REVISED PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) INVESTIGATION WORK PLAN

NORTH BOEING FIELD/GEORGETOWN STEAM PLANT, SEATTLE, WASHINGTON

Prepared for

The Boeing Company
City of Seattle
King County

Prepared by

Geosyntec Consultants, Inc.

Project Number: WR3529

July 25, 2025

Geosyntec consultants

Revised Per- and Polyfluoroalkyl Substances (PFAS) Investigation Work Plan

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ACRONYMS AND ABBREVIATIONS

AFFF	aqueous film-forming foam
Boeing	Boeing Company, Global Enterprise Sustainability Remediation Group
bgs	below ground surface
City	City of Seattle
County	King County
DPT	direct push technology
Ecology	Washington State Department of Ecology
EHS	Environmental Health and Safety
EIM	Environmental Information Management system
Geosyntec	Geosyntec Consultants, Inc.
GTSP	Georgetown Steam Plant
HDPE	high-density polyethylene
IDW	investigation-derived waste
KCIA	King County International Airport
Landau	Landau Associates
LDPE	low-density polyethylene
LDW	Lower Duwamish Waterway
NBF	North Boeing Field
ng/L	nanogram per liter
PFAS	per- and polyfluoroalkyl substances
PLP	potentially liable persons
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RI	remedial investigation
USEPA	United States Environmental Protection Agency

1. INTRODUCTION

1.1 Overview

This work plan (Work Plan) describes proposed per- and polyfluoroalkyl substances (PFAS) investigation activities at the North Boeing Field (NBF)/Georgetown Steam Plant (GTSP) Site located in Seattle, Washington (Site). The Work Plan was prepared by Geosyntec Consultants, Inc. (Geosyntec) on behalf of The Boeing Company (Boeing), the City of Seattle (City), and King County (County), who are the potentially liable persons (PLPs). This work plan is being developed as a part of a remedial investigation (RI) under Agreed Order No. DE 5685 with the Washington State Department of Ecology (Ecology) for the NBF/GTSP Site.

On September 15, 2022, Ecology sent a letter requesting that Boeing, the City, and the County investigate potential sources, nature, and extent of PFAS at the Site (Ecology 2022). As described in Ecology's letter, aqueous film-forming foam (AFFF) is currently stored at the NBF Site. PFAS are known to be present in AFFF and have been detected in soil and groundwater at military bases, airports, and bulk fuel storage facilities nationwide. In addition, PFAS are used in a variety of other industrial and consumer products and have also been detected at low "background" concentrations in the environment.

As a first step in response to Ecology's letter (Ecology 2022), Landau Associates (Landau) prepared a Site report titled *Historical Records Review for Use, Storage, Spills, and Discharges of PFAS-Containing Materials* (Landau 2025). As described in the report, historical Site records related to the potential storage and use of PFAS-containing materials were reviewed in detail. Areas where PFAS-containing materials were previously or are currently stored at the Site were identified, as well as buildings/areas where historical AFFF spills or discharges occurred to the sanitary sewer or storm drain system (Landau 2025). A draft report was submitted to Ecology on August 30, 2024; a revised report and response to Ecology comments was submitted on February 6, 2025 (Landau 2025).

1.2 Purpose and Objectives

As requested in Ecology's letter, this Work Plan describes proposed sampling activities to evaluate the presence or absence of PFAS in groundwater at the Site. The Work Plan is organized as follows:

- **Section 2** presents background information on Site operations and the environmental setting, as well as areas where AFFF storage and AFFF spills/discharges occurred.
- **Section 3** describes the investigation approach and proposed investigation activities including groundwater monitoring and grab groundwater sampling. Sampling methods, analytical laboratory methods, and quality assurance/quality control (QA/QC) procedures are also described.
- **Section 4** describes the schedule for completing proposed investigation activities and associated reporting.
- **Section 5** provides a list of references cited in this Work Plan.

2. SITE BACKGROUND

2.1 Site Setting

The Site is located approximately 4 miles south of downtown Seattle, Washington on the eastern side of the Lower Duwamish Waterway (LDW; Figure 1). The Site includes a portion of the Boeing-owned or Boeing-leased NBF property located at 7370 East Marginal Way, which is approximately 113 acres. The Site also includes City-owned GTSP property located at 6700 13th Ave South. As shown in Figure 2, these properties are bordered to the southwest by East Marginal Way, to the east by King County International Airport (KCIA), and to the northwest by Ellis Avenue South and property owned by entities other than Boeing or the City (Landau 2025). There are commercial, industrial, and residential areas in the vicinity; however, land use at the properties are zoned as industrial as of 2023 (Seattle Geodata, 2024).

Boeing has operated at NBF since the 1940s. Activities include airplane painting and finishing, aircraft testing, fueling, flight testing, aircraft research and development, and support services. GTSP is a National Historic Landmark. Built in 1906, the 19,400-square foot GTSP building was historically used as a power generation plant, where fuel oil- and coal-fired boilers generated steam and power. The plant was last operable in 1964 and was permanently shut down in 1977 (Landau 2025).

The properties are located on the Duwamish floodplain within the north-south trending Duwamish Valley (Landau 2025). Surface water in the area drains to the nearby LDW, which flows north towards Puget Sound. Although the LDW is located approximately 1,300 feet southwest of the NBF property, Slip 4 is located much closer – approximately 150 feet from the property boundary (Figure 2), and receives the majority of Site stormwater.

The geologic setting consists of a "broad glacial drift plain that is dissected by a network of deep marine embayments and lakes" (Landau 2025). The area is underlain by fill material consisting of sand, silt, and gravel from 3 to 20 feet below ground surface (bgs) (Leidos 2013). This fill unit is underlain by fine to medium sands in river/floodplain deposits from approximately 30 to 60 feet bgs. Groundwater occurs at a depth of approximately 3 to 10 feet bgs and is unconfined within the fill deposit and river/floodplain deposits (Leidos 2013). The direction of localized groundwater flow direction varies seasonally; flow is typically towards the LDW and Slip 4 (Landau 2023).

2.2 Historical Records Review Report

The *Historical Records Review Report* (Landau 2025) provided a summary of each of the buildings/areas where PFAS-containing materials were stored, used, or otherwise discharged on the Site. The report described buildings/areas where AFFF is currently stored, areas where AFFF was formerly stored, and areas with documented historical AFFF spills or discharges. Key findings were as follows (Table 1; Figure 2):

- *Current AFFF storage* – AFFF is currently stored in several buildings in the northern and central areas of the Site, including the Fuel Test Pad Facility and adjacent Building 3-626, Building 3-380, Building 3-369 and the adjacent Building 3-374, and Building 3-390.

- *Former AFFF storage* – Four buildings were identified in the northern and southern areas where AFFF was previously stored, including Former Building 3-321, Building 3-315, Building 3-811, and Building 3-812.
- *AFFF spills/discharges* – Documented AFFF spills and discharges have occurred at multiple buildings/areas. The *Historical Records Review Report* provided additional information on the nature of each documented spill or discharge and whether the spill or discharge was fully contained on-site, directed to the sanitary sewer, or entered the storm drain system, to the extent the information was available (Landau 2025).
    - *Fully contained* – Two documented AFFF spills/discharges were fully contained, as described in the historical records review report (Landau 2025). These occurred at Building 3-380 and Building 3-812.
    - *Sanitary sewer* – Documented AFFF spills/discharges to the sanitary sewer occurred at six locations, including two areas in the northern portion of the Site (Fuel Test Pad Facility and Sweeper Dump), two centrally-located areas (Building 3-380 and Building 3-369) and two southern areas (C10 Wash Stall and Building 3-811/Building 3-812). The majority of these were permitted discharges to the County sanitary sewer that were approved by the County in advance under a King County Department of Natural Resources Industrial Wastewater Discharge Permit (Boeing 2009).
    - *Storm drain* – Documented AFFF spills/discharges to the storm drain occurred at seven locations, including four northern areas (Fuel Test Pad Facility, Former Building 3-321, Building 3-335, and the Former F&G Fuel Slabs), one central area (Building 3-380), and two southern areas (Building 3-811/Building 3-812, and Stall B-14).

Several additional areas with no documented AFFF storage or use were also described in the *Historical Records Review Report*. The Former Boeing Smoke Test Area (Figure 2), also referred to as the GTSP South Yard, was described by Landau (2025) as follows: "Interviews with Boeing Fire Department personnel indicated that the Former Smoke Test Area was used to train firefighters on how to enter an aircraft that had an interior fire and perform rescue operations; typical smoke testing activities would have been conducted using artificial smoke under controlled settings, and likely would not have involved large fires." No documents were found during the historical records review to indicate AFFF usage at this location.

In the southern portion of the GTSP property, significant excavation was completed as part of an interim remedy (Integral 2012). Prior to remedy implementation, older reports indicated that a former drainage ditch was present along southern GTSP fence line (Figure 3). The ditch received runoff from the northern portion of the GTSP property and drained westward; shallow depressions were reportedly present where infiltration likely occurred (Leidos 2013). No documents were identified that indicated AFFF use in this area.

An industrial wastewater pre-treatment system is located in the central area of the Site, on the south side of Building 3-369 (Figure 4). The pre-treatment system provides a batch treatment process for wash waters, including wash waters from paint hangars (Buildings 3-380 and 3-369)

as well as non-hazardous wash water from Plant 2 and some stormwater from the wastewater pre-treatment system's secondary containment area (Landau 2025). Treatment typically consists of metals precipitation, flocculation, organics stripping, phenol reduction, and sand filtering. Effluent from the pre-treatment system is discharged to the King County sanitary sewer. Industrial solids generated during the process are non-hazardous and are shipped off-site for disposal. Nationwide, PFAS have been detected in wastewater effluent and biosolids. However, at the Site, industrial pretreatment occurs within tanks and other unit processes located in a paved area, within secondary containment. No holding ponds are present and no land application of biosolids occurs on the Property. Therefore, there is a low likelihood of potential environmental impacts from industrial pretreatment operations.

3. PROPOSED INVESTIGATION ACTIVITIES

This section provides an overview of the investigation approach and description of planned investigation activities, including general PFAS sampling precautions, groundwater monitoring, grab groundwater sampling, as well as QA/QC sample collection, laboratory analysis, decontamination, and waste management.

