PFAS-Specific Sampling and Analysis Plan, Red Hill Bulk Fuel Storage Facility, Adit 6

JOINT BASE PEARL HARBOR-HICKAM, O‘AHU, HAWAI‘I

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Prepared for: Red Hill OIC

***This plan replaces the 01 DEC 2022 approved plan in its entirety.**

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Figure 1. Adit 6 Distance to Well Locations

Figure 2. Adit 6 Distance to Drinking Water Wells

Executive Summary

This PFAS Sampling and Analysis Plan outlines the Navy's sampling strategy at Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor Hickam, Hawai'I in response to the 29NOV2022 Aqueous Film Forming Foam (AFFF) release at Adit 6. This document is being prepared by the Department of the Navy, Naval Facilities Engineering Systems Command (NAVFAC), Red Hill OIC in accordance with the Navy's SAP policy guidance and USEPA guidance and regulations to help ensure that data collection and laboratory analyses follow proper scientific protocols and practices. This plan replaces the 01 DEC 2022 approved plan in its entirety (Red Hill PFAS ADIT 6 PLAN Rev2a).

Background

On 29NOV2022 at the Adit 6 location of Red Hill Bulk Storage Fuel Facility, approximately 1,300 gallons of AFFF concentrate was released. The investigation is on-going to determine the cause of the release. Impacted areas include a 100-foot section inside the tunnel, and immediate areas outside and adjacent to the Adit 6 entrance. The outside areas include a crushed-rock apron, soil, and a stormwater conveyance system that eventually empties into the Halawa Stream. Remedial actions were taken on the day of the spill and included collection of concentrate with appropriate spill-absorbing material, and soil excavation in areas the apron. Further remedial actions are pending based on sampling efforts for proper delineation of the contaminated areas.

Approach

Tasks identified in the plan shall include aqueous and soil sample collection protocols, mobilization, technical support, and laboratory analytical methods for an initial six (6) month period. The Contractor shall provide all necessary personnel, equipment and materials to adequately sample aqueous and soil samples from wells and areas to be determined by the Navy. At a minimum, work shall include but shall not be limited to, the following tasks and/or deliverables:

- Sample collection and transport, including tools for surficial and sub-slab drilling
- Analytical results/reports by an accredited laboratory
- Project Management
- Potential disposal of and AFFF concentrate, AFFF-contaminated liquid, and AFFF-contaminated soil samples

Acronyms and Abbreviations

°C	degree Celsius
>	greater than
≥	greater than or equal
<	less than
≤	less than or equal
--	not applicable
µg/L	microgram(s) per liter
µg/kg	microgram(s) per kilogram
%	percent
APP	Accident Prevention Plan
AQM	Activity Quality Manager
bgs	below ground surface
BMT	Base Motor Transport
CA	corrective action
CAS	Chemical Abstracts Service
CCV	continuing calibration verification
CLEAN	Comprehensive Long-term Environmental Action—Navy
COPC	Chemicals of Potential Concern
CSM	conceptual site model
CTO	Contract Task Order
DL	detection limit
DO	dissolved oxygen
DoD	Department of Defense
DU	Decision Unit
DV	data validation
EB	equipment rinsate blank
EDS	Environmental Data Services
EIS	Extracted Internal Standard
ELAP	Environmental Laboratory Accreditation Program
FB	field blank
FBI	Federal Bureau of Investigation

FD	field duplicate
FTL	Field Team Leader
FTS	fluorotelomer sulfonate
g	gram(s)
H&S	health and safety
HDOH	Hawai'i Department of Health
HDPE	high-density polyethylene
HEER	Hazard Evalutation and Emergency Response Office
HFPO-DA	hexafluoropropylene oxide dimer acid
HHRS	human health risk screening
HI	hazard index
HQ	hazard quotient
HSM	Health and Safety Manager
IB	instrument blank
ICAL	initial calibration
ICC	initial calibration confirmation
ICV	initial calibration verification
ID	identification
IDW	investigation-derived waste
ISC	instrument sensitivity check
ISP	Incremental sampling plan
LCL	lower control limit
LC-MS/MS	liquid chromatography tandem mass spectrometry
LCS	laboratory control sample
LIMS	laboratory information management system
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
MD	matrix duplicate
mg/L	milligram(s) per liter
MILSPEC	military specification
mL	milliliter(s)
MS	matrix spike

MSD	matrix spike duplicate
N/A	not applicable
NAVFAC	Naval Facilities Engineering Systems Command
Navy	Department of the Navy
ng/L	nanogram(s) per liter
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
NTV/E	non-tactical vehicle and equipment
ORP	oxidation-reduction potential
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbons
PAL	project action limit
PC	Project Chemist
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutane sulfonate
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexoanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PFPeA	perfluoropentanoic acid
PFTA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnA	perfluoroundecanoic acid
PID	photoionization detector
PM	Project Manager
POC	point of contact

PVC	polyvinyl chloride
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RPD	relative percent difference
RPM	Remedial Project Manager
RSL	regional screening level
RT	retention time
S/N	Signal to Noise
SAP m	Sampling and Analysis Plan
SD	standard deviation
SI	Site Inspection
SL	Safety Liaison
SME	Subject Matter Expert
SOP	standard operating procedure
SPE	Solid Phase Extraction
TBD	to be determined
TGM	Technical Guidance Manual
TM	Task Manager
UCL	upper control limit
UCMR5	Unregulated Contaminant Monitoring Rule 5
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
WQP	water quality parameter
Y/N	Yes/No

