been constructed north of the original building footprint, on the opposite side of the road leading into the shop office area. A new driveway appears leading from Building 4483 to the main road. Wash Rack 1 is no longer present to the west of Building 4475.
- **2006 –** No significant differences were observed between 2002 and 2006.
- **2009** – Stockpiling of equipment can be seen around the Building 4483 Fire Station. A field to the north of the airstrip is being used to park vehicles.
- **2011 and 2013 –** No significant differences were observed between 2009 and 2013.
- **2015 –** Building 1864 had collapsed by 2015, and the debris from the structure remains in place.
- **2019 –** No significant differences were observed between 2015 and 2019. A helicopter from WDNR's Helitack wildlands fire response program can be seen staged at the eastern end of the airstrip in the 2019 aerial photograph.

3.3 PA SITE VISIT

Prior to the site visit, the PA team corresponded with Army and Clark County personnel to coordinate site visit dates, gain access to the facility, and identify potential interviewees. The Camp Bonneville PA site visit was conducted on August 9, 2022. The PA site visit included a site walk and visual inspection of all readily accessible areas at Camp Bonneville to identify potential sources of PFAS and gather information for developing CSMs at AOPIs. In addition, the PA team visited the Vancouver Fire Department and Clark County Fire District 3 and conducted interviews with fire department personnel regarding historical fires and historical fire response procedures. Appendix D contains photographs from the PA site visit.

3.4 SUMMARY OF INTERVIEWS

A PFAS PA questionnaire for gathering information related to PFAS usage at Camp Bonneville from key personnel was developed and distributed prior to the site visit. The Army BRAC Environmental Coordinator, the Clark County Parks and Lands Division Program Manager for Camp Bonneville, and the Chief Pilot and Program Manager for the WDNR Helitack program responded to the questionnaire; the

questionnaire responses are presented in Appendix E. Although no former Army personnel with direct knowledge of historical operations at Camp Bonneville could be identified during this PA, responses to the questionnaires were used to identify whether PFAS-containing materials, including AFFF, were used on-post in the past or are currently being used. No current uses were identified.

In addition, telephone interviews with current and former personnel from WDNR and local Clark County Fire Districts were conducted prior to and during the site visit. Former fire personnel indicated that AFFF was stored on-post in the past; however, none of the individuals interviewed were aware of any release of AFFF occurring at Camp Bonneville. Table 3-2 summarizes the interviews conducted and the pertinent information provided.

Table 3-2. Interviews Conducted for PA

Title (Years of Experience at Facility)	Date	Information Provided
Fire Chief, East County Fire and Rescue (1997 to present)	Telephone interview on August 4, 2022	The Fire Chief has 25 years of experience as a firefighter in Clark County and provided the following information: • He has no knowledge of firefighting foam/AFFF being used to fight a fire a Camp Bonneville. • It is standard practice for his department to keep Class A (i.e., non-PFAS containing) foam on their wildland fire apparatus.
Former Deputy Fire Chief, Vancouver Fire Department (1984 to 2019)	Telephone interview on August 9, 2022	The former Deputy Fire Chief was a firefighter in Clark County for 35 years and provided the following information: • The Fire District kept an engine at the Camp Bonneville Fire Station (Building 4483) that stored up to 20 gallons of AFFF. • The AFFF was stored on the engine in 5-gallon buckets. It was only stored on the fire truck, and additional AFFF was not stored on-post. • The AFFF was provided by the Fire District, but it was never used at Camp Bonneville to his knowledge. • The fire truck was kept at the Camp Bonneville station starting in approximately 1989 until closure. • In general, AFFF usage by the county fire districts was low. The Fire Chief recalled a zip tie being placed around the handle for AFFF. If you broke the zip tie, you were required to write a report providing the quantity used and reason for use. AFFF was expensive. In his 35 years of service, they only flowed it approximately a dozen times. • The Fire Chief had no recollection of any building fires occurring at Camp Bonneville. • The Fire Chief did not recall any AFFF training areas at Camp Bonneville. They ran drills as a fire department during site walk throughs, but he did not remember “blowing water out” at Camp Bonneville. • He indicated that the use of AFFF for training was not a common practice. The department would have used a different material such as dish soap, which behaves the same as foam, for training purposes.

Table 3-2. Interviews Conducted for PA (Continued)

Title (Years of Experience at Facility)	Date	Information Provided
Fire Chief, Clark County Fire District 3 (1979 to present)	Telephone interview on August 16, 2022	The Fire Chief has 43 years of experience as a firefighter in Clark County and provided the following information: • Fire District 3 trained for fighting wildlands fires at Camp Bonneville approximately 10 to 15 years ago. The training was arranged with the Clark County Forrester and was conducted in the managed area along the northern fence line of Camp Bonneville where the installation borders Fire District 3. The Fire Chief indicated that they may have used Class A (i.e., non-PFAS containing) foam as part of this training. • The Fire Chief did not recall any other fire training activities at Camp Bonneville and was not aware of any other structure fires at the installation. • He indicated that training with foam was not a common practice for Fire District 3.
Chief Pilot and Program Manager, WDNR Helitack Program (2019 to present)	Telephone interview on September 14, 2022; Questionnaire returned on September 14, 2022	The Chief Pilot and Program Manager for the WDNR Helitack Program has 3 years of experience with the property. He completed the PA Questionnaire included in Appendix E and provided the following information: • WDNR has leased a portion of the airstrip, a barracks building, and the post commander's house for the past three seasons to support wildland firefighting efforts for the Pacific Cascade Region. • WDNR houses several vehicles and a modified UH-1H helicopter on the premises during fire season (approximately June to October). Standard fuels and oils are contained within the vehicles (Jet-A for the helicopter). • The helicopter carries PFAS free Phos-Chek foam concentrate that is mixed onboard during firefighting operations as needed. The foam is stored in tanks on the helicopter, and the manufacturer's containers (jugs) are kept on board the refuel trucks. The amount stored varies but does not exceed 20 gallons. • At no time has WDNR dropped water or foam on Camp Bonneville. WDNR also has not battled any fires on or in proximity to Camp Bonneville.
BRAC Environmental Coordinator (2007 to present)	Questionnaire returned on July 18, 2022	The BRAC Environmental Coordinator has 15 years of experience with the property. He completed the PA Questionnaire included in Appendix E.
Clark County Parks and Lands Division Program Manager for Camp Bonneville (2021 to present)	Questionnaire returned on July 18, 2022	The Clark County Parks and Lands Division Program Manager for Camp Bonneville has 1 year of experience with the property. He completed the PA Questionnaire included in Appendix E.

4. SUMMARY OF PA DATA

4.1 PREVIOUS PFAS INVESTIGATIONS

In 2012, USEPA published the Third Unregulated Contaminant Monitoring Rule (UCMR3), which required nationwide public water systems (i.e., waterworks) to sample for a list of 30 unregulated contaminants, including 6 PFAS (i.e., PFOS, PFOA, PFBS, PFNA, perfluoroheptanoic acid [PFHpA], and PFHxS). In Washington State, the UCMR3 sampling included 132 water systems representing 94 percent of people served by Group A water systems (WSDH 2021a).

Results from UCMR3 and additional testing at military bases identified several areas in Washington with PFAS in groundwater. Almost a dozen Group A public water systems and more than 200 private wells in 5 areas of the state (all more than 100 miles from Camp Bonneville) were found to have PFAS contamination in their groundwater supplies above USEPA and other state health advisory levels (WSDH 2021b). PFAS-based firefighting foam is the suspected source of contamination at all these areas. Ongoing investigations may identify other contributing sources (WSDH 2021a).

As part of UCMR3, Clark Public Utilities sampled 10 wells with the nearest well approximately 3 miles west of Camp Bonneville. In addition, the city of Vancouver sampled nine water stations approximately 8 to 16.75 miles southwest of Camp Bonneville. PFAS was not present at detectable concentrations (USEPA 2017). USEPA published the Fifth Unregulated Contaminant Monitoring Rule (UCMR5) in 2021, which expanded the list to 29 PFAS and included more public water systems serving populations less than 10,000 (USEPA 2023). As part of the UCMR5 sampling, subject to the availability of USEPA appropriations, public water systems in the vicinity of Camp Bonneville (e.g., Clark Public Utilities and city of Vancouver) may be included for sampling between January 2023 and December 2025 (USEPA 2023).

Recent (May 2023) testing of Clark Public Utilities wells has indicated 1 of the 27 wells tested to date contained trace concentrations of PFAS (The Columbian 2023). PFAS from Well 22, located in southwest Clark County, approximately 9 miles west of Camp Bonneville, was detected in groundwater below the state action levels (SALs) for PFOS, PFOA, PFHxS, and PFBS (WSDH 2021c) and the individual and combined LHA for PFOS and PFOA (USEPA 2016). PFAS has not been detected in the other Clark Public Utilities tested wells (DOH 2023).

Since 2020, the city of Vancouver had completed proactive testing for PFAS. Quarterly sampling of drinking water from nine water stations was initiated by the city of Vancouver in 2023 and analyzed for PFOA, PFOS, PFNA, PFHxS, and PFBS (COV 2023). PFAS were detected in groundwater at seven stations, and SALs for PFOA and PFOS (WSDH 2021c) were exceeded at three of the stations (Water Stations 4, 14, and 15). The highest concentrations of PFOA (15 ng/L) and PFOS (22 ng/L) in the May 2023 samples were detected at Water Station 14, which is 9.5 miles from Camp Bonneville (COV 2023). The detected concentrations were below the individual and combined LHA for PFOS and PFOA (USEPA 2016).

No PFAS investigations have been conducted at Camp Bonneville prior to this PA.

4.2 EVALUATED SITES

During the PA records reviews, interviews, aerial photographic analysis, and site reconnaissance, the PA team investigated available documentation and physical evidence for areas having a potential historical PFAS release. The sites evaluated include fire stations; fire training areas (FTAs); landfills; plating operations; WWTPs; pesticide facilities; vehicle maintenance shops, which used car washes and engine lubricants; paint shops; and photographic processing facilities, as shown in Figure 4-1 and described in the following sections.