3.1 Investigation Approach

Several factors were considered when developing the proposed PFAS investigation approach in accordance with Ecology's 2023 PFAS Guidance (Ecology 2023). The *Historical Records Review Report* did not find documentation of spills or discharges of AFFF or other PFAS-containing products onto soil or non-paved ground surfaces. The majority of the Site is paved, which reduces the likelihood of surface soil impacts. In addition, extensive environmental investigations and remedial actions, including soil excavations, have already been completed in multiple areas, including the Former Smoke Test Facility, drainage ditch area, Former Building 3-321, Former F&G Fuel Slabs, and Building 3-374. Depth to groundwater is shallow, indicating a high likelihood of detecting a historical environmental release to Site soils in groundwater; additionally, a robust network of existing groundwater monitoring wells is present.

To date, no groundwater samples have been collected to assess the presence or absence of PFAS in Site groundwater. Therefore, this Work Plan proposes a phased investigation beginning with the following:

- Gauging a network of up to 25 existing wells to assess depth to groundwater and verify localized groundwater flow direction.
- Collecting groundwater samples from up to 16 existing shallow monitoring wells in the northern (10), central (4), and southern (2) areas of the Site.
- Collecting up to four grab groundwater samples from the northern (1) and southern (3) portions of the Site.

Proposed sampling locations in the northern, central, and southern areas of the Site are shown on Figures 3 through 5, respectively. Shallow existing monitoring wells selected for sampling are located within or downgradient of each of the buildings/areas identified as having or having had AFFF present (Table 1). For each of the monitoring wells planned for sampling, well screen intervals begin at 4.5 to 5 feet bgs and extend to 14.5 to 15 feet bgs. At four buildings/areas (Table 2 and Figures 3 and 5), shallow groundwater monitoring wells are not present downgradient of the building/area. This Work Plan therefore proposes collecting up to four grab groundwater samples (one per area). The proposed boring locations may be adjusted based on the presence of nearby utilities, access issues, or other conditions observed in the field.

As discussed with Ecology and noted above, this PFAS investigation is expected to be a multi-phased process. The need for additional phase(s) of investigation, including sampling of other media (e.g. soil, catch basin solids) will be discussed with Ecology following receipt of the initial phase sampling results. Potential preferential pathways (e.g., storm drain infrastructure) will also be considered if future phase(s) of investigation are needed.

3.2 PFAS Sampling Precautions

Special precautions are needed during PFAS sampling because PFAS are known to be present in a variety of commonly used field equipment, materials, and products. For example, field sampling equipment may have Teflon™ and Viton™ components, which contain PFAS. PFAS may also present in field staff raingear, steel-toed boots, and personal care products. PFAS can be present in or sorb onto low density polyethylene (LDPE) tubing. Because laboratory analytical method detection limits are low (e.g., at nanogram [ng/L] concentrations), field personnel will take additional precautions to reduce the potential for PFAS cross-contamination and false positive results. Recommended materials and equipment for use during PFAS sampling are summarized in guidance published by Ecology (Ecology 2023). Equipment and materials in direct contact with the sample (e.g., tubing, sample containers) will be PFAS-free. Other on-site materials that contain or may contain PFAS will be minimized; any exceptions will be noted in a daily field checklist (Appendix A) and their potential impact on sampling results will be evaluated by collecting and analyzing QA/QC samples (see Section 3.6 and Appendix A).

3.3 Pre-Field Activities

Prior to the start of field activities, Geosyntec will perform the following tasks:

- Select and retain subcontractors for utility clearance, grab groundwater sampling, groundwater monitoring, and laboratory analysis. Geosyntec will work with the drilling subcontractor to prepare and submit a permit application for grab groundwater sampling.
- Prepare a health and safety plan with procedures for hazard identification and mitigation, emergency response protocols, incident reporting, and use of appropriate personal protective equipment. The plan will require that a safety tailgate meeting be conducted each day prior to the start of field activities and will include task hazard assessments of the field activities to be performed to describe safe work practices.
- Coordinate with Boeing, the City, and/or the County regarding access to the proposed sampling locations. Access to collect groundwater samples in the southern area of the NBF property will require additional coordination within Boeing and careful planning due to proximity of at least one sample location (downgradient of Stall B-14) to an active airplane towpath.
- Notify Ecology of the planned work schedule prior to the start of field activities.

Before beginning intrusive investigative activities, grab groundwater boring locations will be marked with white paint and the Washington Utility Notification Center (WA 811) will be contacted at least 48 hours in advance to notify underground utility companies of proposed subsurface activities. A private utility locator will be contracted to perform a geophysical survey of the area near each proposed boring location to identify and mark utilities, pipelines, or other subsurface obstructions that may be present. Additionally, a hand auger will be used to clear the top five feet prior to borehole advancement.

3.4 Grab Groundwater Sampling

At each new groundwater sampling location, a borehole will be hand-augered to a depth of five feet bgs. Additional hand augering or a direct push technology (DPT) drill rig will be used to reach a depth of approximately 8 to 13 feet bgs, at least 3 feet below first encountered groundwater. A no-purge grab sample will be collected using a PFAS-free peristaltic pump with PFAS-free high-density polyethylene (HDPE) tubing. Field parameters (i.e., temperature, pH, electrical conductivity, and turbidity) will be measured.

If sufficient water is not present for sampling after 30 minutes, then a temporary well will be constructed to allow time for groundwater recharge prior to sample collection. Each temporary well will be constructed using Schedule 40 polyvinyl chloride (PVC) casing and at least 3 feet of 1-inch-diameter PVC well screen. Depending on the geology encountered, a filter pack consisting of clean, fine-grade silica sand secured to the PVC screen using an overlay of stainless steel mesh to hold the sand in place may be used to reduce the amount of fine-grained sediment infiltrating into the temporary well. If a temporary well is left in place overnight, a bentonite seal will be placed around the temporary well casing at the ground surface, and a well cap will be installed in the casing. Each temporary well will not be left in the ground for more than 24 hours. Following temporary well installation, depth to groundwater will be measured and low-flow purging and groundwater sampling will occur. After sampling, temporary well casings will be removed and the borings will be sealed by tremie grouting with neat cement or bentonite in accordance with Washington Administrative Code (WAC) 173-160-460.

Samples will be collected into laboratory-supplied sample containers and labeled with a unique sample identifier, sample date and time, and QA/QC sample type, if applicable. Sample container labels will be completed using ball-point pen, since some water-resistant inks may be potential sources of PFAS. Samples will be stored in an ice-cooled chest for transport under chain-of-custody procedures to Ecology-accredited laboratory ALS Environmental – Kelso for analysis of 40 PFAS using United States Environmental Protection Agency (USEPA) Method 1633 (Ecology 2025). PFAS concentrations will be reported down to the laboratory minimum detection limit (Table 1). Ice will be double-bagged in sealed bags (e.g., Ziploc®) to reduce the potential for leakage of melted ice into the cooler.

3.5 Groundwater Monitoring Well Gauging and Sampling

Depth to groundwater will be measured at up to 25 existing monitoring wells; low-flow purging and sampling will be completed at up to 16 existing groundwater monitoring wells, as summarized in Table 2 and on Figures 3 through 5.

The sampling setup will consist of a peristaltic pump with new PFAS-free HDPE and/or silicone tubing, and a flow-through cell and multi-meter for measuring water quality parameters (i.e., dissolved oxygen, pH, oxidation reduction potential, temperature, electrical conductivity, and turbidity). If present, dedicated tubing or other equipment (e.g., bailers, transducers) will be removed from well casing prior to purging and sample collection. Low-flow sampling procedures (i.e., a purge rate ranging from 100 to 500 milliliters per minute) will be conducted. Groundwater parameters will be measured until they stabilize, or the well is pumped dry. Stabilization of water quality indicators is typically defined as follows: pH – three successive readings within ±0.1 pH

unit; specific conductance – three successive readings within ±3%; temperature – three successive readings within 0.5 °C; and turbidity – three successive readings within ±10% or less than 10 Nephelometric Turbidity Units (NTU). Parameter stability is an indication that the well has achieved stable, laminar flow and well water is in equilibrium with the surrounding aquifer.

Groundwater samples will be collected into laboratory-supplied sample containers and labeled with a unique sample identifier, sample date and time, and QA/QC sample type, if applicable. Sample container labels will be completed using ball-point pen, since some water-resistant inks may be potential sources of PFAS. Samples will be stored in an ice-cooled chest for transport under chain-of-custody procedures to an Ecology-accredited laboratory for analysis of 40 PFAS using USEPA Method 1633. Ice will be double-bagged in sealed bags (e.g., Ziploc®) to reduce the potential for leakage of melted ice into the cooler.

3.6 Quality Assurance/Quality Control Samples

For QA/QC purposes, field staff will collect the following samples along with the primary groundwater samples:

- *Field duplicates* – one field duplicate will be collected for every 10 primary samples. Field duplicates will be labeled with a unique sample identifier and not indicated as a duplicate (i.e., submitted as "blind") and duplicate sample identifiers will be noted in field logs.
- *Field blanks* – one field blank will be collected during each day of sampling. Samples will be prepared using laboratory-certified PFAS-free water.
- *Equipment blanks* – one equipment rinsate sample will be collected each day of sampling by rinsing new or decontaminated reusable sampling equipment (e.g., water level meter). Samples will be prepared using laboratory-certified PFAS-free water. Results will be evaluated to assess the adequacy of the decontamination process.

3.7 Decontamination

Non-disposable sampling equipment that is in contact with sampled matrix will be cleaned prior to and between uses at each sampling location, according to the following procedures:

- Clean reusable sampling equipment using a polyethylene or PVC brush and detergent (e.g., Alconox®, Liquinox®, or Citranox®) in a 5-gallon bucket,
- Rinse thoroughly with PFAS-free water (repeat 3x), and
- Dry with paper towels or leave the equipment to air dry in a location away from dust.

Reusable equipment includes the depth to water probe used during groundwater monitoring, and hand auger used for grab groundwater sample collection.

During drilling activities, drillers typically bring multiple DPT rods and thoroughly decontaminate them as a group. As drill rods are pulled up, they will be wiped down with a rag to remove residual soils and set aside for decontamination prior to reuse. Equipment will be fully decontaminated using the above procedures or equivalent (i.e., pressure wash in a lined constructed decontamination area). DPT rods will be cleaned prior to re-use.