Identifying Information

Site Name: JOINT BASE PEARL HARBOR-HICKAM, O'AHU, HAWAI'I, RED HILL BULK FUEL STORAGE FACILITY (RHBFSF)

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the following:
   - Guidance for Quality Assurance Project Plans (USEPA, 2002)
   - Uniform Federal Policy for Quality Assurance Project Plans (USEPA, 2005)
   - Guidance on Systematic Planning Using the Data Quality Objectives Process (USEPA, 2006)
   - Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for Naval Facilities Engineering Command (NAVFAC) Remedial Project Managers (RPMs) (NAVFAC, 2020)
   - HDOH, 2021, Interim Soil and Water Environmental Action Levels (EALs) for Perfluoroalkyl and Polyfluoroalkyl Substances (PFASs).
   - HDOH, 2021, Technical Guidance Manual.

2. List organizational partners (stakeholders) and connection with lead organization:
   - United States Environmental Protection Agency (USEPA) Region 9 – Regulatory Stakeholder
   - State of Hawai'i Department of Health (HDOH)

3. Lead organization:
   - Department of the Navy, NAVFAC Hawaii, Red Hill OIC

Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records / Certificates
Field Operations	PFAS-Specific Sampling	Protocols Defined in the standard operating procedures (SOPs) or in this plan.	Before arrival to site	All site workers	All site workers	N/A

Project Action Limits

Groundwater

- Groundwater data will be screened against residential scenario regional screening levels (RSLs) based on a hazard quotient (HQ) of 0.1 (DoD, 2022). RSLs for PFOS, PFOA, PFBS, PFHxS, PFNA, and HFPO-DA based on an HQ of 0.1 are presented in the November 2022 RSL Table (USEPA, 2022). Data will also be screened against HEER Office TGM Section 4.2.7 (HDOH 2021), interim

soil and water environmental action levels (EALs) Per- and Polyfluroroalkyl Substances (April 2021).

Soil

- Soil data will be screened residential scenario RSLs based on an HQ of 0.1 (DoD, 2022). Residential soil RSLs for PFOS, PFOA, PFBS, PFHxS, PFNA, and HFPO-DA based on an HQ of 0.1 are presented in the November 2022 RSL Table (USEPA, 2022). Data will also be screened against HEER Office TGM Section 4.2.7 (HDOH 2021), interim soil and water environmental action levels (EALs) Per- and Polyfluroroalkyl Substances (April 2021).

How will the data be used?

- The data will be used to determine the extent of contamination related to the release event and used to inform any further delineation and/or remediation efforts to protect human health and the environment.

Uncertainties to be considered in data use:

- Scientific research and regulatory guidelines related to PFAS are rapidly evolving. As such, the information provided in this SAP presents the state of the science at the time of issuance of the SAP. The Navy will re- evaluate changing science and regulations at the time of reporting to ensure data evaluation and risk screening presented in the SI report reflect any changes to toxicology information, regulatory standards, and DoD and Navy policy and guidance. Updates to the proposed data evaluation and risk screening approaches will be discussed with stakeholders prior to issuance of the report.
- The sampling approach includes sampling of existing monitoring wells. While procedures for installation of new wells include requirements for avoidance of PFAS-containing materials, there is no way to confirm whether these materials might have been used during construction of existing wells. Based on sampling of numerous background wells at other facilities, impacts from past well construction are believed to be minimal; however, well construction will be considered if data indicate impacts are likely (for example, a group of wells installed concurrently have similar concentrations regardless of location relative to the likely release areas).

What types of data are needed (matrix, target analytes, analytical groups, field screening, onsite analytical or offsite laboratory techniques, sampling techniques)?

- The data to be collected during this investigation will include the following: laboratory analytical results for PFAS in groundwater and soil samples.

Are there any special data quality needs, field or laboratory, to support environmental decisions?

- There are no special data quality needs.

Where, when, and how should the data be collected/generated?

- All sampling locations are based on field investigations and samples will be collected in accordance with current sampling protocols and guidance from USEPA and the Navy.

- The data will be collected following the methodologies and standard operating procedures (SOPs) presented in this plan.