4.2.1 AFFF Use, Storage, and Disposal

The PA included a search for evidence of current or historical AFFF use, storage, or disposal at Camp Bonneville. Documentation specifying the use of AFFF at Camp Bonneville during Army ownership and operation was not identified during the records reviews and aerial photographic analysis. However, historical AFFF storage and use were identified through data collected from interviews with personnel at the Vancouver and Clark County Fire Departments. AFFF is not currently known to be used or stored at Camp Bonneville. The areas identified as potential areas of historical AFFF usage and/or storage at Camp Bonneville are discussed below.

Two historical Fire Stations (Buildings 1864 and 4483) were identified during the PA. Building 1864 in the Bonneville cantonment was used as a fire house, fire equipment shed, and for fire truck storage from the late 1940s until the late 1970s. According to a handwritten note associated with the 1946 appraisal of Camp Bonneville (USACE 1997), the Building 1864 Fire House consisted of two buildings that had been moved to the present location (former Buildings 908 and 1819) and connected. Between 1977 and 1980, Building 1864 was used for pesticide mixing and storage (EEI 2010), before becoming a roads and grounds shop (Woodward-Clyde 1997). A sink inside the building was located during a previous non-PFAS PA (EEI 2010) and found to discharge to a dry well along the eastern side of the building. Based on the available aerial imagery, Building 1864 collapsed in approximately 2015. Based on the time frame that the Building 1864 Fire Station was operational, AFFF could have been used and/or stored at the building.

Building 4483 in the Killpack cantonment operated as a fire station from the late 1980s until approximately 2007. According to the former Deputy Fire Chief, AFFF was historically stored on the fire truck that was kept at Building 4483 as part of a fire protection contract with Clark County Fire District 4. Fire District 4 was later consolidated with Fire District 5, which subsequently became part of the Vancouver Fire Department. Up to 20 gallons of AFFF were stored on the fire truck in 5-gallon buckets. The former Deputy Fire Chief indicated that AFFF was only stored on the fire truck, and additional AFFF was not stored at the Fire Station. He also was not aware of any release of AFFF at Camp Bonneville. According to the 1997 Environmental Baseline Survey (EBS) (Woodward-Clyde 1997), the current Building 4483 was built in 1993 and used as the relocated fire station, although it is unclear from where the fire station had been relocated. The original Building 4483 was constructed as a shed garage prior to 1946. The original building footprint was parallel to the main road through the installation and adjacent to Building 4475. Based on the available aerial imagery, the eastern end of the original building was demolished between 1975 and 1981 and Building 4483 was deconstructed completely by 1990. In 1993, Building 4483 was replaced by a second building with the same name located north of the original building footprint, on the opposite side of the road leading into the shop office area at the Killpack cantonment.

The emergency airstrip consists of a 2.9-acre grass airstrip located between the main entrance to Camp Bonneville and the Killpack cantonment. Based on the available aerial imagery, construction of the airstrip began prior to 1951, and historical reports noted that helicopters occasionally used the emergency landing strip (Woodward-Clyde 1997). The eastern end of the airstrip is currently being used by the WDNR Helitack Program to stage a modified UH-1H helicopter on the premises during fire season (approximately June to October) to support wildland firefighting efforts for the Pacific Cascade Region. According to the Chief Pilot and Program Manager for the Helitack Program, WDNR has leased a portion of the airstrip, a barracks building, and the post commander's house since 2019. The helicopter carries PFAS-free Phos-Chek foam concentrate that is mixed onboard as needed during firefighting operations. The foam is stored in tanks on the helicopter, and the manufacturer's containers (jugs) are kept on board the refuel trucks. The amount stored varies but does not exceed 20 gallons. No additional information about the historical use of AFFF for emergency management or fire suppression at the airstrip has been located.

Three building fires have occurred at Camp Bonneville, involving Buildings 1962, 1983, and the CS Gas Training Building. Buildings 1962 and 1983 were both near the southeastern corner of the Bonneville cantonment and were burned in place with the debris removed to an unknown location (EEI 2010). The

dates of both fires are unknown. Building 1962 was a wood-framed building built in 1933 and used as a storage shed. Building 1983 was a wood-framed building built in the 1930s and used as an outdoor theater and stage. The CS Gas Training Building was north of Firing Range 7 and used as a gas mask training chamber (Woodward-Clyde 1997). The building was demolished and burned in place in the late 1970s. Records related to the emergency response to these building fires have not been identified. However, according to interviews with fire department personnel, use of AFFF by the local Clark County Fire Districts was infrequent.

A burn area was located north of Landfill 3 and southeast of the sewage lagoons. The area was reportedly used infrequently for burning wood and other debris, and evidence of the disposal of wood debris in this area exists (Woodward-Clyde 1995). The burn area has not been used for burning material since the mid-1980s (EEI 2010). Additional specific details regarding the period of use and materials burned are not available.

Camp Bonneville had three Open Burning/Open Detonation (OB/OD) Areas that were used to destroy a wide range of UXO, accelerants, and miscellaneous explosives. These areas were referred to as Demolition Area 1, Demolition Area 2, and Demolition Area 3 and were evaluated in the PA for AFFF use during training, destruction, and disposal operations. There was no evidence indicating AFFF use at any of the three OB/OD Areas.

4.2.2 Metal Plating Operations

No current or historical metal plating operations were identified at Camp Bonneville.

4.2.3 Wastewater Treatment Plants

The Killpack cantonment was originally built with a septic system composed of a septic tank and leach field. Sewage from the Bonneville cantonment discharged to an unlined effluent pond approximately 360 feet south of Building 1940. The former sewage pond was approximately 50 to 75 feet in diameter and 10 feet deep. The pond was abandoned when the sewage treatment system was constructed in 1978, when it was reportedly pumped out and filled with clean soil from a local source (Woodward-Clyde 1997).

The sewage treatment lagoons were constructed in 1978 to treat wastewater from the Camp Bonneville and Camp Killpack cantonments. The treatment system consisted of a pumping station, two non-overflow lagoons with aerators, and a chlorine contact chamber (Woodward-Clyde 1997). Wastewater was stored in the lagoons during the winter, and the system was configured for spray irrigation for the disposal of excess wastewater during the summer. Historically, evaporation generally exceeds the influx rate, and the irrigation system was not typically used.

4.2.4 Landfills

This section describes waste disposal at the four former landfills (identified as Landfills 1, 2, 3, and 4), three former grease pits, a drum burial area, and a paint and solvent burial area at Camp Bonneville:

- **Landfill 1** – This landfill is east of the Bonneville cantonment and north of the sewage treatment lagoons, Landfill 1 was discovered during a 1980 cultural resources survey (Woodward-Clyde 1995). The landfill is described as a 13- by 16-foot shallow depression that contains bottle fragments dating to the early 1900s. No additional information regarding the length of use or disposal practices implemented at the landfill was found during the records review.
- **Landfill 2** – This landfill is northeast of the Bonneville cantonment. Landfill 2 was reportedly discovered when fill material was encountered during the construction of the sewage treatment lagoons in approximately 1978 (Woodward-Clyde 1995). The period of use was estimated to be from 1940 to 1950. No additional information regarding the types and quantity of material disposed of at the landfill was found during the records review.

- **Landfill 3** – This landfill is southeast of Landfill 2 and the sewage treatment lagoons, Landfill 3 is suspected to have been used for the burial of trash. The area contains items such as a refrigerator, a locker, wall boards, and paint cans. According to an interview conducted for the EBS (Woodward-Clyde 1997), the landfill was reportedly used from the mid- to late 1970s to the early to mid-1980s, and the size of the burial site is estimated to measure 12 by 40 feet and is 8 feet deep.
- **Landfill 4** – This landfill is in the north-central part of the installation and underlies Demolition Area 1. The site contains several patches of soil with a pinkish-red hue that were generally devoid of vegetation. The cause of the discoloration is unknown; however, it is consistent with similarly discolored surface soil that has been reported at sites with explosives contamination (SWT 1999). Surface debris at the landfill consisted primarily of metal scraps, such as wiring, metal shards, and automobile parts. Landfill 4 was reportedly used by Vancouver Barracks for disposal of building demolition debris in the mid-1960s (Woodward-Clyde 1997). According to an interview conducted for the EBS, the landfill also was used for the disposal of firearms; however, the time frame for this disposal was not reported. As discussed in Section 4.2.1, several groups and agencies have used Landfill 4 for training and disposal operations, including the Army; Portland Air National Guard; the Bureau of Alcohol, Tobacco, and Firearms; local fire departments; and law enforcement (BCRRT 2009). Landfill material encountered during a 2004 interim removal action at Landfill 4 included remnants of burned military flares, rocket mortars, practice ordnance, ammunition, casings, civilian fireworks, and other ordnance-like items and munitions debris (EEI 2012).
- **Grease Pits** – Three grease pits were located at Camp Bonneville and used for the disposal of cooking grease and oils from the mess halls (Woodward-Clyde 1997). Two grease pits were located at the Bonneville cantonment north of Building 1828 and one was located at the Killpack cantonment east of Building 4389. The pits were constructed of corrugated metal tubes, approximately 2 feet in diameter, that extend into gravel-filled pits to an unknown depth. Based on an interview conducted for the 1997 EBS, uncontrolled disposal of potentially hazardous substances may have occurred in these pits.
- **Drum Burial Area** – A suspected drum burial area was identified in May 1996 by an anonymous report made by a former facility employee to the Camp Bonneville Facility Manager. The report indicated that pesticides, paints, and solvents had been disposed of in an area southeast of the Killpack cantonment and east of the gravel road leading south from the main roadway through Camp Bonneville. Cleanup activities were conducted at the drum burial area in 2000 that removed buried drums and debris, including paint cans, corrugated and scrap metal, and barbed wire (EEI 2010).
- **Paint and Solvent Burial Area** – A suspected paint and solvent burial area was identified in May 1996 by an anonymous report made by a former facility employee to the Camp Bonneville Facility Manager. The report indicated that paints and solvents had been disposed of in an open area south of the Killpack cantonment. Cleanup activities were conducted at the paint and solvent burial area in 2000 that removed buried debris, including a paint can, paint chips, pipes, and wires (EEI 2010).