3.8 Investigation-Derived Waste Management

Investigation-derived waste (IDW) will primarily consist of washwater from the decontamination process of non-dedicated and non-disposable sampling equipment, purge water from groundwater monitoring wells and temporary well locations, and soil cuttings from temporary well installation. Used disposable sampling equipment, paper towels, and personal protective equipment (e.g., nitrile gloves) will be placed in heavy-duty garbage bags and disposed of as municipal waste. IDW will be managed, characterized, and disposed of consistent with the Site-specific monitoring program procedures. Following receipt of laboratory results and profiling, IDW will be transferred to Site personnel (Boeing Environmental Health and Safety) for management under Site protocols, as described in Section 2.7.2 of the project QAPP associated with the *North Boeing Field/Georgetown Steam Plant Site Remedial Investigation/Feasibility Study* (Leidos 2014).

3.9 Post-Field Activities

Post-field activities include scanning and saving field notes, returning rental equipment, reviewing laboratory logins, and processing subcontractor invoices.

4. SCHEDULE AND REPORTING

4.1 Reporting

Following Work Plan implementation, Geosyntec will prepare and submit a PFAS Investigation Report to document field activities and summarize investigation results. The Investigation Report will include the following:

- A description of pre-field activities and investigation activities, including any deviations from the Work Plan
- QA/QC sample results
- A table comparing Stage 2B validated results for the 10 PFAS with the most recently available Model Toxic Control Act Cleanup Levels and Risk Calculation (CLARC) values will be included in the report (Ecology 2023, 2024). Results for all 40 PFAS included in Method 1633 will be tabulated in an Appendix. Results may also be evaluated in the context of potential human health and ecological exposure and associated screening levels, as well as background concentrations.
- Appendices with field forms, sampling logs, and laboratory reports.

Once complete, an electronic copy of the report will be submitted to Ecology for review. Electronic data deliverables will be uploaded to Ecology's Environmental Information Management (EIM) system.

4.2 Schedule

The proposed schedule for completing the investigative tasks described in this Work Plan is as follows:

- Within 30 days of Work Plan approval, subcontract with a driller for grab groundwater sampling. Coordinate with Boeing, City and/or County to schedule Site access.
- Drilling and sampling will be scheduled following Ecology approval of the Work Plan, confirmation of Site access, and receipt of the boring permit. Field work will ideally coincide with groundwater monitoring to facilitate interpretation of groundwater flow directions. Grab groundwater sampling is expected to be completed within 45 days of confirming Site access and receiving boring permit approval.
- Groundwater monitoring will be scheduled following Ecology approval of the Work Plan and is expected to be completed within 60 days of Work Plan approval.
- Validated analytical results will be summarized in a PFAS Investigation Report and sent to Ecology within 90 days of receiving validated analytical results.

This schedule is subject to change based on Ecology review, subcontractor availability, field conditions, and access constraints. If delays are anticipated due to these constraints, Geosyntec will work with Boeing, City, County, and Ecology to reach a mutually agreed-upon alternative schedule.

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TABLES

Table 1. Minimum Detection and Reporting Limits for ALS Environmental Kelso

Target Analyte[a]	Abbreviation	CASRN	EPA Method 1633 Non-Potable Water	
			RL[1] (ng/L)	MDL[2] (ng/L)
Perfluoroalkyl carboxylic acids				
Perfluorobutanoic acid	PFBA	375-22-4	5.0	0.86
Perfluoropentanoic acid	PFPeA	2706-90-3	5.0	0.64
Perfluorohexanoic acid	PFHxA	307-24-4	5.0	0.63
Perfluoroheptanoic acid	PFHpA	375-85-9	5.0	0.71
Perfluorooctanoic acid	PFOA	335-67-1	5.0	0.87
Perfluorononanoic acid	PFNA	375-95-1	5.0	0.75
Perfluorodecanoic acid	PFDA	335-76-2	5.0	0.60
Perfluoroundecanoic acid	PFUnDA	2058-94-8	5.0	0.82
Perfluorododecanoic acid	PFDoDA	307-55-1	5.0	0.16
Perfluorotridecanoic acid	PFTrDA	72629-94-8	5.0	0.46
Perfluorotetradecanoic acid	PFTeDA	376-06-7	5.0	1.3
Perfluoroalkyl sulfonic acids				
Perfluorobutanesulfonic acid	PFBS	375-73-5	5.0	0.43
Perfluoropentanesulfonic acid	PFPeS	2706-91-4	5.0	0.89
Perfluorohexanesulfonic acid	PFHxS	355-46-4	5.0	0.82
Perfluoroheptanesulfonic acid	PFHpS	375-92-8	5.0	0.69
Perfluorooctanesulfonic acid	PFOS	1763-23-1	5.0	0.83
Perfluorononanesulfonic acid	PFNS	68259-12-1	5.0	0.33
Perfluorodecanesulfonic acid	PFDS	335-77-3	5.0	0.67
Perfluorododecanesulfonic acid	PFDoS	79780-39-5	5.0	0.56
Fluorotelomer sulfonic acids				
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4	5.0	0.42
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2	5.0	1.3
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4	5.0	0.86
Perfluorooctane sulfonamides				
Perfluorooctanesulfonamide	FOSA	754-91-6	5.0	0.72
N-ethylperfluorooctanesulfonamide	EtFOSA	4151-50-2	5.0	0.85
N-methylperfluorooctanesulfonamide	MeFOSA	31506-32-8	5.0	1.2
Perfluorooctane sulfonamidoacetic acids				
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6	5.0	0.95
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9	5.0	0.91

Target Analyte[a]	Abbreviation	CASRN	EPA Method 1633 Non-Potable Water	
			RL[1] (ng/L)	MDL[2] (ng/L)
Perfluorooctane sulfonamide ethanols				
N-ethyl perfluorooctanesulfonamidoethanol	N-EtFOSE	1691-99-2	5.0	0.92
N-methyl perfluorooctanesulfonamidoethanol	N-MeFOSE	24448-09-7	5.0	0.82
Per- and Polyfluoroether carboxylic acids				
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6	5.0	0.41
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	5.0	0.36
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	5.0	0.41
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	5.0	0.54
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	5.0	0.58
Ether sulfonic acids				
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1	5.0	0.45
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9	5.0	0.39
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	5.0	0.43
Fluorotelomer carboxylic acids				
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5	200	6.80
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3	200	4.20
3-Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4	200	6.00

[1]Reporting Limit
[2]Method Detection Limit

Table 2. Buildings/Areas and Proposed PFAS Sampling Locations

Site Area	Building/Area	Proposed PFAS Sampling Locations	Screen Interval (ft bgs)
Northern	Fuel Test Pad Facility	NGW513 NGW514 NGW515	5-14.9 5-14.9 5-14.9
	Building 3-626	Grab groundwater or temporary well 1	5-8
	Former Building 3-321 Building 3-335 Former F&G Fuel Slabs	NGW604 NGW519	4.7-14.7 5-14.9
	Building 3-315	NGW611	4.7-14.7
	Sweeper Dump		
	Former Boeing Smoke Test Area	GTSP-1 GTSP-2 NGW505	5.0-15.0 4.5-14.5 5-14.9
	Former drainage ditch	NGW521	5-15
Central	Building 3-380 Building 3-369/Building 3-374 Building 3-390 Wastewater treatment plant	NGW621 NGW251 NGW609	4.7-14.7 5-20 4.7-14.7
	Concourse C Decomissioned Utility Lines	NGW357	5-15
Southern	Stall C-10	Grab groundwater or temporary well 2	5-8
	Building 3-811	Grab groundwater or temporary well 3	5-8
	Building 3-812	Grab groundwater or temporary well 4	5-8
	Former Stall B-14/B-12	NGW620 NGW625	5-15 5-15

FIGURES

Site Location Map

North Boeing Field/Georgetown Steam Plant
Seattle, Washington

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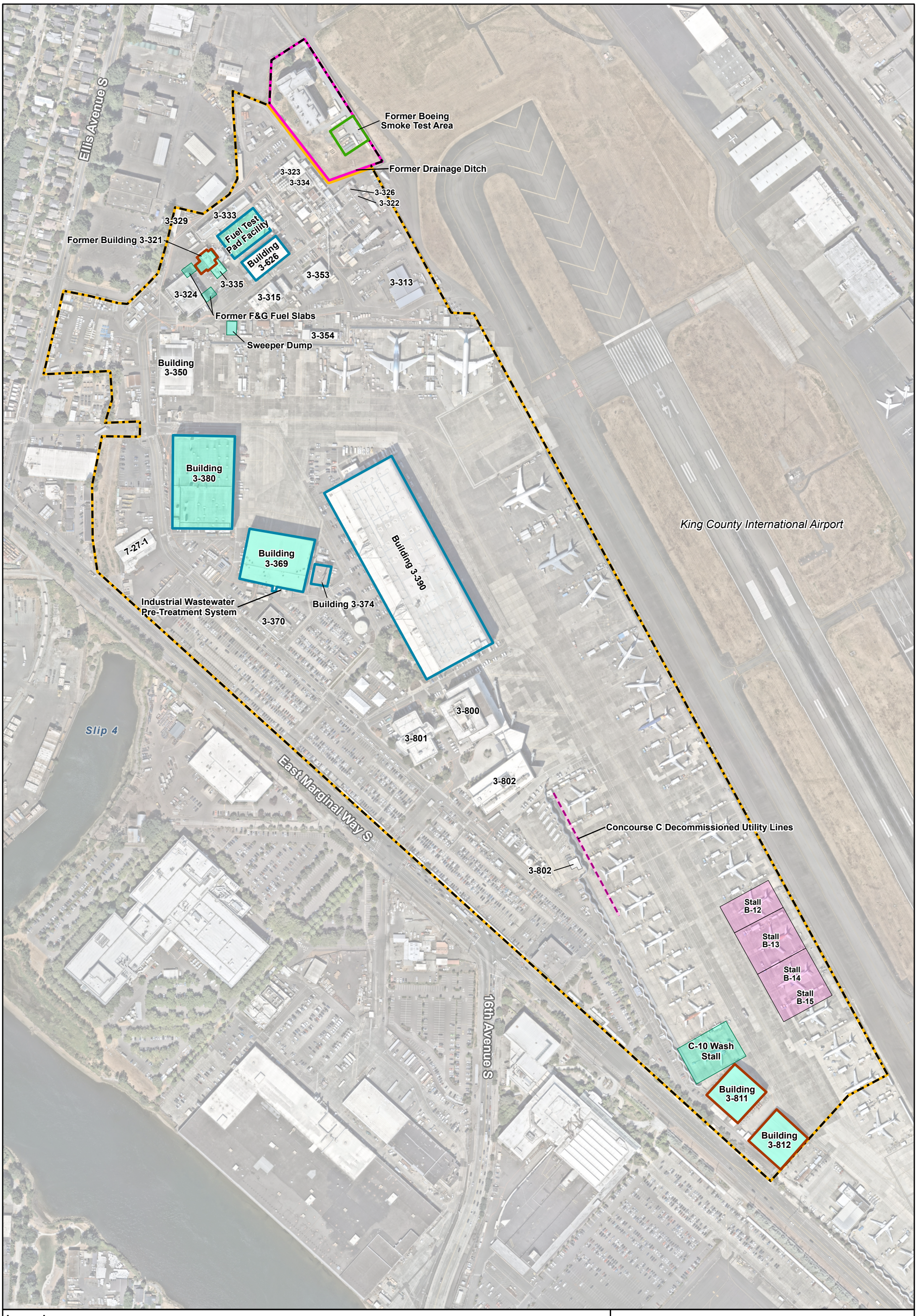
WR3529	July 2025