Sampling Tasks

- Initial period of performance will be six (6) months; Navy has discretion to adjust this sampling time period as necessary.
- Mobilization for the field effort includes procurement of necessary field equipment and initial transport to the site. Equipment and supplies will be brought to the site when the field team mobilizes for field activities. Field notes will be captured on loose leaf paper/forms or electronic devices each day. A location for the placement of IDW will be determined, and IDW will be stored in a manner consistent with the SOPs within. Before beginning any phase of work, Contractor and its subcontractors will have field meetings to discuss the work items and worker responsibilities, and to familiarize workers with the SAP.
- In general, work will be performed in Level D personal protective equipment, consisting of a hard hat, safety glasses, safety-toed boots, and hearing protection, with special precautions taken to avoid any clothing materials that could contain PFAS.
- Field activities will take place during normal daylight working hours.
- DOH and DOH contractors shall have the opportunity to be present, observe, and elect to collect independent samples. The Navy will provide a schedule of sampling once developed to help facilitate this.
- Routine NOI and LTM sampling will continue during this PFAS sampling effort.
- Due to the proprietary nature of AFFF, Draft EPA Method 1633 may not identify the other PFAS components for Ansulite AFC-3MS 3% AFFF Concentrate manufactured by Ansul. Section 3.1 of the Safety Data Sheet lists additional chemical components in this mixture. While the Navy will continue evaluating appropriate chemical component(s) to analyze as additional potential indicator(s) of AFFF contamination, the following has been identified:
    - Navy will add 2-(2-Butoxyethoxy)ethanol for analyses to serve as an indicator of AFFF in case there is minimal overlap of PFAS in the subject AFFF and PFAS analytes included in EPA draft method 1633.
    - Analytical method will be based on EPA Publication EPA/600/R-14/ 008| January 2014: The Verification of a Method for Detecting and Quantifying Diethylene Glycol, Triethylene Glycol, Tetraethylene Glycol, 2-Butoxyethanol and 2-Methoxyethanol in Ground and Surface Waters. EPA Method 8015_Direct Aqueous Injection (DAI) has been identified as a method that can be used for this analyte.

Typical guidance and procedures, such as ASTM International D 4823-95 and D 4448-01, USEPA compendium EPA 540/P-87/001a, OSWER 9355.0-14, and USEPA SESDPROC-513-R2, remain the basis for a PFAS sampling protocol. Examples of special considerations for PFAS sampling include the types of sampling equipment or materials used; field and equipment blanks above and beyond what is normally required; the need for low laboratory quantitation limits; low state and federal screening levels, cleanup criteria; potential for background sources of PFAS in the environment; and modified decontamination measures.

Groundwater Sampling

Collect groundwater samples for PFAS analyses using a bailer (this would allow sampling to start as soon as bottles are received from the lab) or low-flow pump. Figure 2 shows well locations distances from Adit 6.

The groundwater monitoring wells will be sampled using bailers or low flow pumps and tubing free from PFAS containing materials (e.g., Teflon) to avoid introducing PFAS from outside sources. Groundwater samples for PFAS will be collected into 500-milliliter or larger, HDPE unpreserved bottles with non-Teflon lid liners and tested for PFAS constituents using Draft EPA Method 1633. The bottles will be placed into coolers with ice to maintain temperatures at 4 degrees Celsius ± 2°C until the samples are delivered to the laboratory. Use of glass sample containers will be avoided when collecting water samples due to the potential for adsorption of PFAS, specifically PFOS to the glass. Field duplicate PFAS groundwater samples will be collected at a rate of one per sampling event.

Weekly PFAS samples will be collected from the following wells using Draft EPA Method 1633:

- RHMW02
- RHMW03
- RHMW04
- RHMW06
- RHMW10
- RHMW12A
- RHMW16
- RHMW17
    - Two additional samples will be collected at piezometers (shallow and intermediate) staged in perched groundwater depths.
- RHMW2254-01
- HDMW2253-03

Soil Sampling

Decision Units (DU) are defined as sample collection areas. They will be identified based on visually impacted areas and provided in Enclosure 1.

Collect two (2) replicate samples from one (1) DU where the greatest contamination has occurred in accordance with Section 4.2.7 of the HEER Office TGM. Use the resulting triplicate data (primary plus two replicates) in conjunction with the final sample collection and processing method to assess the precision and usability of the data in accordance with Section 4.2.8 of HEER TGM.

Each DU sample will be comprised of 30 soil increments which will be tested for PFAS constituents using Draft EPA Method 1633. Collect a minimum three (3) kg sample prepared by combining a minimum of 30 increments from the subject DU. Each sample will consist of a 1 kg sample per selected drum. Increments will be collected from exposed to a depth of approximately six (6) inches (DU depth/thickness). This will be used to estimate the soil volume associated with each DU and DU sample. Collected samples will be placed in a laboratory provided sample container or a new, clean, Ziploc bag or equivalent. Soil samples will be collected using a stainless steel or disposable HDPE scoop or trowel. Soil sample increments will be collected at a 6-inch depth in the over-excavated area (12 inches horizontally

beyond the observed impacted areas, as marked in the field immediately upon discovery of the release) as confirmation samples. To evaluate project performance, a field replicate sample will be collected from one decision unit. Thirty (30) additional soil increments will be collected per replicate sample as described above. Zip-top polyethylene plastic bags will be used for double-bagging samples prior to placing them in a cooler with ice for preservation until the samples are shipped to the laboratory. Because of potential interference from PAHs, asphalt will not be sampled for PFAS.

Collect one (1) multi-increment sample of the excavated, contaminated soil

The multi-increment samples (triplicates) will be collected from three (3) drums containing the most contaminated soil. Contaminated areas were excavated to a depth of six (6) inches during the initial response effort. That excavated soil is currently staged on site in a dump truck and drums. Because of potential interference from PAHs, asphalt will not be sampled for PFAS.

All multi-increment soil samples will be collected in accordance with Section 4.2.7 of the HEER Office TGM. The laboratory will follow accepted and approved practices and procedures for incremental sampling analysis. Upon laboratory selection, the Navy will request their ISM protocols and SOPs.