4.2.5 Other Potential Sources of PFAS

In addition to AFFF-related PFAS sources, other potential sources of PFAS may be associated with the use of some types of pesticides, car washes, engine lubricants, paint shops, laundry or waterproofing facilities, and photographic processing facilities. Document research, the site visit, and interviews resulted in identification of other potential PFAS sources at Camp Bonneville. Potential non-AFFF PFAS sources at Camp Bonneville are noted in Figure 4-1 and discussed below:

- **Maintenance Activities** – Maintenance activities were conducted at Building 4475, which was used as the shop office area at the Killpack cantonment. Light vehicle maintenance activities, such

as those that were conducted at Building 4475, would generate soiled rags, used oils, and used antifreeze. Used oils and antifreeze are recycled off-post (Woodward-Clyde 1997). A maintenance pit was beneath the concrete floor under the western end of Building 4475. The pit was an unlined excavation in the ground that potentially received vehicle fluids, such as oil or antifreeze, for an unknown period of time. The exact size, depth, and location of the maintenance pit are unknown (EEI 2010). According to the 1997 EBS (Woodward-Clyde 1997), an area of ground south of the building measuring approximately 4 by 85 feet showed evidence of stressed vegetation and red staining. This area reportedly received runoff from the galvanized steel roof of Building 4475.

- **Wash Racks –** Wash Rack 1 was immediately west of Building 4475 and consisted of a wooden two-track vehicle ramp. The wash rack was used for vehicle washing between 1978 and approximately 1994 (EEI 2010). Wash Rack 1 did not have an oil/water separator (OWS). Wash water was discharged into a nearby ditch via uncontrolled overland flow. Wash Rack 2, also referred to as the vehicle maintenance rack, was at the northeastern corner of the shop office area, adjacent to Building 4476 (EEI 2010). Wash Rack 2 was constructed of two parallel wooden timbers with gravel in between, and it was deconstructed in the 1980s. Wash water was discharged directly onto the ground, which sloped gently toward the road. Wash Rack 2 also was used for vehicle maintenance, including draining engine fluids (Woodward-Clyde 1997).

- **Hazardous Material Storage –** Dedicated hazardous material storage occurred at Buildings 1995, 4475A, 4475B, and 4476. According to the 1997 EBS (Woodward-Clyde 1997), Building 1995 was built in 1978 and used for storing 12 percent sodium hypochlorite for sewage treatment. Buildings 4475A and 4475B were built in 1992 and used for storing oil, antifreeze, and transmission fluid. Building 4476, also referred to as the Covered Vehicle Maintenance Storage, was built in 1990 and used to store drums containing liquids such as antifreeze and waste oil. It may have been used for temporary storage of drums of other hazardous materials (EEI 2012).

- **Pesticides** – Building 4126 at the Killpack cantonment was built in approximately 1958 and used for pesticide mixing and storage until 1977 (URS 2000). This building was used to store 55-gallon drums of 2,4,5-trichlorophenoxy acetic acid (2,4,5-T), 2,4-dichlorophenoxy acetic acid (2,4-D), and an unknown amount of dichlorodiphenyltrichloroethane (DDT) until 1977. Building 4126 is on the edge of a grassy field 75 feet south of the main road into Camp Bonneville. The ground surface in this area generally slopes gently to the south, away from the roadway. In 1977, pesticide mixing and storage was moved to Building 1864 in the Bonneville cantonment. As noted in Section 4.2.1, a sink inside Building 1864 was found to discharge to a dry well along the eastern side of the building. Pesticides storage at Camp Bonneville ceased in 1980 when these materials were sent to Fort Lewis (Woodward-Clyde 1997). According to interviews conducted for the 1997 EBS (Woodward-Clyde 1997), small-scale mixing and loading of pesticides also was conducted in front of Building 4475, but no spills or other releases were reported for this area. Pesticides are not currently stored at Camp Bonneville. Although a complete list of pesticides stored, used, disposed of, and/or released at Camp Bonneville is not available, the pesticides that have been identified are not associated with PFAS. In addition, the use of fluorinated pesticides was infrequent until about the mid-2000s (Alexandrino et al. 2022). Given the operational period of Camp Bonneville, the likelihood of PFAS impacts due to pesticide use, storage, or disposal is assumed to be low.

During the document research and site visit, no additional potential PFAS-containing material use, storage, or disposal were identified.

4.3 POTENTIAL OFF-POST AND POST TRANSFER PFAS SOURCES

The search to identify potential off-post PFAS sources (i.e., not related to operations at the Army's operations at Camp Bonneville), although not exhaustive, included review of significant potential contributors (i.e., airports, landfills, WWTPs). In addition, EDR conducted a search of state and Federal

environmental databases for the Camp Bonneville property and adjacent properties (EDR 2022). No known PFAS-containing material releases have occurred post transfer on Camp Bonneville property; however, some uncertainty exists due to ongoing use of the airstrip for helicopter operations associated with the WDNR Helitack Program. Most of the surrounding area is rural and sparsely populated and is used primarily for livestock grazing and agriculture. A rock quarry is immediately to the south of the BRAC property. Figure 4-2 shows the fire stations, airports, and helipads within a 5-mile radius from Camp Bonneville.

5. SUMMARY OF PA RESULTS

The areas evaluated for potential PFAS use, storage, or disposal at Camp Bonneville were further refined during the PA process and categorized as an AOPI or not retained. Areas not retained as AOPIs are discussed in Section 5.1. AOPIs are discussed in Section 5.2.

5.1 AREAS NOT RETAINED AS AOPIs

Based on analysis of information obtained during this PA, the areas described below were not retained as AOPIs. These areas were previously identified as potential PFAS sources (e.g., AFFF storage, car washes, automobile maintenance, paint shops, photographic processing, pesticide use or storage, WWTPs, landfills). However, PA research does not indicate that PFAS-containing material was used, stored, or disposed of at these areas. A brief site history and the rationale for eliminating the areas as AOPIs are presented in Table 5-1.

Table 5-1. Summary of Areas Not Retained as AOPIs at Camp Bonneville

Area Description	Dates of Operation	Relevant Site History	Rationale
Airfield	Late 1940s to present	Emergency airstrip occasionally used for helicopter landing.	No structures are present and only occasional use pre-BRAC transfer; the presence of emergency management or fire suppression system is unlikely. No evidence that PFAS-containing materials were used, stored, or disposed of.
Building 1962 Storage Shed	1933 to unknown	Building 1962 was a wood-framed storage shed. The building burned in place, and the debris was removed to an unknown location.	Exact date of fire is unknown. AFFF use by local fire districts was infrequent, and AFFF application is not a standard response for a wood-framed structure fire. No evidence that PFAS-containing materials were used, stored, or disposed of.
Building 1983 Outdoor Theater and Stage	1930s to unknown	Building 1983 was an outdoor theater and stage. The building burned in place, and the debris was removed to an unknown location.	Exact date of fire is unknown. AFFF use by local fire districts was infrequent, and AFFF application is not a standard response for a wood-framed structure fire. No evidence that PFAS-containing materials were used, stored, or disposed of.
Building 1995 Chemical Storage	1978 to unknown	Building 1995 was a metal building with concrete floor that stored 12 percent sodium hypochlorite used for sewage treatment.	Although Safety Data Sheets were unavailable for review at the time of the PA, sodium hypochlorite is not considered a PFAS-containing material. No evidence that PFAS-containing materials were used, stored, or disposed of.
Building 4126 Pesticide Mixing and Storage	1958 to 1977	Building 4126 was used for pesticide mixing and storage until 1977 when these materials were moved to Building 1864.	Safety Data Sheets were unavailable for review at the time of the PA; however, identified pesticides are not associated with PFAS-containing materials. The dates of pesticide use at the facility also pre-date the use of fluorinated pesticides. No evidence that PFAS-containing materials were used, stored, or disposed of.

Table 5-1. Summary of Areas Not Retained as AOPIs at Camp Bonneville (Continued)

Area Description	Dates of Operation	Relevant Site History	Rationale
Building 4475 Vehicle Maintenance	1937 to unknown	Building 4475 was used for vehicle maintenance and as the shop office area at the Killpack cantonment. An unlined maintenance pit was located at the western end of the building.	Exact dates of operation as a vehicle maintenance facility are unknown. Safety Data Sheets were unavailable for review at the time of the PA. No evidence that PFAS-containing materials were used, stored, or disposed of.
Building 4475A Hazardous Material Storage	1992 to unknown	Building 4475A was used for storing hazardous materials associated with vehicle maintenance, including oil, antifreeze, and transmission fluid.	No evidence that PFAS-containing materials were used, stored, or disposed of. Safety Data Sheets were unavailable for review at the time of the PA.
Building 4475B Hazardous Material Storage	1992 to unknown	Building 4475B was used for storing hazardous materials associated with vehicle maintenance, including oil, antifreeze, and transmission fluid.	No evidence that PFAS-containing materials were used, stored, or disposed of. Safety Data Sheets were unavailable for review at the time of the PA.
Building 4476 Covered Vehicle Maintenance Storage	1990 to unknown	Building 4476, also known as the Covered Vehicle Maintenance Storage, was used to store drums containing liquids such as antifreeze and waste oil. It may have been used for temporary storage of drums of other hazardous materials.	No evidence that PFAS-containing materials were used, stored, or disposed of. Safety Data Sheets were unavailable for review at the time of the PA.
Burn Area	Unknown to mid-1980s	Located north of Landfill 3 and southeast of the sewage lagoons, the burn area was reportedly used on an infrequent basis for burning wood and other debris.	AFFF use by local fire districts was infrequent, and AFFF application is not a standard practice when disposing of wood and other debris by burning. No evidence that PFAS-containing materials were used, stored, or disposed of.
CS Gas Training Building	Unknown to late 1970s	The CS Gas Training Building was used as a gas mask training chamber. The building was demolished and burned in place in the late 1970s.	AFFF use by local fire districts was infrequent, and AFFF application is not a standard response for a wood-framed structure fire. No evidence that PFAS-containing materials were used, stored, or disposed of.
Landfill 1	Early 1900s	Landfill 1 was discovered during a 1980 cultural resources survey (Woodward-Clyde 1995) and described as a 13- by 16-foot shallow depression that contains bottle fragments dating to the early 1900s. No additional information regarding the length of use or disposal practices implemented at the landfill has been found.	Based on the age of materials found at the landfill during the cultural resources survey, dates of landfill operation precede the wide use of PFAS-containing materials; therefore, it is unlikely PFAS-containing materials were used, stored, or disposed of.