Figure 1

P:\GIS\Boeing\NorthBoeingField\Project\2024-12_SAP\Figures.aprx\Fig01_SiteLocationMap 1/24/2025 10:26 AM (KWalton)



Legend

- Area with AFFF Spills/Discharges[1]
- Building/Area with Existing AFFF Storage/System[1]
- Building/Area with Former/Historic AFFF Storage/System/Use[1]
- Former Boeing Smoke Test Area[1]
- Former Stall Configuration (1994)
- Concourse C Decommissioned Utility Lines
- North Boeing Field Property[1]
- Georgetown Steam Plant Property[1]
- Site Boundary

Notes:

[1] Landau 2025. Historical Records Review for Use, Sources, Spills, and Discharges of PFAS-containing materials, NBF/GSTP.

- Aerial imagery source: Nearmap, August 2024.

N

0 330 Feet

Site Layout and AFFF Storage, Spills, and Discharge Areas

North Boeing Field/Georgetown Steam Plant
Seattle, Washington

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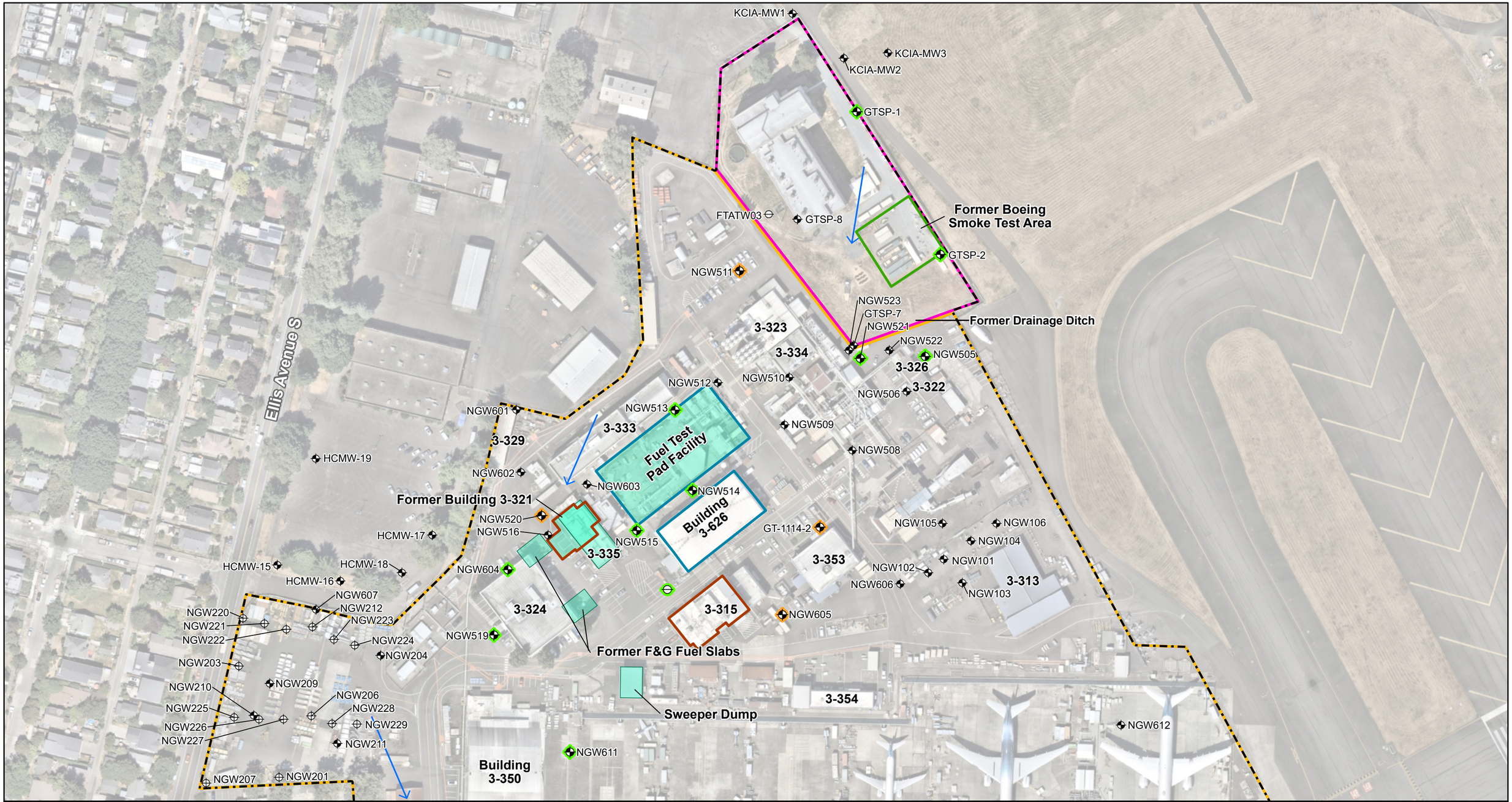
Figure 2

\\oakland-01\data\GIS\Boeing\NorthBoeingField\Project\2025-07_SAPrev\Figures.aprx\Fig02_SiteLayout 7/22/2025 2:18 PM (kwalton)



Legend

- Groundwater Gauging Location (Existing Well)
- Groundwater Gauging and PFAS Sampling Location (Existing Well)
- Groundwater PFAS Sampling Location (Proposed Temporary Well)
- Monitoring Well
- Injection Well
- Grab Groundwater or Temporary Well
- Approximate Groundwater Flow Direction[1]
- Area with AFFF Spills/Discharges[2]
- Building/Area with Existing AFFF Storage/System[2]
- Building/Area with Former/Historic AFFF Storage/System/Use[2]
- Former Boeing Smoke Test Area[2]
- North Boeing Field Property[2]
- Georgetown Steam Plant Property[2]
- Site Boundary

Notes:

[1] Landau. 2023. Draft Remedial Investigation Report, North Boeing Field/Georgetown Steam Plant, Seattle Washington. September 29.

[2] Landau 2025. Historical Records Review for Use, Sources, Spills, and Discharges of PFAS-containing materials, NBF/GSTP.

- Aerial imagery source: Nearmap, August 2024.

N

0 150 Feet

Proposed Sampling Locations, Northern Area

North Boeing Field/Georgetown Steam Plant
Seattle, Washington

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Figure 3

P:\GIS\Boeing\NorthBoeingField\Project\2024-12_SAP\Figures.aprx\Fig03_Sampling_North 1/24/2025 10:26 AM (KWalton)

Legend

- Groundwater Gauging Location (Existing Well)
- Groundwater Gauging and PFAS Sampling Location (Existing Well)
- Monitoring Well
- Injection Well
- Approximate Groundwater Flow Direction[1]
- Approximate Location of Concourse C Decommissioned Utility Lines in Seacor 1991/1992 Reports (Exent Unknown)
- Area with AFFF Spills/Discharges[2]
- Building/Area with Existing AFFF Storage/System[2]
- North Boeing Field Property[2]
- Site Boundary

Notes:

[1] Landau. 2023. Draft Remedial Investigation Report, North Boeing Field/Georgetown Steam Plant, Seattle Washington. September 29.

[2] Landau 2025. Historical Records Review for Use, Sources, Spills, and Discharges of PFAS-containing materials, NBF/GSTP.

- Aerial imagery source: Nearmap, August 2024.

N

0 230 Feet

Proposed Sampling Locations, Central Area

North Boeing Field/Georgetown Steam Plant
Seattle, Washington

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Figure 4

\\oakland-01\data\GIS\Boeing\NorthBoeingField\Project\2025-06\Figures.aprx\Fig04_Sampling_Central 7/22/2025 10:29 AM (kwalton)

Legend

- Groundwater Gauging and PFAS Sampling Location (Existing Well)
- Groundwater PFAS Sampling Location (Proposed Temporary Well)
- Monitoring Well
- Injection Well
- Area with AFFF Spills/Discharges[1]
- Building/Area with Former/Historic AFFF Storage/System/Use[1]
- Former Stall Configuration (1994)
- North Boeing Field Property[1]
- Site Boundary

Notes:
[1] Landau 2025. Historical Records Review for Use, Sources, Spills, and Discharges of PFAS-containing materials, NBF/GSTP.
- Aerial imagery source: Nearmap, August 2024.

N

0 150 Feet

Proposed Sampling Locations, Southern Area

North Boeing Field/Georgetown Steam Plant
Seattle, Washington

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Figure 5

\\oakland-01\data\GIS\Boeing\NorthBoeingField\Project\2025-07_SAPrev\Figures.aprx\Fig05_Sampling_South 7/22/2025 10:27 AM (kwalton)

APPENDIX A
Quality Assurance Project Plan Addendum 7: PFAS Sampling and Analysis

REVISED QUALITY ASSURANCE PROJECT PLAN ADDENDUM 7: PFAS SAMPLING AND ANALYSIS

NORTH BOEING FIELD/GEORGETOWN STEAM PLANT, SEATTLE, WASHINGTON

Prepared for

The Boeing Company
City of Seattle
King County

Prepared by

Geosyntec Consultants, Inc.