Overflow Holding Tank Sampling

A sample of the AFFF concentrate remaining in the overflow holding tank in Adit 6 will be collected. Using Draft Method 1633, this sample will be used to determine which of the forty (40) target PFAS compounds are present in this specific batch of AFFF concentrate. The Navy will also perform a total organoflourine analysis solely on the AFFF concentrate to potentially identify additional PFAS compounds that may not register in Draft EPA Method 1633.

Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use in accordance with the SOP listed within. Non-disposable equipment will be decontaminated using the following solutions in this order:

1. Distilled water (laboratory-certified PFAS-free) and Liquinox solution
2. Distilled water (laboratory-certified PFAS-free) rinse 10 percent isopropanol and distilled water solution (laboratory-certified PFAS-free) and air-dried
3. Laboratory grade deionized water (laboratory-certified PFAS-free)

Decontamination fluids will be contained in a tank or 55-gallon drum and disposed of offsite as described herein.

Investigation-derived Waste Management

IDW is expected to consist of soil, purge water, groundwater sampling, and decontamination fluids. Aqueous IDW and solid IDW will be stored in separate roll-off containers, portable tanks or drums. IDW will be managed in accordance with the Interim PFAS Site Guidance for NAVFAC RPMs, November 2020 Update (NAVFAC, 2020), applicable SOPs contained in this plan. IDW will be properly sampled for characterization and disposed of in accordance with all federal, state, and local laws and disposal facility requirements. Disposable equipment, including personal protective equipment, will be disposed of with normal municipal waste.

Sample Shipment

All analytical samples and equipment will be shipped by FedEx. All samples will be shipped in accordance with the SOP identified within this plan.

Sample Analysis

The laboratory will maintain, test, inspect, and calibrate analytical instruments according to current EPA laboratory methods and standards. The laboratory will analyze aqueous and soil samples for PFAS. SOPs for all laboratory analytical tasks and will be conducted by a laboratory TBD by Contractor and the Navy. Aqueous and soil samples will be analyzed using Draft EPA Method 1633.

Samples will be processed (e.g., air dried and sieved to <2mm particle size), subsampled (minimum 30 increments) and tested by the laboratory using Multi-Increment methods in accordance with Section 4.2.6 of the HEER TGM. This will include the collection and testing of a minimum of 10 grams per sample. A summary of sample processing and subsampling methods in the will be included in the report.

Data Validation, Review, and Management Tasks

Data from all media samples (groundwater and soil) obtained from the analytical laboratory will be validated. The PC is responsible for data tracking and storage. Definitive analytical laboratory data will be reported as a Stage 4 data package including Certificates of Analysis for traceability and 10 percent of the data will undergo Stage 4 validation before use by the Navy, while the remaining 90 percent will undergo Stage 2B validation. All WQP data will be checked by the PC before use. The FTL is responsible for ensuring the photoionization detector (PID) and WQP meter are calibrated prior to sample collection. The precision and usability of soil sample data will be evaluated in accordance with HEER Office TGM Section 4.2.8 and based on the final sample collection and processing methods used and the precision of the replicate (triplicate) sample data. All analytical data will be loaded into the Navy EDMS Red Hill Database for HDOH retrieval, and unvalidated sample results will be provided to HDOH as well. Validated data will also be furnished once the Navy receives confirmation of validated data TAT.

Analytical and Validation Tasks

Projected turnaround times (TAT) for final (unvalidated) data from potential laboratories will be:

- Aqueous samples will have a five day TAT + 2 day transport time
- Soil samples will have a seven day TAT + 2 day transport time

All data will be uploaded into EDMS directly by the laboratories and be made available to the regulatory authorities.

Additional laboratory tasks include:

- The laboratory will maintain, test, inspect, and calibrate analytical instruments.
- The laboratory will process and prepare samples for analysis.
- All analytical data to be used for chemical characterization of the site, excluding IDW characterization, will be validated.
- A data usability assessment will be performed on the SI data.

Demobilization

Full demobilization will occur when the project is complete, and appropriate QA/QC checks have been performed. Personnel no longer needed during the course of field operations may be demobilized before the final project completion date. The following will occur before demobilization:

- Chain-of-custody records will be reviewed to verify that all samples were collected as planned and submitted for appropriate analysis.
- Restoration of the site to an appropriate level (for example, repair of deep ruts from drilling equipment) will be verified by the FTL.
- Any imported soil for backfill will be certified clean fill.
- All equipment will be inspected, packaged, and shipped to the appropriate location.

Sampling Design and Rationale

PFAS are generally water-soluble and relatively mobile through soils to groundwater. Groundwater and soil sample locations are based on this rationale and access considerations. In addition, groundwater sample locations were chosen to refine the understanding of the hydrogeological characteristics at each area. Samples will be analyzed for all PFAS components delineated by Draft EPA Method 1633, compliant with Quality Systems Manual Version 5.4 Table B-15 (or the latest version of the QSM for which the laboratory is certified at the time of sampling).

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): AECOM **Sample Packaging[a] (Personnel/Organization):** AECOM **Coordination of Shipment (Personnel/Organization):** AECOM **Type of Shipment/Carrier**: Overnight Carrier/FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): TBD AECOM and Navy **Sample Custody and Storage (Personnel/Organization):** TBD AECOM and Navy **Sample Preparation (Personnel/Organization):** TBD AECOM and Navy **Sample Determinative Analysis (Personnel/Organization)**: TBD AECOM and Navy
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 45 **Sample Extract/Digestate Storage (No. of days from extraction/digestion):** 45
SAMPLE DISPOSAL

Personnel/Organization: TBD AECOM and Navy
Number of Days from Analysis: 45

a PFAS-free shipping materials will be used for shipping samples.