Table 5-1. Summary of Areas Not Retained as AOPIs at Camp Bonneville (Continued)

Area Description	Dates of Operation	Relevant Site History	Rationale
Landfill 2	1940 to 1950	Landfill 2 was discovered when fill material was encountered during the construction of the sewage treatment lagoons in approximately 1978 (Woodward-Clyde 1995). Period of use was estimated to be from 1940 to 1950. No additional information regarding the types and quantity of material disposed of at the landfill has been found.	Dates of landfill operation precede the wide use of PFAS-containing materials; therefore, it is unlikely PFAS-containing materials were used, stored, or disposed of.
Landfill 3	Mid- to late 1970s to early to mid-1980s	Landfill 3 is suspected to have been used for the burial of trash and contains items such as a refrigerator, a locker, wall boards, and paint cans. The landfill was reportedly used from the mid- to late 1970s to the early to mid-1980s, and the size of the burial site is estimated to be 12 by 40 feet and 8 feet deep.	No evidence that PFAS-containing materials were used, stored, or disposed of.
Landfill 4	Mid-1960s to unknown	Landfill 4 underlies Demolition Area 1. The landfill was reportedly used by Vancouver Barracks for disposal of an unknown quantity of building demolition debris in the mid-1960s. The landfill also was used for the disposal of an unknown quantity of firearms, munitions debris, and residue and debris from on-post ordnance demolition activities. No additional information regarding the period for disposal activities has been found.	No evidence that PFAS-containing materials were used, stored, or disposed of. The materials within this landfill would not contain PFAS-containing materials.
Grease Pits	1935 to 1996	The Grease Pits were corrugated metal tubes that extend into gravel-filled pits to an unknown depth and were used for the disposal of cooking grease and oils from the mess halls. According to an interview conducted for the 1997 EBS (Woodward-Clyde 1997), uncontrolled disposal of potentially hazardous substances may have occurred in these pits.	No evidence that PFAS-containing materials were used, stored, or disposed of.
Drum Burial Area	Unknown	Drum burial site identified by an anonymous report from a former facility employee to the Camp Bonneville Facility Manager.	No evidence that PFAS-containing materials were used, stored, or disposed of.
Paint and Solvent Burial Area	Unknown	Paint and solvent burial site identified by an anonymous report from a former facility employee to the Camp Bonneville Facility Manager.	No evidence that PFAS-containing materials were used, stored, or disposed of.

Table 5-1. Summary of Areas Not Retained as AOPIs at Camp Bonneville (Continued)

Area Description	Dates of Operation	Relevant Site History	Rationale
OB/OD Areas (Demolition Areas 1, 2, and 3)	Late 1960s to unknown (Demolition Area 1), unknown to late 1960s (Demolition Area 2), and unknown (Demolition Area 3)	Demolition Area 1 was used by several groups and agencies for training and disposal operations for a wide range of UXO, accelerants, and miscellaneous explosives. Demolition Area 1 was colocated with Landfill 4, and use of the area began in the late 1960s. Prior to the 1960s, ordnance disposal operations occurred at Demolition Area 2. Demolition Area 3 consists of a surficial depression that is approximately 20 feet in diameter and 10 feet deep and may be an excavation or a detonation crater.	Dates of operation of Demolition Area 2 precede the wide use of PFAS-containing materials. Standard practice for UXO disposal was to allow it to burn until destroyed; therefore, the use of AFFF for fire suppression is unlikely. No evidence that PFAS-containing materials were used, stored, or disposed of.
Former Sewage Pond	1927 to 1978	The Former Sewage Pond was an unlined effluent pond that received sewage from the Bonneville cantonment. The pond was abandoned when the sewage treatment system was constructed in 1978.	Used for domestic waste only; no evidence that the Former Sewage Pond received potential PFAS-impacted wastewater.
Sewage Treatment Lagoons	1978 to present	The sewage treatment lagoons were constructed in 1978 to treat wastewater from the Camp Bonneville and Camp Killpack cantonments. The treatment system consisted of a pumping station, two non-overflow lagoons with aerators, and a chlorine contact chamber.	Used for domestic waste only; no evidence that the Sewage Treatment Lagoons received potential PFAS-impacted wastewater.

5.2 AOPIs

Based on analysis of information obtained during document research, personnel interviews, and/or site reconnaissance, three areas were categorized as AOPIs and are presented in Table 5-2 and Figure 5-1. Site research conducted for this PA indicates that PFAS-containing material use, storage, or disposal is potentially suspected at these areas.

Table 5-2. Summary of AOPIs at Camp Bonneville

Area Description	Dates of Operation	Relevant Site History	Rationale
Building 1864 Fire Station	Late 1940s to late 1970s	Building 1864 in the Bonneville cantonment operated as a fire house, fire equipment shed, and for fire truck storage from the late 1940s until the late 1970s.	Fire station with potential AFFF use.
Building 4483 Fire Station	Late 1980s to 2007	Building 4483 in the Killpack cantonment operated as a fire station from the late 1980s until approximately 2007. AFFF was historically stored on the fire truck inside the fire station.	Fire station with reported AFFF storage on fire truck.

Table 5-2. Summary of AOPIs at Camp Bonneville (Continued)

Area Description	Dates of Operation	Relevant Site History	Rationale
Former Wash Racks (Wash Racks 1 and 2)	1978 to 1994 (Wash Rack 1), unknown to 1980s (Wash Rack 2)	Wash Rack 1 consisted of a wooden two track vehicle ramp and was used for vehicle washing between 1978 and approximately 1994. Wash Rack 2, also referred to as the vehicle maintenance rack, was constructed with two parallel wooden timbers with gravel in between and was used until the 1980s. Both wash racks were in the shop office area at the Killpack cantonment, in the vicinity of the Building 4483 Fire Station.	Potentially received PFAS-containing AFFF during fire truck cleaning activities. AFFF is reported to have been present on the fire truck at the adjacent Building 4483 Fire Station.

A summary of the preliminary CSM is presented in Section 5.2.1. AOPI overviews and CSM summaries for each AOPI are presented in Sections 5.2.2 through 5.2.4.

5.2.1 Preliminary CSM

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) and USEPA guidance. The preliminary CSMs identified potential human receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSMs identified soil, groundwater, surface water, and sediment pathways as potentially complete.

Based on the documented or potential historical use, storage, or disposal of PFAS-containing materials at Camp Bonneville, affected media are likely to consist of soil, groundwater, surface water, and sediment. Release and transport mechanisms include dissolution/desorption from soil to groundwater, runoff/dissolution/adsorption with surface water or stormwater, and recharge to groundwater from surface water. While other potential exposure media (i.e., soil and sediment) besides drinking water sources (i.e., groundwater and/or surface water) may be impacted by PFAS, direct ingestion via drinking water is the most likely exposure route, and thus the Army's primary concern for human exposure. Therefore, the focus of the Army's PA program is on potential human exposures via drinking water ingestion. The potential for human exposures to PFAS through non-drinking water pathways has not yet been established and may be evaluated in the future if it is determined that those pathways warrant further consideration. The CSMs presented in this report focus on drinking water pathways via groundwater and surface water that are known to be used as a source of potable water.

Drinking water at Camp Bonneville is carried in as needed by site personnel. As discussed in Section 2.8, no nearby water supply wells are used as a drinking water source. A groundwater exposure pathway is considered potentially complete where constituents of interest (COIs) could migrate from the AOPI source area to groundwater that is used for drinking water. Otherwise, the groundwater exposure pathway is considered incomplete. The following parameters are used to determine if an AOPI source area had a potentially complete groundwater exposure pathway:

- AOPIs located upgradient or in the vicinity of drinking water sources and that have the potential to influence groundwater associated with these potable sources are considered to have a potentially complete groundwater exposure pathway for drinking water receptors.

- AOPIs located outside the vicinity or downgradient from potable sources (drinking water wells) are considered to have an incomplete groundwater exposure pathway.

The soil exposure pathway is considered potentially complete where COIs could be present in soil. A surface water exposure pathway is considered potentially complete where COIs could be present in a surface water body (e.g., a reservoir or large river) that serves as a potable water source. No on-post surface water features are used as a drinking water source, nor is surface water migration a potential exposure medium for off-post drinking water receptors. Surface water at Camp Bonneville includes Lacamas Creek and numerous minor tributaries.

Figure 5-1 presents the locations of the AOPIs. AOPI-specific CSM summaries are provided in Tables 5-3 through 5-5.

5.2.2 Building 1864 Fire Station AOPI Rationale and CSM

Building 1864 was identified as an AOPI following records reviews, interviews, aerial photograph review, and site reconnaissance due to the potential for AFFF use.

Building 1864 is in the Bonneville cantonment and was reportedly constructed during the late 1940s by moving two buildings (former Buildings 908 and 1819) to the present location and connecting them. The building was used as a fire house, a fire equipment shed, and for fire truck storage from the late 1940s until the late 1970s. The building had one drive-in bay. Building 1864 was used for pesticide mixing and storage between 1977 and 1980, before becoming a roads and grounds shop. Ownership of the building was transferred from the Army to Clark County, and then BCRRT assumed ownership from Clark County in September 2006. BCRRT conveyed ownership of the building back to Clark County in December 2011. Building 1864 collapsed in approximately 2015 after falling into disrepair, and the building debris remains on-post.

A visual inspection of Building 1864 was conducted. No floor drains or sumps were observed; however, the floor of the building was obscured by debris from the former roof. A previous PA (unrelated to PFAS) (EEI 2010) reported that a sink inside the building discharged to a dry well along the eastern side of the building. The exterior ground surface at Building 1864 is either grass-covered soil or dirt and gravel. The dirt and gravel surface of the outdoor ramp and driveway in front of the former bay doors is partially revegetated and slopes toward the roadway. A small unnamed creek that flows south toward Lacamas Creek is approximately 100 feet east of Building 1864.