Project Number: WR3529

May 09, 2025

Revised Quality Assurance Project Plan Addendum 7: PFAS Sampling and Analysis

North Boeing Field/Georgetown Steam Plant Seattle, Washington

Prepared for

The Boeing Company
The City of Seattle
King County

Thomas Wanzek, PhD
Scientist

Elisabeth L. Hawley, PE (CA)
Principal

Project Number: WR3529

May 09, 2025

Geosyntec consultants

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
CA SWRQB	California State Water Resources Control Board
CAS	Chemical Abstract Service
CCV	continuing calibration verification
CoC	chain of custody
DoD	United States Department of Defense
DOT	United States Department of Transportation
DPT	direct push technology
Ecology	Washington Department of Ecology
EDD	electronic data deliverable
EIM	Environmental Information Management system
EGLE	Michigan Department of Environment, Great Lakes, and Energy
Geosyntec	Geosyntec Consultants, Inc.
HDPE	high-density polyethylene
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IDW	investigation-derived waste
LCS	laboratory control sample
LLCS	low level laboratory control sample
LDPE	low-density polyethylene
MDL	method detection limit
mL	milliliters
MS/MSD	matrix spike/matrix spike duplicate
9Cl-PF3ONS	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid
11Cl-PF3OUdS	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
NEtFOSE	N-ethyl perfluorooctanesulfonamidoethanol
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
NMeFOSE	N-methyl perfluorooctanesulfonamidoethanol
ng/L	nanograms per liter

PFAS	per- and polyfluoroalkyl substances
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPP	quality assurance project plan
QSM	Quality Systems Manual
RI/FS	remedial investigation/feasibility study
RL	reporting limit
RPD	relative percent difference
SPE	solid phase extraction
SOP	standard operating procedure
USEPA	United States Environmental Protection Agency
UV	ultraviolet

1. INTRODUCTION

1.1 Objectives

This Quality Assurance Program Plan (QAPP) presents Addendum No. 7 to the North Boeing Field/Georgetown Steam Plant Site (Site) Remedial Investigation/Feasibility Study (RI/FS) Sampling and Analysis Plan and QAPP (Leidos 2014). This addendum provides additional information to guide the sampling and analysis of per- and polyfluoroalkyl substances (PFAS) under Agreed Order No. DE 5685 with the Washington State Department of Ecology (Ecology) for the Site in response to a letter from Ecology on September 15, 2022 (Ecology 2022).

This PFAS QAPP Addendum documents sampling procedures, analytical procedures, and the quality assurance/quality control (QA/QC) criteria that will be adhered to during groundwater PFAS investigations at the Site. Groundwater samples will be collected in accordance with PFAS sampling Standard Operating Procedures developed following the *Guidance for Investigating and Remediating PFAS Contamination in Washington State* (Ecology PFAS Guidance; Ecology 2023) referencing the Michigan Department of Environment, Great Lakes, and Energy (EGLE) *General PFAS Sampling Guidance* (MI-EGLE 2024; Michigan PFAS Sampling Guidance) and California State Water Resources Control Board (CA SWRQB) *Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines* (CA SWRQB 2020). Groundwater samples will be analyzed by a laboratory accredited by Ecology in Washington State using United States Environmental Protection Agency (USEPA) Method 1633 for 40 PFAS compounds. Stage 2B data validation will be performed in accordance with United States Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for PFAS Analysis by Quality Systems Manual (QSM) Table B-24 (DoD 2022).

1.2 Report Organization

Information in the QAPP is organized as follows:

- **Section 2 – Laboratory selection and analytical methods**: This section describes information relevant to the selection and contracting process with a commercial analytical laboratory, an overview of laboratory accreditations, PFAS analytical methods, sample containers, sample volumes, provision of laboratory-certified PFAS-free water, and other topics related to laboratory coordination prior to field sampling events.
- **Section 3 – Field sampling procedures**: General procedures for gauging groundwater elevation and collecting groundwater samples are provided. Details regarding Site access and groundwater sample collection will be provided in a separate Work Plan. This section describes field documentation, chain of custody (CoC) preparation, and sample packaging and shipping instructions. This section also provides an overview of the sampling precautions and decontamination procedures for equipment to avoid cross-contamination or biased results for PFAS. PFAS-free sampling equipment and appurtenances will be utilized to the extent practicable.

- **Section 4 – QA/QC procedures**: This section describes collection of QA/QC samples to incorporate into the evaluation of sample results. QA/QC procedures and samples described in this section include field QA/QC samples, laboratory procedures, sample holding times, as well as data validation to obtain and report valid and representative data.
- **Section 5 – References**: A list of references cited is provided in this section.

2. LABORATORY SELECTION AND ANALYTICAL METHODS

The project team will select an Ecology-accredited laboratory to conduct the sample analysis. This section provides information on the specified PFAS analytical method, laboratory accreditations, reporting limits (RLs), sample containers, preservatives, holding times, storage conditions, and other information to supplement Site-specific work plans.

2.1 Laboratory Analytical Method and Accreditations

Geosyntec will contract with an Ecology-approved laboratory that is accredited by DoD Environmental Laboratory Accreditation Program using PFAS method that is consistent with Table B-24 of QSM version 5.4 or later (Ecology 2023). Samples will be submitted for laboratory analysis of 40 PFAS compounds included in USEPA Method 1633 Revision A and summarized in Table 1.

2.2 Parameters and Reporting Limits

Typical PFAS RLs for groundwater are summarized in Table 1 below. A commercial analytical Ecology-accredited laboratory will be selected that can generally provide RLs equal to or below these RLs. PFAS are typically reported to method detection limits (MDLs). MDLs vary based on compound and can vary from one laboratory to another and from one year to another; MDLs for PFAS are typically between 0.16 and 6.8 nanograms per liter (ng/L). Ecology guidance will be considered when evaluating PFAS sample results. For example, Model Toxic Control Act Cleanup Levels and Risk Calculation (CLARC) values have been published for 10 PFAS in groundwater (Ecology 2024) and will be considered when evaluating the groundwater analytical results.

Table 1. Typical Reporting Limits for PFAS in Groundwater Samples

PFAS Chemical Name	Abbreviation	CAS No.[1]	Reporting Limit (ng/L)
Perfluorobutanoic acid[2]	PFBA	375-22-4	5
Perfluoropentanoic acid	PFPeA	2706-90-3	5
Perfluorohexanoic acid[2]	PFHxA	307-24-4	5
Perfluoroheptanoic acid	PFHpA	375-85-9	5
Perfluorooctanoic acid[2]	PFOA	335-67-1	5
Perfluorononanoic acid[2]	PFNA	375-95-1	5
Perfluorodecanoic acid[2]	PFDA	335-76-2	5
Perfluoroundecanoic acid	PFUnDA	2058-94-8	5
Perfluorododecanoic acid	PFDoDA	307-55-1	5
Perfluorotridecanoic acid	PFTrDA	72629-94-8	5
Perfluorotetradecanoic acid	PFTeDA	376-06-7	5
Perfluorobutanesulfonic acid[2]	PFBS	375-73-5	5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4	5
Perfluorohexanesulfonic acid[2]	PFHxS	355-46-4	5
Perfluoroheptanesulfonic acid	PFHpS	375-92-8	5
Perfluorooctanesulfonic acid[2]	PFOS	1763-23-1	5

PFAS Chemical Name	Abbreviation	CAS No.[1]	Reporting Limit (ng/L)
Perfluorononanesulfonic acid	PFNS	68259-12-1	5
Perfluorodecanesulfonic acid	PFDS	335-77-3	5
Perfluorododecanesulfonic acid	PFDoS	79780-39-5	5
4:2 Fluorotelomer sulfonic acid	4:2 FTS	757124-72-4	5
6:2 Fluorotelomer sulfonic acid[2]	6:2 FTS	27619-97-2	5
8:2 Fluorotelomer sulfonic acid	8:2 FTS	39108-34-4	5
Perfluorooctanesulfonamide	FOSA	754-91-6	5
N-ethylperfluorooctanesulfonamide	EtFOSA	4151-50-2	5
N-methylperfluorooctanesulfonamide	MeFOSA	31506-32-8	5
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6	5
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9	5
N-Methyl perfluorooctane sulfonamide ethanol	NMeFOSE	24448-09-7	10
N-ethyl perfluorooctanesulfonamidoethanol	N-EtFOSE	1691-99-2	10
Hexafluoropropylene oxide dimer acid[2]	HFPO-DA	13252-13-6	5
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	5
Perfluoro-3-methoxyproanoic acid	PFMPA	377-73-1	5
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	5
Nonafluoro-3,3-dioxaheptonic acid	NFDHA	151772-58-6	5
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1	5
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9	5
Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7	5
2H,2H,3H,3H-Perfluorihexanoic acid	3:3FTCA	356-02-5	200
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3	200
2H,2H,3H,3H-Perfluorodecanoic acid	7:3FTCA	812-70-4	200

Notes:
[1] CAS – chemical abstract service
[2] PFAS with published Model Toxic Control Act CLARC values (Ecology 2024)

2.3 Sample Containers, Preservation, Holding Times, and Storage

Information on PFAS sample bottle requirements, preservative, storage conditions, and holding times typical to PFAS groundwater analyses are as follows:

- Depending on laboratory requirements and standard operating procedures, at least one 500-milliliter (mL) high-density polyethylene (HDPE) bottle (or two 250-mL bottles) will be used to collect each sample.
- A nominal sample size of 500-mL volume with <50 milligrams of solids is required for the laboratory to extract and analyze the sample.

- No preservative will be added to each sample bottle, since the groundwater that will be sampled is not chlorinated.
- The laboratory will be required to ensure that the sample bottles provided to clients are verified as clean (i.e., meet the acceptance criteria required for blank analysis).
- Samples will be stored at less than 6 degrees Celsius (°C).
- Per USEPA Method 1633 Revision A, holding times for aqueous samples are 28 days from collection to extraction and 90 days from extraction to analysis when stored at 0 to 6 ºC, with the exceptions of N-methyl perfluorooctanesulfonamidoethanol N-ethyl perfluorooctanesulfonamidoethanol (NMeFOSE), (NEtFOSE), N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA), N-methyl perfluorooctane sulfonamidoacetic (NEtFOSAA), (9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS), and 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS). The holding time for NMeFOSE, NEtFOSE, NMeFOSAA, and NEtFOSAA in aqueous samples is 7 days from collection to extraction when stored at 0 to 6 ºC. The holding time for 9Cl-PF3ONS and 11Cl-PF3OUdS is 28 days from extraction to analysis when stored less than 6°C. When stored at -20 ºC and protected from light, samples may be stored for up to 90 days from collection to extraction and 90 days from extraction to analysis (USEPA 2024).