Sample Custody Requirements

Sample Labeling

Sample labels will include, at a minimum, client name, site, sample identification (ID), date/time collected, analysis group or method, preservative, and sampler's initials. Labels will be applied to the jar to ensure that they do not separate.

Chain-of-Custody Procedures:

Chains of custody will include, at a minimum, laboratory contact information, client contact information, sample information, and relinquished by/received by information. Sample information will include sample ID, date/time collected, number and type of containers, preservative information, analysis method, and comments. The chain of custody will also have the sampler's name and signature. The chain of custody will link location of the sample from the field logbook to the laboratory receipt of the sample.

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Samples will be collected by field team members under the supervision of the FTL. As samples are collected, they will be placed into containers and labeled, as outlined above. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples than less than or equal to 10°C (storage in the laboratory will be less than or equal to 6°C) but not frozen. The chain of custody will also be placed into the cooler. Coolers will be shipped to the laboratory via appropriate methods, with the airbill number indicated on the chain of custody (to relinquish custody). Upon delivery, the laboratory will log in each cooler and report the status of the samples.

Laboratory Sample Custody Procedures:

All PFAS samples will be shipped to a laboratory TBD by AECOM and Navy.

The analytical laboratories will have established custody procedures, which include the following:

- Designate a sample custodian.
- Completion by the custodian of the chain-of-custody record, any sample tags, and laboratory request sheets, including documentation of sample condition upon receipt.
- Comply with laboratory sample tracking and documentation procedures.
- Secure sample storage with the appropriate environment (e.g., refrigerated, dry), consistent with analytical method requirements.
- Practice proper data logging and documentation procedures, including custody of original laboratory records.

Upon arrival of the samples at the analytical laboratory, a sample custodian will take custody of the samples, assess the integrity of sample containers, and verify that the information on the sample labels matches the information on the associated chain-of-custody record. The laboratory will restrict access to the storage areas to authorized laboratory personnel only, to prevent unauthorized contact with samples, extracts, or documentation. The sample custodian will maintain security of the samples in accordance with the analytical laboratory SOP.

Sample Identification Procedures:

Upon opening the cooler, the receiving clerk signs the chain of custody and then takes the temperature using the temperature blank (if absent, a sample container or infrared thermometer is used). The sample containers in the cooler are unpacked and checked against the client's chain of custody and any discrepancies or breakage is noted on the chain of custody. Next, if any water samples require preservative, the clerk will check the pH values to see if they are in the acceptable pH range. The clerk will deliver the chain of custody (and any other paperwork, such as temperature or pH QA notice) to the PM for LIMS entry and client contact (if needed).

The field logbook will identify the sample ID with the location, depth, date/time collected, and the parameters requested. The laboratory will assign each field sample a laboratory sample ID based on information in the chain of custody. The laboratory will send sample log-in forms to the project chemist to check sample IDs and parameters are correct.

Assessment Findings and Corrective Action Responses

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings (Name, Title, Organization)**	**Timeframe of Notification**	**Nature of CA Response Documentation**	**Individual(s) Receiving CA Response (Name, Title, Organization)**	**Time Frame for Response**
Field Performance Audit	Checklist and Written Audit Report	TBD	Within 1 week of audit	Memorandum	TBD	Within 1 week of receipt of CA Form
Offsite Laboratory Technical Systems Audit	TBD AECOM	TBD	Within 2 months of audit	Memorandum	TBD	Within 2 months of receipt of initial notification

Standard Operating Procedures

Chain-of-Custody

I. Purpose

The purpose of this SOP is to provide information on chain-of-custody procedures to be used under the CLEAN Program.

II. Scope

This procedure describes the steps necessary for transferring samples through the use of Chain-of-Custody Records. A Chain-of-Custody Record is required, without exception, for the tracking and recording of samples collected for on-site or off-site analysis (chemical or geotechnical) during program activities (except wellhead samples taken for measurement of field parameters). Use of the Chain-of-Custody Record Form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. This procedure identifies the necessary custody records and describes their completion. This procedure does not take precedence over region specific or site- specific requirements for chain-of-custody.

III. Definitions

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed two- part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to another custodian. One copy of the form must be retained in the project file.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under one's custody if:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and then he/she locked it up to prevent tampering.
- It is in a designated and identified secure area.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

IV. Procedures

The term "chain-of-custody" refers to procedures which ensure that evidence presented in a court of law is valid. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom, as well as providing security for the evidence as it is moved and/or passed from the custody of one individual to another.

Chain-of-custody procedures, recordkeeping, and documentation are an important part of the management control of samples. Regulatory agencies must be able to provide the chain-of-possession and custody of any samples that are offered for evidence, or that form the basis of analytical test results introduced as evidence.

Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed.

Sample Identification

The method of identification of a sample depends on the type of measurement or analysis performed. When *in situ* measurements are made, the data are recorded directly in bound logbooks or other field data records with identifying information.