Table 5-3. AOPI CSM Information Profile – Building 1864 Fire Station

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI site structures/description	Rectangular wooden structure on concrete underlain by soil. The historical structure has collapsed, and debris remains in place. Surface water runoff flows south toward the roadway. Former dirt and gravel ramp and driveway have been partially revegetated. Sink discharged to a dry well along the eastern side of the building.
	Latitude, longitude	45.694617, -122.4171
	Size	0.06 acres
Land Use	Current/future land use	Recreational use

Table 5-3. AOPI CSM Information Profile – Building 1864 Fire Station (Continued)

Profile Type	Information Needs	Preliminary Assessment Findings
CSM Profile	Source media	Soil
	Migration routes/release mechanisms	Constituents could migrate from soil to groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff, dissolution, and adsorption to suspended sediment from stormwater. Interaction and potential connectivity between surface water and groundwater (i.e., discharge and recharge) presents another potential migration pathway of constituents.
	Exposure pathways, media, and human receptors	Soil is considered a complete exposure pathway at Building 1864. On-post groundwater is not currently used for drinking water, and groundwater use is restricted to non-potable water at this site. Therefore, groundwater is not considered a complete exposure pathway for on-post receptors at this AOPI for the duration that the groundwater LUC remains on the property. However, because the deed restrictions are not based on PFAS contamination, a potential future groundwater pathway exists on-post. In addition, groundwater flows to the southeast across this area and has the potential to influence drinking water wells immediately downgradient from Camp Bonneville. Therefore, a complete groundwater exposure pathway potentially exists for off-post human receptors.

5.2.3 Building 4483 Fire Station AOPI Rationale and CSM

Building 4483 was identified as an AOPI following records reviews, interviews, aerial photograph review, and site reconnaissance due to reported AFFF storage.

Building 4483 is in the Killpack cantonment and operated as a fire station from the late 1980s until approximately 2007. According to personnel interviews, AFFF was historically stored on the fire truck that was kept at the fire station as part of a fire protection contract with the local Clark County Fire District. The building had one drive-in bay, and up to 20 gallons of AFFF were stored on the fire truck in 5-gallon buckets. The former Deputy Fire Chief was not aware of any release of AFFF at Camp Bonneville.

The current Building 4483 was built in 1993. The 1997 EBS (Woodward-Clyde 1997) identified this building as the relocated fire station, although it is not clear if this was in reference to the relocation from Building 1864 or from the previous structure identified as Building 4483. The original Building 4483 was constructed as a shed garage prior to 1946 and was parallel to the main road through the installation, adjacent to Building 4475. Based on the available aerial imagery, the original building was demolished by 1990. In 1993, Building 4483 was replaced by a second building with the same name north of the original building footprint. Ownership of Building 4483 was transferred from the Army to Clark County, and then BCRRT assumed ownership from Clark County in September 2006. BCRRT conveyed ownership of the building back to Clark County in December 2011. The building is currently being used for vehicle and equipment storage.

A visual inspection of Building 4483 was conducted. No floor drains or sumps were observed. The floor of the structure is concrete, and the exterior ground surface is dirt and gravel. The concrete and gravel surface of the outdoor ramp in front of the bay door slopes toward the road. A drainage ditch along the western side of Building 4483 continued southwest along the gravel driveway leading to the shop office area before connecting with the drainage ditch along the road. Water was actively flowing in the ditch at the time of

the inspection and appeared to be coming from a wet area in the woods behind Building 4483. A small unnamed stream is approximately 50 feet east of Building 4483, adjacent to the former location of Wash Rack 1. The steam flows into a culvert that emerges below the gravel pad of the shop office area and then flows aboveground for approximately 15 feet before entering another culvert running south under the road and then continuing south toward Lacamas Creek.

Table 5-4. AOPI CSM Information Profile – Building 4483 Fire Station

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI site structures/description	Rectangular wooden structure on concrete underlain by soil. Surface water runoff flows south toward the road and accumulated in ditches that discharge to small unnamed stream. Former building location is partially vegetated and partially dirt and gravel open storage area that is enclosed by a chain-link fence.
	Latitude, longitude	45.690063, -122.427791
	Size	0.16
Land Use	Current/future land use	Recreational use
CSM Profile	Source media	Soil
	Migration routes/release mechanisms	Constituents could migrate from soil to groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff, dissolution, and adsorption to suspended sediment from stormwater. Interaction and potential connectivity between surface water and groundwater (i.e., discharge and recharge) presents another potential migration pathway of constituents.
	Exposure pathways, media, and human receptors	Soil is considered a complete exposure pathway at Building 4483. On-post groundwater is not currently used for drinking water, and groundwater use is restricted to non-potable water at this site. Therefore, groundwater is not considered a complete exposure pathway for on-post receptors at this AOPI for the duration that the groundwater LUC remains on the property. However, because the deed restrictions are not based on PFAS contamination, a potential future groundwater pathway exists on-post. In addition, groundwater flows to the southeast across this area and has the potential to influence drinking water wells immediately downgradient from Camp Bonneville. Therefore, a complete groundwater exposure pathway potentially exists for off-post human receptors.

5.2.4 Former Wash Racks AOPI Rationale and CSM

The former Wash Racks (Wash Racks 1 and 2) were identified as an AOPI following records reviews, interviews, aerial photograph review, and site reconnaissance due to the potential that these facilities received PFAS-containing AFFF during fire truck cleaning activities. AFFF is reported to have been present on the fire truck at the adjacent Building 4483 Fire Station. Wash Racks 1 and 2 are being considered a single AOPI due to their proximity and similar use.

Wash Rack 1 was approximately 0.03 acres and was immediately west of Building 4475. It consisted of a wooden two-track vehicle ramp that was used for vehicle washing between 1978 and approximately 1994 (EEI 2010). Wash Rack 1 did not have an OWS. Wash Rack 2, also referred to as the vehicle maintenance

rack, was at the northeastern corner of the shop office area, adjacent to Building 4476. It was constructed of two parallel wooden timbers with gravel in between, and it was used as a wash rack and vehicle maintenance rack until the 1980s, when it was deconstructed (Woodward-Clyde 1997). Ownership of the property associated with Wash Racks 1 and 2 was transferred from the Army to Clark County, and then BCRRT assumed ownership from Clark County in September 2006. BCRRT conveyed ownership of the property back to Clark County in December 2011.

A visual inspection of the former Wash Racks was conducted. Wash Rack 1 is a partially vegetated and partially dirt and gravel open storage area that is enclosed within the chain-link fence that surrounds the shop office area. Wash Rack 2 is a partially open clearing that has been revegetated with a mixture of tall grasses, brush, and trees. Surface water runoff from Wash Rack 1 flows toward the road and into an unnamed stream that crosses the site. The steam flows into a culvert that emerges below the gravel pad of the shop office area and then flows aboveground for approximately 15 feet before entering another culvert running south under the road and then continuing south toward Lacamas Creek. The ground surface at Wash Rack 2 slopes to the south toward the road. Surface water from Wash Rack 2 flows toward a ditch that runs along the northern side of the road and joins the stream and runs under the road through the same culvert.

Table 5-5. AOPI CSM Information Profile – Former Wash Racks

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI site structures/description	Historical structures have been removed. Wash Rack 1 is a partially vegetated and partially a dirt and gravel open storage area that is completely enclosed by the chain-link fence surrounding the shop office area. Wash Rack 2 has been revegetated with a mixture of tall grasses, brush, and trees. Surface water runoff at the former Wash Racks flows south toward the road and is accumulated in ditches that discharge to small unnamed stream.
	Latitude, longitude	45.690081, -122.427489 (Wash Rack 1) 45.690489, -122.42705 (Wash Rack 2)
	Size	0.03 acres (Wash Rack 1) 0.01 acres (Wash Rack 2)
Land Use	Current/future land use	Recreational use
CSM Profile	Source media	Soil
	Migration routes/release mechanisms	Constituents could migrate from soil to groundwater via desorption and dissolution. Constituents could migrate to surface water due to runoff, dissolution, and adsorption to suspended sediment from stormwater. Interaction and potential connectivity between surface water and groundwater (i.e., discharge and recharge) presents another potential migration pathway of constituents.
	Exposure pathways, media, and human receptors	Soil is considered a complete exposure pathway at the former wash racks. On-post groundwater is not currently used for drinking water, and groundwater use is restricted to non-potable water at this site. Therefore, groundwater is not considered a complete exposure pathway for on-post receptors at this AOPI for the duration that the groundwater LUC remains on the property. However, because the deed restrictions are not based on PFAS contamination, a potential future groundwater pathway exists on-post. In addition, groundwater flows to the southeast across this area and has the potential to influence drinking water wells immediately downgradient from Camp Bonneville. Therefore, a complete groundwater exposure pathway potentially exists for off-post human receptors.

5.3 DATA LIMITATIONS

The data limitations relevant to the development of this PA for PFAS at Camp Bonneville are discussed below.

A comprehensive well survey was not completed as part of this PA; therefore, the information reviewed regarding off-post wells is limited to an administrative search that resulted in numerous wells that could not be verified. The EDR well search report (Appendix F), water well data layer at Clark County Washington MapsOnline (https://gis.clark.wa.gov/mapsonline/), and online Washington Ecology Well Report Viewer database (https://appswr.ecology.wa.gov/wellconstruction/map/WCLSWebMap/default.aspx) were referenced when identifying potential off-post drinking water receptors.

The searches for ecological receptors and off-post PFAS sources were limited to easily identifiable and readily available information. An online database was referenced when identifying the ecological profile for the site (USFWS 2022).

Records reviewed during the PA process were limited in information regarding PFAS-containing materials, including AFFF use, procurement records, and firefighter training records. Generally, interviews were crucial to understanding past practices and identifying the potential for use, storage, or disposal of PFAS-containing materials because records are often not available after installation closure. Interviews providing information regarding potential PFAS-containing material use were limited in quantity but inclusive of personnel knowledgeable of fire, emergency response, and environmental response over the time frame from 1979 to the present.

The PA was conducted through observation of operational periods, site usage, aerial photographs, records reviews, anecdotal evidence, and personnel interviews to evaluate the use, storage, or disposal of PFAS-containing materials. Therefore, some conclusions and recommendations presented in this report are based on available information, professional judgment, and industry best practices.