The laboratory will provide deionized water that has been tested and confirmed to be PFAS-free for use as field blanks, equipment blanks, and decontamination. The number and type of QA/QC samples will be finalized with the laboratory during the sample planning phase. The recommended number and type of QA/QC samples are described in Section 4.

2.4 Sample Turnaround Time and Report Format

The selected analytical laboratory will be requested to deliver analytical results following standard turn-around-time. The selected laboratory will provide an electronic data deliverable (EDD) in a format that can be uploaded to Ecology's Environmental Information Management (EIM) system. Level II or Level IV reports will be provided by the laboratory as necessary to complete a Stage 2B data validation (Section 4.3).

3. FIELD SAMPLING ACTIVITIES

3.1 PFAS Sampling Precautions

PFAS are potentially present in a variety of equipment, products, and materials that are commonly used in the field during groundwater sampling. In addition, laboratory analytical RLs are very low (low ng/L concentrations). Therefore, conservative precautions will be taken to avoid sample cross-contamination and false positive results. The following precautions are consistent with Ecology's published PFAS Sampling Guidance, which references guidance published by the states of California and Michigan and information included in Sections 11.1.1 through 11.1.7 of the Interstate Technology and Regulatory Council PFAS Guidance (Ecology 2023; Table 2).

Table 2. Items that Are Acceptable and Items to be Avoided during PFAS Sampling

Items to be Avoided	Acceptable Items
Clothing and Personnel Care Products (CA SWRQB 2020, MI-EGLE 2024)	
• New unwashed clothing • Clothing recently washed with fabric softener	• Well-laundered clothing with most recent washing not using fabric softener
• Clothing treated to be water-, stain- or dirt-resistant (including but not limited to Gore-Tex™, Scotchguard™, RUCO®) • Clothing chemically treated to provide insect resistance or ultraviolet (UV) protection	• Waterproof clothing made of polyurethane, polyvinyl chloride (PVC), wax-coated fabrics, rubber, or neoprene
• Coated Tyvek®	• Plain/non-coated Tyvek®
• Latex gloves	• Powderless nitrile gloves
• UV-resistant or insect-resistant clothing • Use of cosmetics, moisturizers, hand creams and other products after previous shower (e.g., day of or night before field sampling)	• See list of allowable sunscreen and insect repellants in California PFAS sampling guidelines[1]
• Boots containing Gore-Tex™ or other fluoropolymers	• Boots made with polyurethane or PVC OR covered with PFAS-free overboots[2]
Food and Drink (CA SWRQB 2020, MI-EGLE 2024)	
• Packaged food or snack items (e.g., paper plates, foil, bags, and wrappers) in the sampling area or in the staging area while sampling	• Food and drink outside of the sampling area, in designated area • Hand washing and new gloves upon re-entering the sampling area
Sample Containers and Other Materials in Direct Contact with Sample (CA SWRQB 2020, MI-EGLE 2024)	
• Glass sample containers, due to PFAS adherence to glass surfaces • Teflon® liners, caps, or sample container lids • Low density polyethylene (LDPE) sample containers or liners, due to sorption of PFAS to LDPE materials	• PFAS-free HDPE or polypropylene containers with screw caps that do not contain Teflon® or other fluoropolymers
Field Equipment and Materials (CA SWRQB 2020)	
• Materials or equipment components containing fluoropolymers. Trademark examples include Teflon®, Hostaflon®, Kynar®, Neoflon®, Tefzel®, and Viton™. Fluorinated ethylene propylene, ethylene tetrafluoroethylene,	• Equipment with these components can be used if the PFAS is internal to the equipment and does not contact the external environment

Items to be Avoided	Acceptable Items
polytetrafluoroethylene, polyvinylidene fluoride and polychlorotrifluoroethylene are other examples	• If in doubt about a product, collect and analyze an equipment blank sample • LDPE[1] not in direct contact with the sample (e.g., Ziploc® bags)
• In the sampling area, avoid using waterproof paper, field books, and forms; plastic clipboards, Post-it Notes® • Regular/thick-size Sharpie® or other felt-tip markers, felt pens and pens with water-resistant ink	• Ball-point pens • Pre-printed labels from the laboratory • Fine and Ultra-Fine point Sharpie® markers and Rite-in-the-rain® notebooks in staging area only
• Decon 90®	• Alconox®, Liquinox®, or Citranox®
• Chemical (blue) ice packs	• Regular (wet) ice that is double-bagged and kept in the staging area and does not contact sample media
Field Equipment and Materials (Based on Geosyntec's Experience)	
• Materials and equipment that are known to contain fluorinated or PFAS components (e.g., Teflon®)	Dedicated or decontaminated equipment including the following: • Submersible pumps, bladder pumps, peristaltic pumps, and inertia pumps that do not have Teflon® components • Silicon and/or HDPE tubing • HDPE Hydrasleeve samplers, Nylon string, and stainless-steel weights • Water quality field meters • Water level probes • Stainless steel bailers without polytetrafluorethylene components (e.g., ball valves), bacon bomb samplers • Telescoping pole
• Binders, or spiral hard cover notebooks • Aluminum foil in direct contact with samples	• Standard/loose plain paper and sample container labels • Boring log sampling forms • CoC record • Masonite or aluminum clipboards
• Products containing LDPE in direct contact with samples	• Thin HDPE sheeting, HDPE trash bags • Paper towels • Hard shell coolers • Bubble wrap • Duct tape and packing tape

Notes:

[1] Per California State Water Resources Control Board (2020) guidance, sunscreen or insect-repellant will not be applied in the exclusion zone. Allowable insect repellents include OFF Deep Woods, Sawyer Permethrin, Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, and California Baby Natural Bug Spray. Allowable sunscreens include Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30, Meijer Sunscreen Lotion Broad Spectrum SPF 30, Neutrogena Ultra-Sheer Dry-

[1] LDPE plastics are commonly identified by a recycling symbol with a number 4 inside it.

Touch Sunscreen Broad Spectrum SPF 30, Banana Boat for Men Triple Defense Continuous Spray Sunscreen SPF 30, Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30, Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30, Banana Boat Sport Performance Sunscreen Stick SPF 50, Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50, Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30, Coppertone Sunscreen Stick Kids SPF 55, L'Oréal Silky Sheer Face Lotion 50+, Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50, Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70, Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70, Neutrogena Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30, and Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+.

[2] Per California State Water Resources Control Board (2020) guidance, if the Health and Safety Plan requires a specific type of boot (such as steel-toed), and PFAS-free boots cannot be purchased, PFAS-free over-boots may be worn. Over-boots must be put on in the staging area, and hands washed after donning the over-boots before the beginning of sampling activities. Over-boots may only be removed in the staging area after the sampling activities are complete.

The items described in Table 2 will be used or not used to avoid inadvertent sample contamination in the field. Equipment usage will be discussed with the field crew prior to the start of the field sampling. The field crew will review a daily checklist each day before the start of sampling and will complete the checklist to document sampling materials, equipment, and field conditions (Attachment 1).

Field personnel will always wear disposable nitrile gloves during sample collection and handling. Staff will don a new pair of nitrile gloves prior to conducting the following activities:

- Collecting a sample;
- Change in sampling location;
- Handling sampling equipment, including but not limited to; sample bottles, cooler ice, or PFAS-free water; and
- Handling QA/QC samples, including field blanks and equipment blanks.

Staff will wash hands thoroughly and don a new pair of nitrile gloves:

- After contact with a material potentially containing PFAS; and
- Prior to entry into the project Site sampling area.

3.2 Groundwater Monitoring Well Gauging and Sampling

Prior to the sampling event, field staff will review information from previous groundwater monitoring events to inform their knowledge of monitoring well locations, field equipment, and field conditions. Upgradient wells will typically be monitored first. At the beginning of each sampling day, field staff will inspect field equipment to check that it is in good working order. Analytical field meters will be calibrated according to instrument manufacturer specifications, and calibration results will be recorded in field notes. Field meters will be decontaminated between sample locations following the procedures outlined in Section 3.4. Dedicated PFAS-free silicone,

vinyl, or HDPE tubing will be used for the PFAS sampling event. During PFAS sampling events, tubing will not be decontaminated or reused from one location to another.

3.2.1 Removal of Dedicated Equipment in Existing Wells

If dedicated pumps, tubing, or bailers are identified during a site visit, the sampling appurtenances will be removed from the well, placed in wrap or bags, and stored in a clean and secure location determined by the Site operator at least two weeks prior to sampling, per Ecology's recommendation. The materials will be inspected, and any materials that may contain PFAS in contact with the water column will be noted in the field records. Equipment may be placed back to the well following completion of PFAS sampling if requested by the Site operator.

3.2.2 Groundwater Elevation Monitoring

The following method will be used to measure groundwater elevations:

1. Remove well caps and allow wells to sufficiently vent any accumulated pressure and water levels to equilibrate.
2. Use a water level meter with 0.01-foot increments to measure and record the static groundwater level using a thoroughly decontaminated (see Section 3.4 for decontamination methodology) groundwater elevation probe relative to a permanently marked survey point located at the top of the well casing.
3. Record the measurement in the field notes.
4. Decontaminate the water level meter and any other non-dedicated equipment prior to proceeding to the next groundwater monitoring well location. Decontamination procedures are described in Section 3.4.

3.2.3 Grab Groundwater Sampling

At each grab groundwater sampling location, a borehole will be advanced to a depth of five feet below ground surface using a hand auger. Additional hand augering or a direct push technology drill rig will be used to reach the desired depth specified in the Work Plan. A no-purge grab sample can be collected using a PFAS-free peristaltic pump with HDPE tubing. Field parameters (i.e., temperature, pH, electrical conductivity, and turbidity) will be measured.