Information which shall be recorded in the field logbook, when in-situ measurements or samples for laboratory analysis are collected, includes:

- Field Sampler(s),
- Contract Task Order (CTO) Number,
- Project Sample Number,
- Sample location or sampling station number,
- Date and time of sample collection and/or measurement,
- Field observations,
- Equipment used to collect samples and measurements, and
- Calibration data for equipment used

Measurements and observations shall be recorded using waterproof ink.

Sample Label

Samples, other than for *in situ* measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling and Analysis Plan. Each sample container is identified by a sample label.

Sample labels are provided, along with sample containers, by the analytical laboratory. The information recorded on the sample label includes:

- Project – Name of project site.
- Sample Identification - The unique sample number identifying this sample.
- Date - A six-digit number indicating the day, month, and year of sample collection (e.g., 05/21/17).
- Time - A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- Medium - Water, soil, sediment, sludge, waste, etc.
- Sample Type - Grab or composite.
- Preservation - Type and quantity of preservation added.
- Analysis - VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- Sampled By - Printed name or initials of the sampler.
- Remarks - Any pertinent additional information.

The field team should always follow the sample ID system prepared by the Project Chemist and reviewed by the Project Manager.

Chain-of-Custody Procedures

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed.

Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.
- A Chain-of-Custody Record will be prepared for each individual cooler shipped and will include ***only*** the samples contained within that particular cooler. The Chain-of-Custody Record for that cooler will then be sealed in a zip-log bag and placed in the cooler prior to sealing. This ensures that the laboratory properly attributes trip blanks with the correct cooler and allows for easier tracking should a cooler become lost during transit.
- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.
- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once downloaded to the server or developed, the electronic files or photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographic prints will be stored in the project files. To identify sample locations in photographs, an easily read sign with the appropriate sample location number should be included.
- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions (e.g., a logbook notation would explain that a pencil was used to fill out the sample label if the pen would not function in freezing weather.)

Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. **A Chain-of-Custody Record Form must be completed for each cooler and should include only the samples contained within that cooler**. A Chain-of-Custody Record Form example is shown in **Attachment B**. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as given below:

- Enter header information (CTO number, samplers, and project name).
- Enter sample specific information (sample number, media, sample analysis required and analytical method grab or composite, number and type of sample containers, and date/time sample was collected).
- Sign, date, and enter the time under “Relinquished by” entry.
- Have the person receiving the sample sign the “Received by” entry. If shipping samples by a common carrier, print the carrier to be used and enter the airbill number under “Remarks,” in the bottom right corner;

- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample-shipping package. Retain the copy with field records.
- Sign and date the custody seal, a 1-inch by 3-inch white paper label with black lettering and an adhesive backing. **Attachment C** is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.
- Place the seal across the shipping container opening (front and back) so that it would be broken if the container were to be opened.
- Complete other carrier-required shipping papers.

The custody record is completed using waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the shipping container (enclosed with other documentation in a plastic zipper-type bag). As long as custody forms are sealed inside the shipping container and the custody seals are intact, commercial carriers are not required to sign the custody form.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

I. Quality Assurance Records

Once samples have been packaged and shipped, the Chain-of-Custody copy and airbill receipt become part of the quality assurance record.

II. Attachments

A. Sample Label
B. Chain of Custody Form
C. Custody Seal

III. References

USEPA. *User's Guide to the Contract Laboratory Program*. Office of Emergency and Remedial Response, Washington, D.C. (EPA/540/P-91/002), January 1991.

Equipment Blank and Field Blank Preparation

I. Purpose

To prepare blanks to determine whether decontamination procedures are adequate and whether any cross-contamination is occurring during sampling due to contaminated air and dust.

II. Scope

The general protocols for preparing the blanks are outlined. The actual equipment to be rinsed will depend on the requirements of the specific sampling procedure.

III. Equipment and Materials

- Blank liquid (use ASTM Type II or lab grade water)
- Sample bottles as appropriate
- Gloves
- Preservatives as appropriate

IV. Procedures and Guidelines

A. Decontaminate all sampling equipment that has come in contact with sample according to SOP *Decontamination of Personnel and Equipment.*

B. To collect an equipment blank for volatile analysis from the surfaces of sampling equipment other than pumps, pour blank water over one piece of equipment and into two or three (lab dependent) 40-ml vials until there is a positive meniscus, then seal the vials. Note the sample number and associated piece of equipment in the field notes as well as the type and lot number of the water used.

For non-volatiles analyses, one aliquot is to be used for equipment. For example, if a pan and trowel are used, place trowel in pan and pour blank fluid in pan such that pan and trowel surfaces which contacted the sample are contacted by the blank fluid. Pour blank fluid from pan into appropriate sample bottles.

Do not let the blank fluid come in contact with any equipment that has not been decontaminated.

C. When collecting an equipment blank from a pump, run an extra gallon of deionized water through the pump while collecting the pump outflow into appropriate containers. Make sure the flow rate is low when sampling VOCs. If a submersible pump with disposable tubing is used, remove the disposable tubing after sampling but before decon. When decon is complete, put a 3- to 5-foot segment of new tubing onto the pump to collect the equipment blank.