6. CONCLUSIONS

This PA was conducted in accordance with DoD, Army, and USEPA guidance documents. Programmatically, the Army has focused its PFAS PA efforts on identifying locations where a potential for a release of PFAS exists (i.e., those locations where PFAS-containing materials were used, stored, or disposed of). Locations on Army installations with the greatest likelihood of releases of PFAS were evaluated as part of this PA, including FTAs, AFFF storage locations, aircraft crash sites, fuel farms, and sites associated with aviation assets. However, other potential sources of PFAS at the installation were considered and have been documented in this PA. A combination of document review, Internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFAS use and releases at Camp Bonneville.

The entire former Camp Bonneville was assessed; 24 preliminary areas were identified and evaluated for potential use, storage, and/or disposal of PFAS-containing materials; and these areas were further refined during the PA process and then either identified as an area not retained for further investigation or as an AOPI. In accordance with the established process for the PA, three of the preliminary areas have been identified as AOPIs.

The AOPIs identified during this PA at Camp Bonneville are listed below:

- Former fire station (Building 1864)
- Former fire station (Building 4483)
- Two former wash racks (Wash Racks 1 and 2).

A site-specific CSM was developed for each AOPI based on an assessment of existing records, personnel interviews, and site reconnaissance trips. This PA did not identify any of the three AOPIs as presently impacting on-post drinking water receptors. However, the exposure pathway for soil is complete for all the AOPIs. In addition, the exposure pathway for off-post drinking water receptors is potentially complete for the three AOPIs.

Given the findings of this PA, the AOPIs presented warrant further evaluation in an SI (40 CFR §300.420 (c)).

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FIGURES


0 2 4 8 Miles
N
W E
S
Camp Bonneville
Columbia City
St Helens
La Center
Yacolt
Ridgefield
Battle Ground
Salmon Creek
Vancouver
Orchards
Mill Plain
Camas
Washougal
Bridal Veil
Troutdale
Corbett
Portland
Gresham
Milwaukie
Tigard
Lake Oswego
Oak Grove
Damascus
Sandy
Brightwood
Hills
Victoria
Seattle
Spokane
WASHINGTON
Olympia
Cascadia Basin
Area Shown
Kennewick
Camp Bonneville
Portland
Salem
OREGON
BLUE MOUNTAINS
IDAHO
Boise
Snake
HARNEY BASIN
Medford
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
US Army Corps of Engineers
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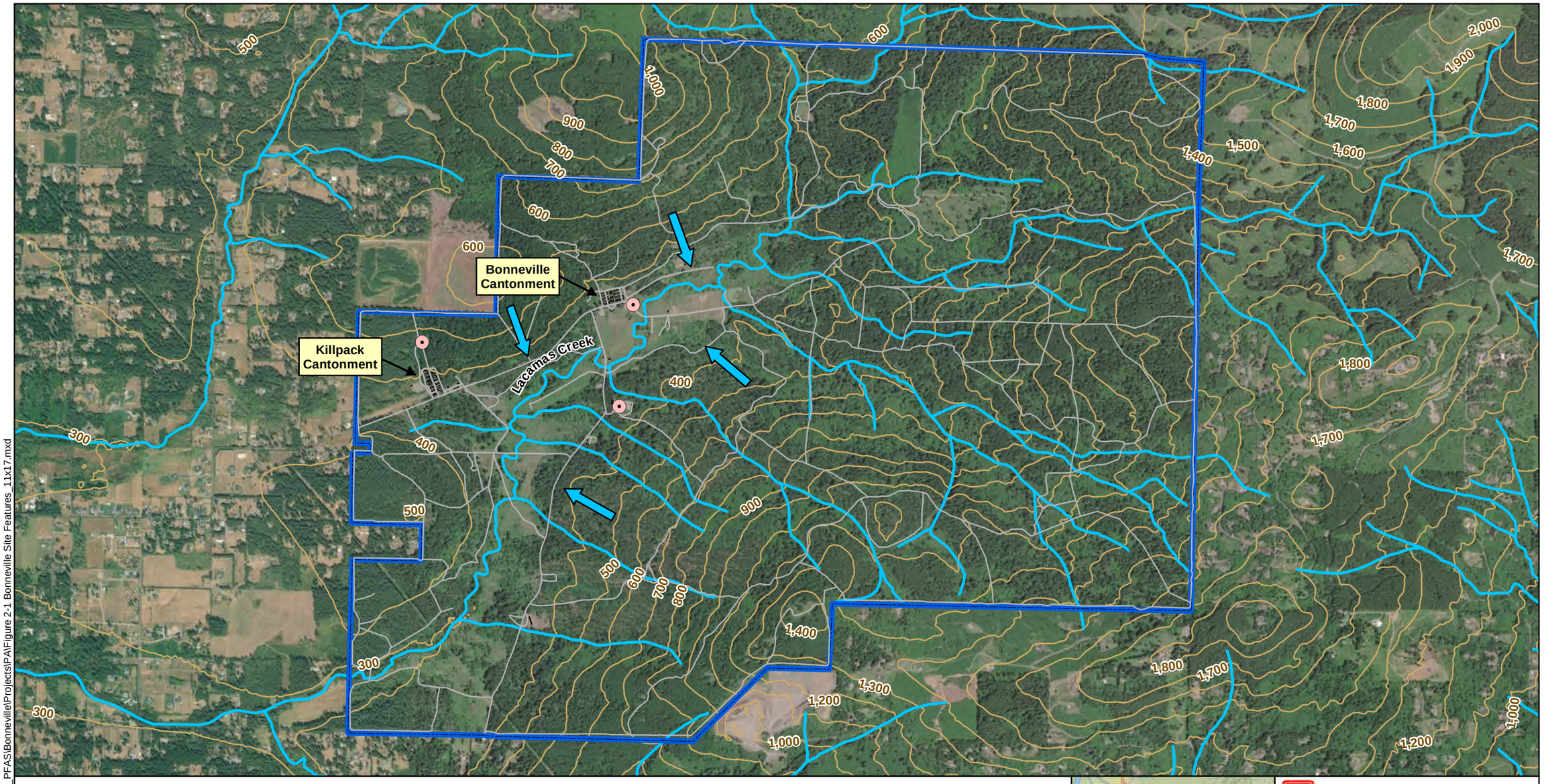
INSTALLATION LOCATION
CAMP BONNEVILLE
VANCOUVER, WASHINGTON
FIGURE 1-1
DATE: 10/10/2022
PROJECT: \GIS_DATA\BRAC_PFAS\Bonneville\Projects\PA\Figure 1-1 Bonneville Installation Location.mxd



PROJECT: \GIS_DATA\BRAC_PFAS\BonnevilleProjects\PAIFigure 2-1 Bonneville Site Features_11x17.mxd

LEGEND:

- Non-Potable Well
- Creek/Stream
- Elevation Contours (100 ft)
- Road
- Building
- Installation Boundary
- Inferred Groundwater Flow Direction

NOTES:

1. Data Sources: USGS National Elevation Dataset (NED), USGS National Hydrography Dataset (NHD).
2. Inferred Groundwater Flow Direction is from the 2010 PA (Ecology and Environment).
3. Background Source: ESRI World Imagery (Vivid/Maxar, 4/2020).

N
WA STATE PLANE SOUTH (NAD83)

0 1,000 2,000 4,000 Feet

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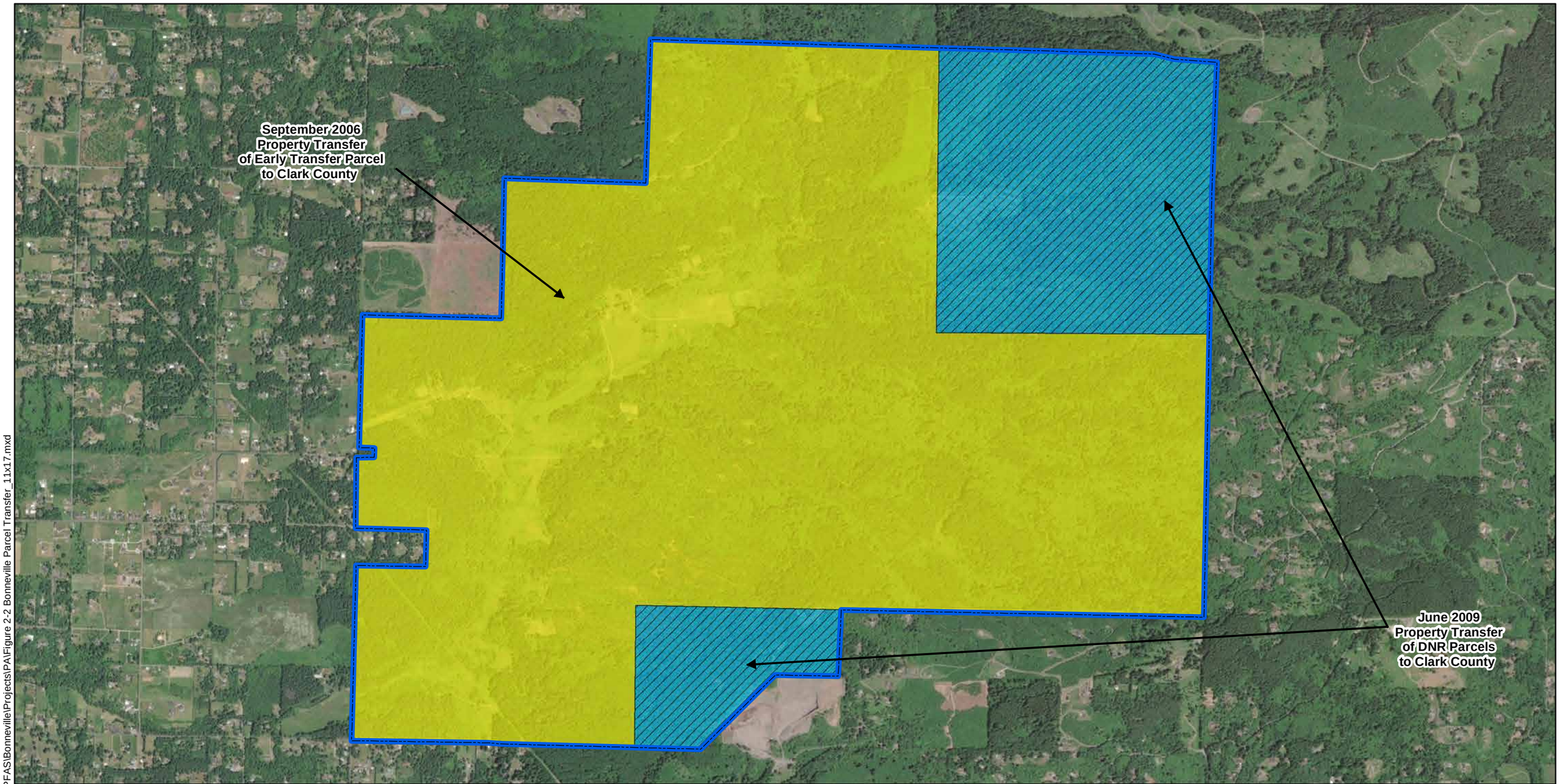
SITE FEATURES