3.2.4 Temporary Wells

Temporary wells, if needed due to low recharge conditions, will be constructed using Schedule 40 PVC casing and at least 3 feet of 1-inch-diameter PVC well screen. Depending on the geology encountered, a filter pack consisting of clean, fine-grade silica sand secured to the PVC screen using an overlay of stainless steel mesh to hold the sand in place may be used to reduce the amount of fine-grained sediment infiltrating into the temporary well. If a temporary well is left in place overnight, a bentonite seal will be placed around the temporary well casing at the ground surface, and a well cap will be installed in the casing. Each temporary well will typically not be left in the ground for more than 24 hours. Following temporary well installation, depth to groundwater will be measured and low-flow purging and groundwater sampling will occur. Samples will be

collected using a peristaltic pump with HDPE tubing. After sampling, temporary well casings will be removed and the borings will be sealed by tremie grouting with neat cement.

3.2.5 Groundwater Purging

After recording the static groundwater elevation, each groundwater monitoring well and temporary well will be purged prior to sampling. Additional groundwater may be purged prior to low-flow sampling if dedicated monitoring equipment containing fluoropolymers was present in the well (Section 3.2.1). A PFAS-free peristaltic pump will be used to collect samples. The following method will be used for purging groundwater monitoring wells prior to sample collection:

1. Assemble the PFAS-free pump and sampling line components in an area free from PFAS. Ensure that the discharge line is affixed so that the initial discharge is captured in a graduated cylinder or purge water collection bucket or drum.
2. Start the pump. Slowly increase the speed of discharge if using a variable speed pump.
3. Maintain laminar flow throughout the sample tubing and flow-through cell; keep all lines and the cell completely filled and air-free during parameter measurement and sampling.
4. Adjust the purge rate to minimize and stabilize drawdown, as measured by the water level probe. Low-flow sampling procedures will be conducted. Typical low-flow pumping rates are between approximately 100 and 500 milliliters per minute; actual rates will be recorded on field forms.
5. Once drawdown is stable, start recording water quality parameters.
6. Measure and record water level, pumping rate, total volume of water purged, routine water quality parameters (e.g., temperature, pH, conductivity, oxidation reduction potential, dissolved oxygen, and turbidity) throughout well purging at approximately 2- to 3-minute intervals. These measurements are collected in the field with a flow-through cell and multi-parameter meter and are used to assess whether aquifer water (rather than casing water) is being pumped.
7. Continue to measure and record the groundwater parameters until the parameters stabilize, or the well is pumped dry. Stabilization of water quality indicators is typically defined as follows: pH – three successive readings within ±0.1 pH unit; specific conductance – three successive readings within ±3%; temperature – three successive readings within 0.5 °C; and turbidity – three successive readings within ±10% or less than 10 Nephelometric Turbidity Units. Parameter stability is an indication that the well has achieved stable, laminar flow and well water is in equilibrium with the surrounding aquifer.
8. For slowly recharging wells, parameters may not stabilize before the well casing is emptied, even when using low flow rates. In this case, purging will be considered complete if one well volume (well casing plus filter pack volume) has been purged from the well, and the well goes dry. The well will be allowed to recharge, and sampling will be initiated within 24 hours of purging. The depth to water in the well will be measured and recorded

immediately prior to sample collection. The date and time of each sample collection will be recorded.

3.2.6 Groundwater Sampling

Groundwater samples will be collected by directing the discharge from the sampling pump tubing into the sample containers. Samples will be collected directly into the sample containers from the pump discharge tubing, not through the flow-through cell. The following sequence will be used to collect groundwater samples:

1. Disconnect the tubing from the analytical field meter.
2. Remove the cap from the sample container.
3. Place the sample container under the water stream. Fill the container to the level specified by the laboratory (samples do not need to be collected headspace free) and then turn off the pump.
4. Close the container by screwing on the cap.
5. Using a paper towel, dry the outside of the sample container if necessary.
6. Label the sample as described in Section 3.3.
7. Decontaminate reusable equipment prior to proceeding to the next groundwater monitoring well location, as described in Section 3.4.

Turbid samples will not be field filtered. Samples received by the lab that are turbid or contain sediment, despite purging efforts, will be centrifuged prior to supernatant extraction and sample processing. If centrifuging is required, the supernatant and solid portions will be analyzed as separate samples. This practice is consistent with USEPA Method 1633 requirements. The need to centrifuge a sample will be determined based on laboratory recommendation, in lieu of sample dilution, which would raise RLs.

3.3 Sample Documentation, Handling, and Shipping

3.3.1 Labeling

As noted in Table 2, some water-resistant inks may be potential sources of PFAS. Laboratory pre-printed labels will be used, or labels will be filled out using a ballpoint pen. (Per Ecology guidance [Ecology 2023], field staff can also fill out the container labels using Fine or Ultra-Fine point Sharpie® markers in the staging area with the sample container closed). Container labels will include the following information:

- A unique sample identifier;
- QC sample type, if applicable;
- Sampling date and time (24-hour format);

- Sampler's name or initials; and
- Method of sample preservation, if any.

Except for temperature blanks, all QC samples will be labeled and included on the CoC record. Field duplicate samples will not be indicated as duplicates; they will be blind duplicates.

3.3.2 Daily Field Notes

Field notes and forms will be used to record daily events, observations, and measurements and document sampling activities. Field documents will be kept in field staff possession while in the field and maintained with the project records. Field staff will record sample locations and sample collection in the daily field notes.

3.3.3 Sample Handling and Packaging

After labeling, sample bottles will be double bagged in re-sealable plastic bags and placed in a cooler for shipment. Sample containers will be packed for shipment using the following steps:

1. Choose an insulated cooler with structural integrity that will withstand shipment.
2. Secure and tape the drain plug with duct tape from the inside and outside.
3. Fill the cooler at least one-third full with double-bagged wet ice. (Chemical blue ice will not be used). Taping the ends of bags with duct tape will aid in waterproofing.
4. Check that the caps on all sample containers are tight and will not leak.
5. Check that the sample labels are intact, filled out, legible, and that the sample identifier exactly matches the CoC record.
6. Double-bag and seal each sample container in sample bags to prevent melt water from getting into the sample or degrading the sample label.
7. Place sample containers into the cooler with their caps upright.
8. Fill excess space within the cooler with bubble wrap (try to avoid using paper, cardboard, or polystyrene foam).
9. Seal the entire cooler with duct tape, particularly the lid and drain plug (if present), to prevent leaks.

3.3.4 Chain of Custody

A sample is considered to be in custody if the following conditions have been observed:

- It is in possession or view of the person in custody;
- It is locked in a secure area;
- It is placed in an area restricted to authorized personnel; or

- It is placed in a container and secured with an official seal, so that the sample cannot be reached without breaking the seal.

The following practices will be observed by field personnel to ensure sample custody:

- As few persons as possible will handle samples.
- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to the laboratory.
- Sample labels will be completed for each sample.

All samples will be accompanied by a CoC record. The CoC record is typically provided by the laboratory. The CoC record will be fully completed in duplicate (e.g., a carbon copy). At a minimum, the following information will be included on a CoC record:

- Site name and project reference number;
- Laboratory name and address;
- Name of person that collected the samples;
- Sample identifier;
- Sample date and time (time in 24-hour format);
- Laboratory analysis requested;
- Preservatives added to each sample;
- Sample matrix (e.g., soil, water);
- Number of containers per sample; and
- Airway bill tracking number, if applicable.

As applicable, the following remarks will be added to the CoC record:

- Contractor name and address;
- Matrix spike and matrix spike duplicate (MS/MSD) sample volume (if necessary);
- A request for rapid turnaround time; and
- A note regarding the potential concentrations in a highly contaminated sample.

The CoC form will be completed and signed by field personnel and the courier (if other than the sampler) for the samples transported to the laboratory. When samples are transported by a commercial carrier, the carrier will not sign the CoC record; however, the airway bill tracking number will be recorded on the CoC record. Airway bills will also be retained with the CoC record

as documentation of transport. For this reason, the date and time of the receiver and relinquisher will not match when shipping with a commercial carrier.

The CoC record will accompany all sample shipments. One CoC record will be prepared for each cooler and the cooler number recorded on the CoC. The samples in the cooler will be listed on the CoC record. The CoC record will be placed in a sealed plastic bag (e.g., Ziploc®) and taped to the inside lid of the cooler. If one sample is contained in two coolers (i.e., one sample has too many containers to fit into one cooler), then the original CoC will be placed into the first cooler and a copy of the CoC record will be placed into the second cooler. The duplicate copy of the CoC record will be retained by the sampler.

Since the samples will be delivered to the laboratory in the custody of a courier or commercial shipment service, custody seals will be used on each ice chest to provide tampering detection. The signed and dated custody seals will be placed on the front right and back left of the shipping container and will be covered with wide, clear tape.

Shipped coolers will be scheduled for priority overnight service to maintain temperature requirements. Saturday deliveries will be coordinated with the laboratory. Samples will be shipped as non-hazardous material unless the samples meet the established Department of Transportation (DOT) criteria for a "hazardous material" or the International Air Transport Association (IATA)/International Civil Aviation Organization (ICAO) for air definition of "dangerous goods." If the samples meet the criteria for hazardous materials or dangerous goods, then DOT and IATA/ICAO regulations must be followed. Prior to shipping samples, field personnel will complete the appropriate air waybill or manifest. A copy of the air waybill or manifest will be kept for recordkeeping.

3.4 Decontamination

Decontamination will occur prior to leaving the sampling area or at a central decontamination location after each sample collection location (as needed) and at the end of each workday. The area may include basins or tubs (e.g., 5-gallon buckets) to capture decontamination wastes, which can be transferred to larger containers as necessary. Alconox®, Liquinox®, Luminox®, or Citranox® detergents are acceptable for decontamination purposes. Decon 90™ should be avoided during decontamination activities. Specific decontamination procedures are not outlined in the Ecology PFAS Guidance; however, the Michigan PFAS Sampling Guidance (EGLE 2024), which is cited in the Ecology PFAS Guidance as a resource for PFAS sampling considerations, provides the following decontamination procedure. Decontamination wastes will be contained and disposed of in accordance with typical Site practices (Section 3.5).

Non-disposable sampling equipment that is in contact with sampled matrix will be cleaned prior to and between uses at each sampling location, according to the following procedures:

- Clean reusable sampling equipment using a polyethylene or PVC brush and detergent (e.g., Alconox®, Liquinox®, or Citranox®) in a 5-gallon bucket;
- Rinse thoroughly with PFAS-free water (repeat 3x); and

- Dry with paper towels or leave the equipment to air dry in a location away from dust.