D. To collect a field blank, slowly pour ASTM Type II or lab grade water directly into sample containers.

E. Document and ship samples in accordance with the procedures for other samples.

F. Collect next field sample.

V. Key Checks and Items

- Wear gloves.
- Do not use any non-decontaminated equipment to prepare blank.
- Use ASTM-Type II or lab grade water.

Groundwater Sampling for Per- and Polyfluoroalkyl Substances (PFAS)

I. Purpose and Scope

This SOP provides guidelines for groundwater sample collection for samples that will be analyzed for per- and polyfluoroalklyl substances (PFAS) via LC/MS/MS Compliant with the most recent version of the Quality Systems Manual (QSM) for which the lab is certified. This SOP should be used in conjunction with approved region-specific groundwater sampling SOPs which provide methods for general and low-flow groundwater sampling. In cases in which information in this SOP conflicts with region-specific groundwater sampling SOPs, this SOP will supersede the information in the general SOPs.

Standard techniques for collecting representative samples are summarized. These procedures are specific to the Navy Comprehensive Long-term Environmental Action Navy (CLEAN) Program. Materials, equipment, and procedures may vary; refer to the Sampling and Analysis Plan and operator's manuals for specific details. Upon identification of the selected laboratory, the Navy will request their SOPs and protocols regarding Draft EPA Method 1633.

II. Equipment and Materials

A. Equipment and Materials Required

- Groundwater sampling equipment
    1. PFAS-free tubing (avoid Teflon, Viton, PTFE and other fluorinated compounds)
        - High density polyethylene tubing (unlined)
        - If Masterflex tubing is needed for peristaltic pumps, Cole Parmer C-Flex (06424 series) and Tygon E-3603 (06509 series) are suitable options
    2. PFAS-free Bailer (if using a bailer)
    3. PFAS-free Pump such as:
        - Geotech PFAS-free Portable Bladder Pump (note, most bladder pumps include a Teflon-lined bladder, but Geotech currently has one model which is Teflon-free).
        - Panacea P120 or P125. The P200 Stainless Steel Pump may also be used, but the standard model contains Teflon at the tube connection. If you are using this Panacea model, you must request one with the "PTFE-free thread sealant option."
        - Waterra stainless foot-valve
        - QED Sample Pro
        - Monsoon or Mega Monsoon submersible pump
        - Grundfos Rediflo2 (this pump contains small Teflon components, but has not been shown to leach, it is less preferable than the other options)
        - Peristaltic pump (may be suitable for shallow locations)
- Groundwater sample containers (high density polyethylene [HDPE] bottle with HDPE screwcap), sample bottles should not be glass as glass may sorb PFAS. Sample bottle caps should not contain Teflon. Notify your project manager (PM) if bottles provided by the lab are glass or contain Teflon parts.
- Laboratory prepared deionized, certified PFAS-free water for field blank collection
- PFAS-free shipping supplies (labels [if available]2, coolers, and ice)
- Loose leaf paper without waterproof coating or a spiral-bound notebook (not waterproof) or tablet (see tablet use notes below)
- Metal clip board (if using loose-leaf paper)
- Pen (not Sharpie)
- Nitrile or latex gloves

B. Equipment and Materials to Avoid During Sampling

Equipment and materials used to collect groundwater samples should not contain any fluorinated compounds, Teflon, or synthetic rubber with fluoropolymer elastomers (e.g., Viton).

Specifically, the following material should be AVOIDED during sampling:

- Gore-Tex brand or similar high-performance outdoor clothing, clothing treated with ScotchGuard brand or similar water repellent, fluoropolymer-coated Tyvek, wrinkle-resistant fabrics, and fire- resistant clothing with fluorochemical treatment or anything advertised as water repellant.
- Weather-proof log books with fluorochemical coatings.
- New clothing that has been washed fewer than six times.

Efforts will be made to obtain PFAS-free labels; however, information on labels is scarce and labels are frequently mounted on PFAS-coated paper to allow for easy removal.

The sample collection area should be clear of the following items:

- Pre-packaged food wrappers (e.g., fast food sandwich wrappers, pizza boxes, etc.)
- Microwave popcorn bags
- Blue ice containers
- Non-Stick aluminum foil
- Kim-Wipes
- Sunscreen, insect repellant and other personal hygiene products that may contain PFAS

The use of electronics (e.g., cell phones and tablets) should be avoided without the implementation of precautionary measures outlined below:

- All devices should be used with clean, ungloved hands and an approved stylus (if desired).

Following the use of a device, hands must be washed with soap and water and clean gloves should be used prior to contact with sampling equipment (bottleware, tubing, etc.).

III. Procedures and Guidelines

Wash hands with dish detergent before sampling and don nitrile gloves. Do not use Kleen Guard powder free nitrile gloves which were shown in research to contain fluorine

Follow Navy CLEAN SOPs for low-flow or conventional groundwater sample collection, depending on site requirements.

A. Sample Collection

Once water quality parameters have stabilized for low-flow purging, samples can be collected. For conventional purging, if water quality parameters do not stabilize, a minimum of 3 well volumes must be purged prior to sample collection.

The steps to be followed for sample collection are as follows:

1. Ensure that the end of the tubing does not touch the ground or equipment. Remove the cap from the sample bottle. Position the sample bottle under the end of the tubing.
2. Fill the bottle. Do not fill the bottle past the middle of the bottle shoulder. Samples do not need to be collected headspace free.