CAMP BONNEVILLE
VANCOUVER, WASHINGTON

FIGURE: 2-1 | DATE: 9/12/2023



PROJECT: \GIS_DATA\BRAC_PFAS\Bonneville\Projects\PA\Figure 2-2 Bonneville Parcel Transfer_11x17.mxd

LEGEND:

- June 2009 Property Transfer of DNR Parcels to Clark County
- September 2006 Property Transfer of Early Transfer Parcel to Clark County
- Installation Boundary

NOTES:

1. Background Source: ESRI World Imagery (Vivid/Maxar, 4/2020).

N
WA STATE PLANE SOUTH (NAD83)

0 1,000 2,000 4,000 Feet

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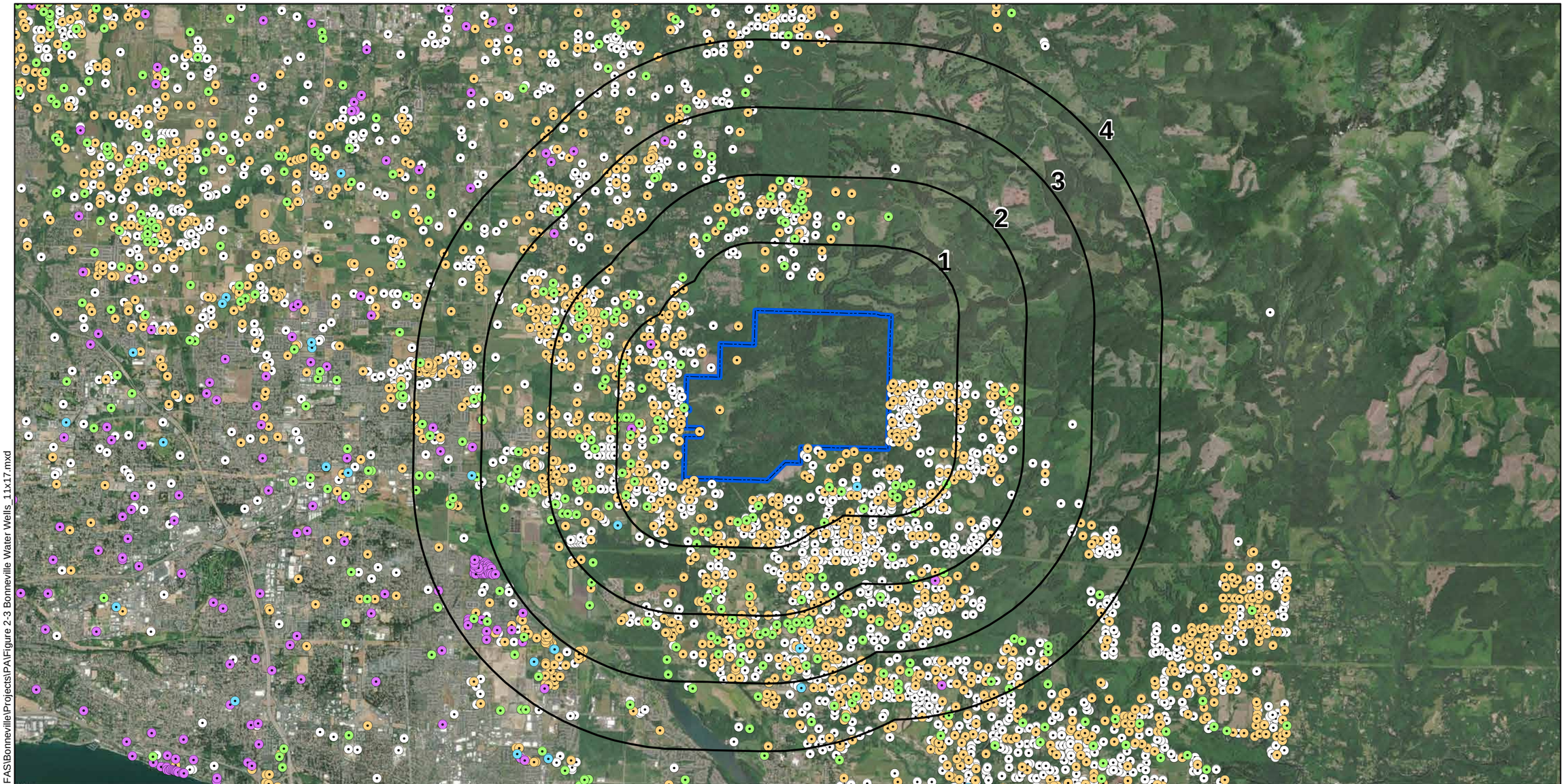
PARCEL TRANSFER MAP

CAMP BONNEVILLE
VANCOUVER, WASHINGTON

FIGURE: 2-2 | DATE: 10/19/2022



PROJECT: \GIS_DATA\BRAC_PFAS\Bonneville\Projects\PA\Figure 2-3 Bonneville Water Wells_11x17.mxd

LEGEND:

- Group A Public Water Well
- Group B Public Water Well
- Irrigation Well
- Individual Water Well
- Unclassified Water Well
- Distance Ring
- Installation Boundary

NOTES:

1. Data Source: Water wells from Clark County, WA Geographic Information Services; https://gis.clark.wa.gov/gishome/.
2. Background Source: ESRI World Imagery (Vivid/Maxar, 4/2020).

0 2,500 5,000 10,000 Feet

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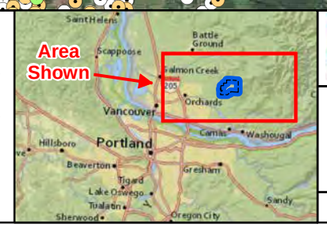
WA STATE PLANE SOUTH (NAD83)



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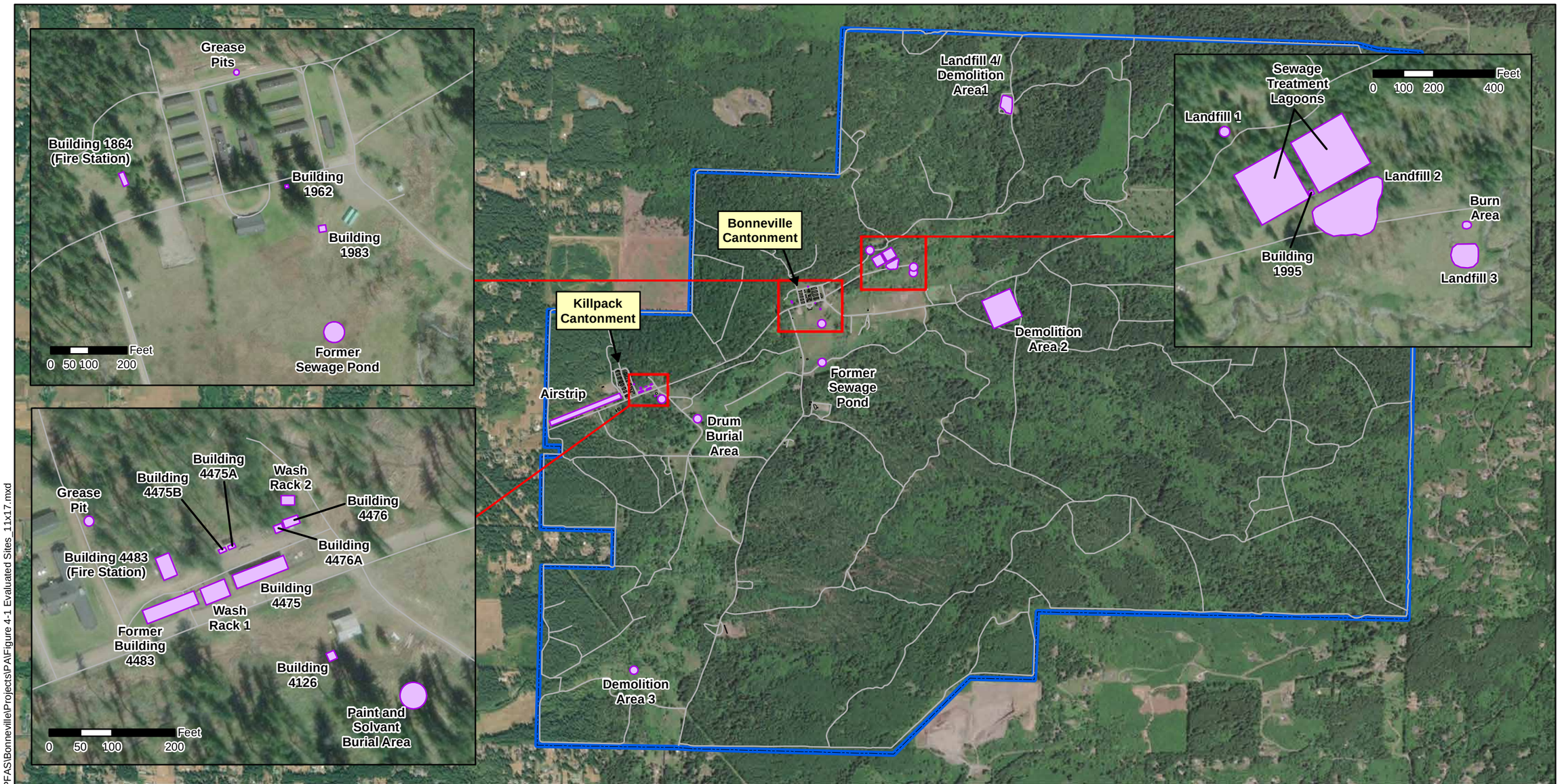
POTABLE WELLS WITHIN A 4-MILE RADIUS