Reusable equipment includes the depth to water probe used during groundwater monitoring, and hand auger used to advance temporary wells or grab groundwater sample borings.

During drilling activities, drillers typically bring multiple direct push technology (DPT) rods and thoroughly decontaminate them as a group. As drill rods are pulled up, they will be wiped down with a rag to remove residual soils and set aside for decontamination prior to reuse. Equipment will be fully decontaminated using the above procedures or equivalent (i.e., pressure wash in a lined constructed decontamination area). DPT rods will be cleaned prior to re-use.

3.5 Investigation-Derived Waste

Investigation-derived waste (IDW) will primarily consist of washwater from the decontamination process of non-dedicated and non-disposable sampling equipment, purge water from groundwater monitoring wells and temporary well locations, and soil cuttings from temporary well installation. Purge water, decontamination fluids, and soil cuttings will be managed, characterized, and disposed of consistent with the Site-specific monitoring program procedures. Used disposable sampling equipment, paper towels, and personal protective equipment (e.g., nitrile gloves) will be placed in heavy-duty garbage bags and disposed of as municipal waste. Following receipt of laboratory results and profiling, IDW will be transferred to Site personnel (Boeing Environmental Health and Safety) for management under Site protocols, as described in Section 2.7.2 of the project QAPP associated with the *North Boeing Field/Georgetown Steam Plant Site Remedial Investigation/Feasibility Study* (Leidos 2014).

4. QA/QC SAMPLES AND DATA VALIDATION

4.1 Field Quality Control Samples

Field QC samples will be assigned unique sample numbers and will be submitted blind to the analytical laboratory. If abnormalities are detected in field QC samples, the data associated with the QC samples will be reviewed and appropriate action will be taken to rectify the issues.

4.1.1 Field Duplicates

Field duplicates are samples collected in the same manner and at the same time and location as a primary sample. They are typically collected from locations of known or suspected contamination. Field duplicates are used to assess field and analytical precision and sample heterogeneity. At least one field duplicate will be collected for every 10 primary samples. Field duplicates will be labeled with a unique sample identifier and not be indicated as a duplicate (i.e., submitted as "blind").

4.1.2 Blanks

Blanks will be shipped and handled in the same manner as environmental samples. Field blanks will be labeled as such on sample bottles and on the CoC. The number and type of blanks will be determined by the field team in consultation with the laboratory prior to sampling.

4.1.2.1 Equipment Blanks

Equipment blanks, or equipment rinsate blanks, are used to assess the effectiveness of decontamination process. Equipment blanks are prepared by pouring PFAS-free water over or through decontaminated field sampling equipment and collecting the rinsate in a sample container. Typically, at least one equipment blank is collected for every 10 primary samples. At least one equipment blank will be collected during the sampling event, and one equipment blank per distinct sampling method will be collected.

4.1.2.2 Field Blanks

Field blanks are used to assess ambient contamination in the field and are an effective way of assessing potential cross-contamination as a result of environmental conditions during sample handling. Field blanks will be prepared by filling a sample container with PFAS-free water in the field in the same manner as environmental samples. Typically, one field blank is collected for each day of sampling.

4.1.2.3 Temperature Blanks

Temperature blanks are used to assess the temperature of samples during shipping. Temperature blanks will be provided by the laboratory and prepared by filling a sample container with PFAS-free water prior to shipment of the sample containers. The blank will be kept in the cooler during sampling and shipment to the laboratory. Once the cooler returns to the laboratory, the laboratory sample custodian will measure the temperature of the blank to determine whether recommended sample storage criteria have been met.

Table 3. Summary of QA/QC Sample Purpose, Typical Frequency, and Typical Measurement Performance Criteria

QC Sample	Purpose	Typical Metric	Frequency
Field duplicate	Assess precision	30% relative percent difference (RPD)	At least one per 10 samples and one per event
Equipment blanks	Assess potential cross-contamination despite decontamination practices and field equipment selection	No analyte detection > ½ RL, 10% of sample result, or 10% of regulatory limit, whichever is greater	At least one per 10 samples and one per event
Field blanks	Assess potential contamination from environmental conditions during sampling	No analyte detection > ½ RL, 10% of sample result, or 10% of regulatory limit, whichever is greater	One per day
Temperature blanks	Assess representativeness of sample due to temperature of storage conditions	Temperature < 6°C	One per cooler

4.2 Laboratory Quality Control Samples

The laboratory QA program consists of laboratory QC samples, documentation of laboratory QC practices, data validation, and laboratory audits. Laboratory QC samples may include laboratory control samples (LCSs), low level LCSs (LLCSs), laboratory duplicates, surrogates, internal standards, method blanks, continuing calibration verifications (CCVs), and instrument blanks. LCS/LLCS samples are analyzed with every batch of up to 20 samples and measure analytical accuracy and bias. Surrogate standards are added to samples, blanks, and LCS/LLCSs to evaluate laboratory sample preparation, and matrix interferences. Laboratory flags are used to indicate sample results associated with QC sample results that are outside of the laboratory-specified or method-specified acceptance criteria. Level III or IV laboratory reports will include sample and QC sample results (e.g., method blanks, LCS, surrogates, CCVs, and instrument blanks).

4.3 Data Review, Verification and Validation

Hand-entered data from field forms (e.g., groundwater elevation data) will be peer reviewed to minimize data entry errors. Field notes and other records of field activity will be saved in the Geosyntec project file.

Geosyntec will conduct verification and validation of data provided by the analytical laboratory. Data verification includes checking that laboratory sample receipt forms match CoC documentation. Verification of laboratory data also includes checking that QA/QC samples defined in this QAPP Addendum are within the acceptance criteria and ensuring that holding times,

precision, accuracy, laboratory blanks, and detection limits are within the laboratory acceptance criteria. For this project, Stage 2B data validation will be implemented for groundwater samples.

Stage 2B validation includes an assessment of laboratory results reported in a standard Level III or Level IV) data package, confirmation/issuance of data qualifiers, and review of instrument-related quality control samples (USEPA 2009; Department of Defense 2019). Data quality will be assessed by comparing the QC parameters to the appropriate criteria (or limits) by method-specific and project-specific requirements. Any verification of laboratory calculations for quantitation is done on a limited basis and may require raw data in addition to the standard data forms normally present in a data package. Stage 2B data validation is performed in general conformance to United States Department of Defense Data Validation Guidelines set forth in Module 6: Data Validation Procedure for PFAS Analysis by Quality Systems Manual (QSM) Table B-24 (Department of Defense, 2022), USEPA protocols set forth in the functional guidelines (USEPA 2009; USEPA 2020) as well as the laboratory SOPs, analytical methods, and professional and technical judgement. Analytical data may be qualified based on data validation reviews, consistent with Department of Defense Data Validation Guidelines Module 6, and will be used to provide data users with an estimate of the level of uncertainty associated with the "qualified" result. If data validation qualifiers impact the overall data interpretation, these will be described in a data validation report.

5. REFERENCES

Department of Defense. 2019. General Data Validation Guidelines. Environmental Data Quality Workgroup. November 4.

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Ecology. 2022. Direction to Investigate Sources, Nature, and Extent of Per- and Polyfluoroalkyl Substances (PFAS) at the North Boeing Field Georgetown Steam Plant Site. 7370 East Marginal Way South, Seattle, Washington. 15 September.

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Ecology. 2024. Cleanup Levels and Risk Calculation (CLARC). https://ecology.wa.gov/regulations-permits/guidance-technical-assistance/contamination-cleanup-tools/clarc. Accessed 02/07/25.

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California State Water Resources Control Board (CA SWRQB). 2020. *Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines*. September 11. California State Water Quality Control Board.

USEPA. 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use,* EPA 540-R-08-005. January.

USEPA. 2020. *Contract Laboratory Program National Functional Guidelines for High Resolution Superfund Methods Data Review*, EPA 542-R-20-007. November.

USEPA. 2020. *Contract Laboratory Program National Functional Guidelines for Organic Superfund Methods Data Review*, EPA 540-R-20-005. November.

USEPA. 2024. *Method 1633, Revision A Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS,* EPA 820-R-24-007. December.

ATTACHMENT 1
Daily Sampling Checklist

Attachment 1. Daily Sampling Checklist

Date: _____

Site Name: _____

Weather (*temperature/precipitation*): _____

Please check all boxes that apply and describe any exceptions in the notes section below along with QA/QC methods used to assess potential sample cross-contamination as a result.

Field clothing and personal protective equipment:

- ☐ No water- or stain-resistant boots or clothing (e.g., GORE-TEX®)
- ☐ Boots made of polyurethane, PVC, rubber, or untreated leather
- ☐ Clothing has not been recently laundered with a fabric softener
- ☐ No coated HDPE suits (e.g., coated Tyvek® suits)
- ☐ Field crew has not used cosmetics, moisturizers, or other related products today
- ☐ Field crew has not used sunscreen or insect repellants today, other than products approved as PFAS-free

Field equipment:

- ☐ Sample containers are made of HDPE or polypropylene, not LDPE
- ☐ Sample caps are made of HDPE or polypropylene and are not lined with Teflon™
- ☐ No materials containing Teflon™, Viton™, or other fluoropolymers
- ☐ No materials containing LDPE in direct contact with the sample (e.g., LDPE tubing)
- ☐ Equipment in direct contact with the sample is made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks
- ☐ No waterproof field books
- ☐ No waterproof or felt pens or markers (e.g., certain Sharpie® products)
- ☐ No chemical (blue) ice, unless it is contained in a sealed bag
- ☐ No aluminum foil
- ☐ No sticky notes (e.g., certain Post-It® products)

Decontamination:

- ☐ Reusable sampling equipment decontaminated before and after each sample location
- ☐ "PFAS-free" water is on site for decontamination of sample equipment
- ☐ Alconox®, Liquinox®, Luminox® or Citranox® used as decontamination detergent

Food and drink:

- ☐ No food or drink on-site, except within staging area
- ☐ Food in staging area is contained in HDPE or stainless-steel container (continued)

Wet weather (as applicable):

- ☐ Field staff rain gear is made of polyurethane, PVC, vinyl, wax-coated or rubber

Notes:

_____

_____

_____

_____

_____

Field Team Leader Name (Print): _____

Field Team Leader Signature: _____

Date/Time: _____