CAMP BONNEVILLE
VANCOUVER, WASHINGTON

FIGURE: 2-3 | DATE: 11/3/2022



LEGEND:

- Road
- Evaluated Site
- Building
- Installation Boundary

NOTES:

1. Background Source: ESRI World Imagery (Vivid/Maxar, 4/2020).

0 1,000 2,000 4,000 Feet

N
WA STATE PLANE SOUTH (NAD83)

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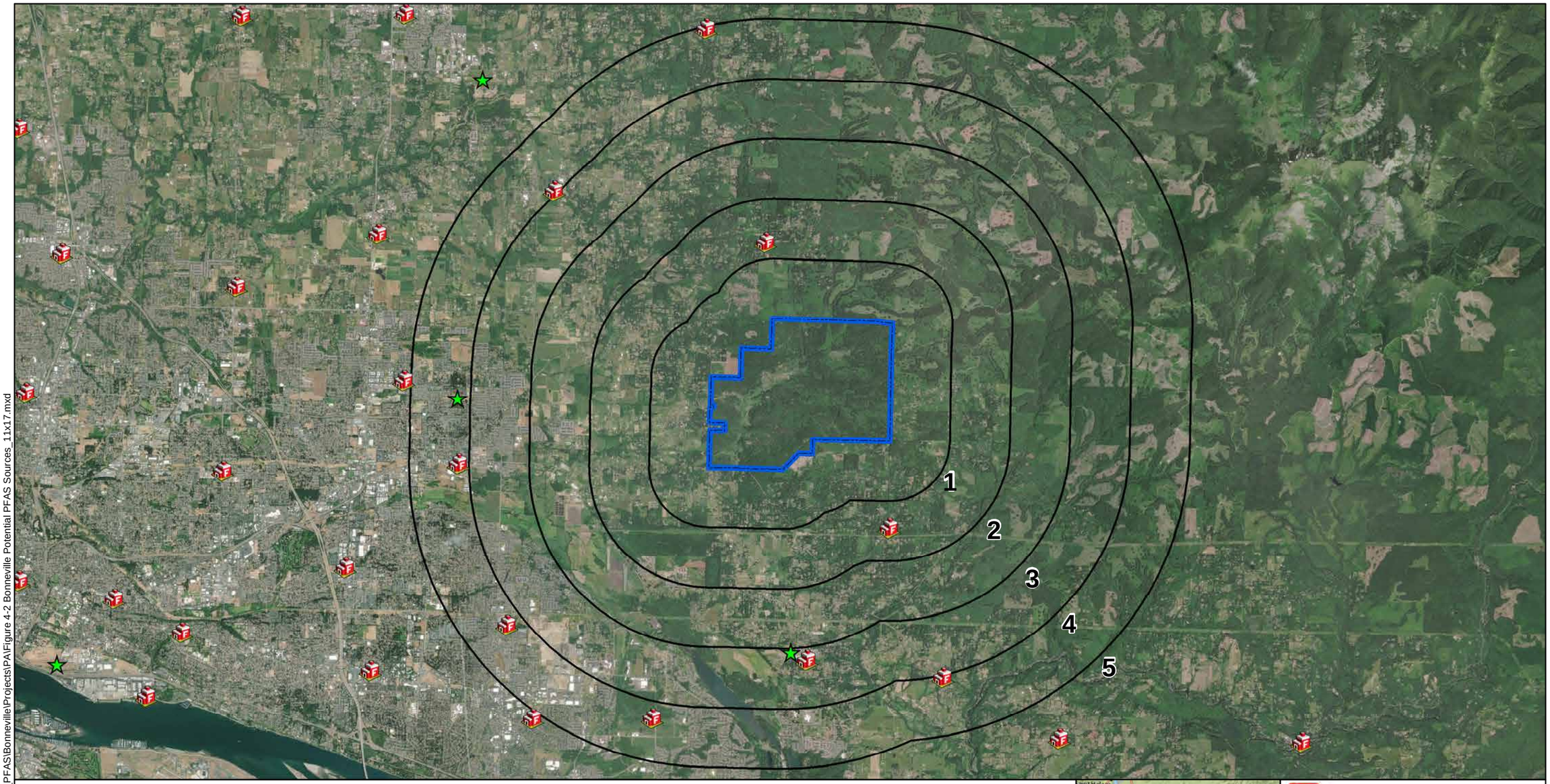
EVALUATED SITES

CAMP BONNEVILLE
VANCOUVER, WASHINGTON

FIGURE: 4-1 | DATE: 11/10/2022

PROJECT: \GIS_DATA\BRAC_PFAS\BonnevilleProjects\PAIFigure 4-1 Evaluated Sites_11x17.mxd



PROJECT: \GIS_DATA\BRAC_PFAS\Bonneville\Projects\PA\Figure 4-2 Bonneville Potential PFAS Sources_11x17.mxd

LEGEND:

- Airport/Helipad
- Fire Station
- Distance Ring
- Installation Boundary

NOTES:

1. Data Sources:
   https://wsdot.wa.gov/data/tools/geoportal/
   https://hub-clarkcountywa.opendata.arcgis.com/
2. Background Source: ESRI World Imagery (Vivid/ Maxar, 4/2020).

0 5,000 10,000 20,000 Feet

N
WA STATE PLANE SOUTH (NAD83)

US Army Corps of Engineers

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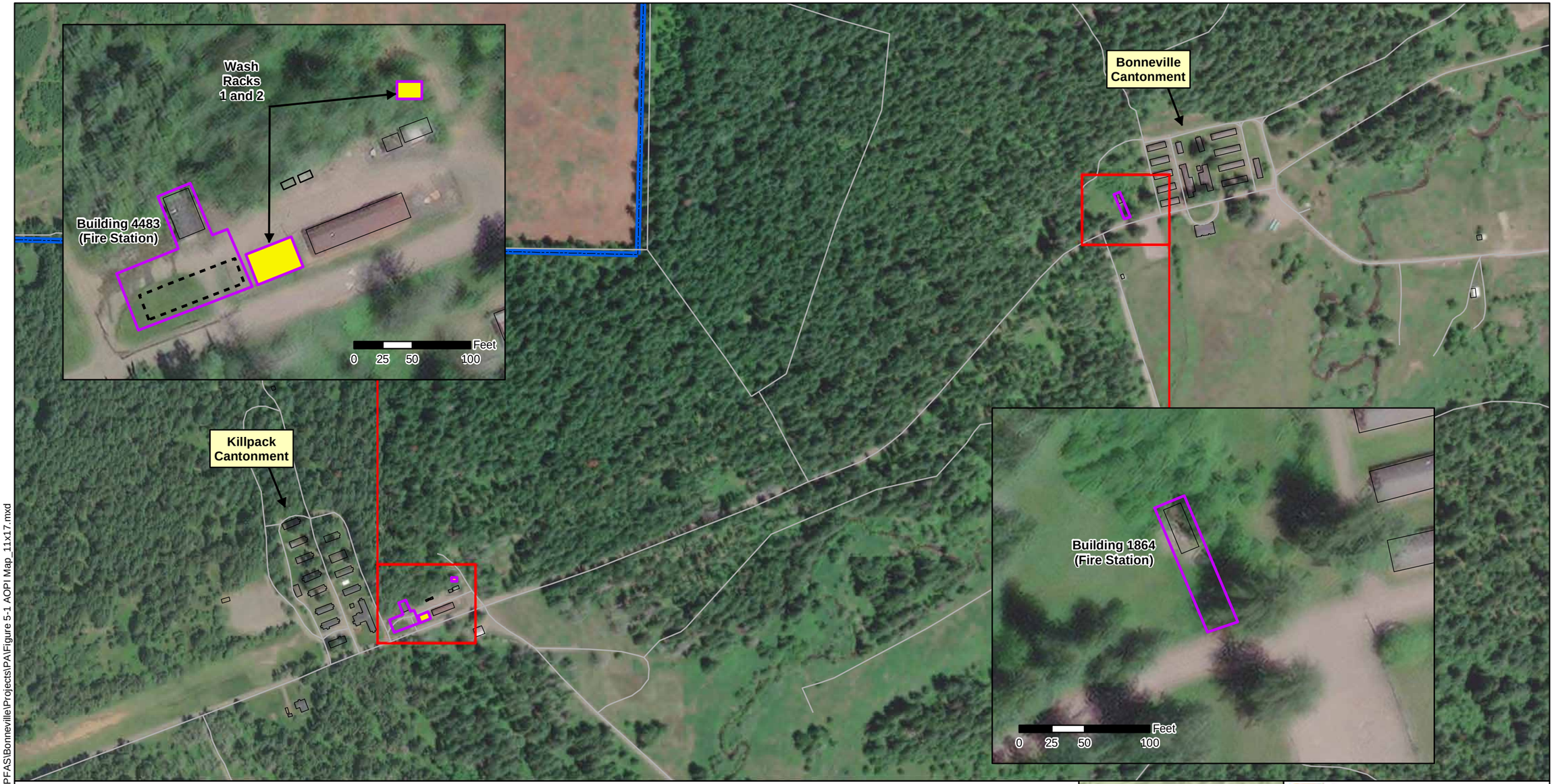
POTENTIAL PFAS SOURCES WITHIN A 5-MILE RADIUS
CAMP BONNEVILLE
VANCOUVER, WASHINGTON

FIGURE: 4-2 | DATE: 10/19/2022



PROJECT: \GIS_DATA\BRAC_PFAS\BonnevillePrjects\PA\Figure 5-1 AOPI Map_11x17.mxd

LEGEND:

- Area of Potential Interest (AOPI)
- Wash Racks 1 and 2
- Current Building
- Former Building
- Installation Boundary
- Road

NOTES:

1. Background Source: ESRI World Imagery (Vivid/Maxar, 4/2020).

0 250 500 1,000 Feet

N
WA STATE PLANE SOUTH (NAD83)

US Army Corps of Engineers.

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AOPI MAP

CAMP BONNEVILLE
VANCOUVER, WASHINGTON

FIGURE: 5-1 | DATE: 11/10/2022