3. Affix labels after bottles have been closed; collect only one sample at a time to avoid mislabeling. Pack the sample on ice immediately for shipment to the offsite laboratory. Avoid packing materials that may contain fluorine. Unpublished research has allowed us to generate a list of packing materials which do not contain fluorine. Please contact Bill Diguiseppi or Laura Cook for recommendations (because the research is not ours, it cannot be released externally at this time).

B. Equipment Decontamination

Whenever possible, use disposable equipment when collecting groundwater samples. If reusable equipment must be used, the equipment must be cleaned/decontaminated between uses. Alconox and Liquinox soap are acceptable for cleaning/decontaminating reusable equipment at PFAS sites. Any water used for cleaning/decontamination must be certified PFAS-free by a laboratory. Consider triple-rinsing. Once decontaminated, wrap equipment in plastic bags (such as Ziploc) or un-coated aluminum foil, and store away from potential PFAS sources.

Use of Water Quality Equipment and Water Level Indicators

Water quality meters typically do not contain PFAS. However, consistent with general sampling SOPs, disconnect the water quality meter prior to sampling. Some water level indicators do contain small polyvinylidene fluoride (a PFAS constituent for which we do not currently monitor) or less frequently, Teflon, components, but we have not noted cross contamination from water level indicators at any sites. The Durham Geoslope Water Level Indicators and the Solinst Model 101 with the P2 meter have been shown to be fluorine free.

IV. References

United States Environmental Protection Agency (USEPA), 2009. *Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/ Tandem Mass Spectrometry (LC/MS/MS).* September.

United States Navy, 2020. *Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs)/November 2020 Update*. November.

United States Navy, 2015. *Navy Drinking Water Sampling Policy for Perfluorochemicals: Perfluorooctane Sulfonate and Perfluorooctanoic Acid.* September.

Packaging and Shipping Procedures for Low-Concentration Samples

I. Purpose and Scope

The purpose of this guideline is to describe the packaging and shipping of low- concentration samples of various media to a laboratory for analysis.

II. Scope

The guideline only discusses the packaging and shipping of samples that are anticipated to have low concentrations of chemical constituents. Whether or not samples should be classified as low-concentration or otherwise will depend upon the site history, observation of the samples in the field, odor, and photoionization- detector readings.

If the site is known to have produced high-concentration samples in the past or the sampler suspects that high concentrations of contaminants might be present in the samples, then the sampler should conservatively assume that the samples cannot be classified as low-concentration. Samples that are anticipated to have medium to high concentrations of constituents should be packaged and shipped accordingly.

If warranted, procedures for dangerous-goods shipping may be implemented. Dangerous goods and hazardous materials pose an unreasonable risk to health, safety, or property during transportation without special handling.

Equipment and Materials

- Coolers
- Clear tape
- Strapping tape
- Contractor bags
- Absorbent pads or equivalent
- Resealable bags
- Bubble bags (for glass bottle ware)
- Bubble wrap (if needed)
- Ice
- Custody seals

III. Procedures and Guidelines

Low-Concentration Samples

A. Prepare coolers for shipment:
    - Tape drains shut.
    - Place mailing label with laboratory address on top of coolers.
    - Fill bottom of coolers with absorbent pads or similar material.
    - Place a contractor bag inside the cooler.
B. Affix appropriate adhesive sample labels to each container. Protect with clear packing tape.
C. Arrange decontaminated sample containers in groups by sample number. Consolidate VOC samples into one cooler to minimize the need for trip blanks. Cross check CoC to ensure all samples are present.
D. Seal each glass sample bottle within a separate bubble bag (VOCs grouped per sample location). Sample labels should be visible through the bag. Whenever possible, group samples per location for all analytes and place in resealable bags. Make sure to release as much air as practicable from the bag before sealing.
E. Arrange sample bottles in coolers so that they do not touch.
F. If ice is required to preserve the samples, cubes should be repackaged in resealable bags and placed on and around the containers.
G. Fill remaining spaces with bubble wrap if needed.
H. Complete and sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or the courier.

I. Close lid and latch.
J. Carefully peel custody seals from backings and place intact over lid openings (right front and left back). Cover seals with clear packing tape.
K. Tape cooler shut on both ends, making several complete revolutions with strapping tape. Cover custody seals with clear packing tape to avoid seals being able to be peeled from the cooler.
L. Relinquish to Federal Express or to a courier arranged with the laboratory. Scan airbill receipt and CoC and send to the sample documentation coordinator along with the other documentation.

Medium- and High-Concentration Samples:

Medium- and high-concentration samples are packaged using the same techniques used to package low-concentration samples, with potential additional restrictions. If applicable, the sample handler must refer to instructions associated with the shipping of dangerous goods for the necessary procedures for shipping by Federal Express or other overnight carrier. If warranted, procedures for dangerous-goods shipping may be implemented. Dangerous goods and hazardous materials pose an unreasonable risk to health, safety, or property during transportation without special handling.

IV. Key Checks and Items

- Be sure laboratory address is correct on the mailing label
- Pack sample bottles carefully, with adequate packaging and without allowing bottles to touch
- Be sure there is adequate ice
- Include chain-of-custody form
- Include custody seals

Figure 1. Adit 6 Distance to Well Locations

CUI

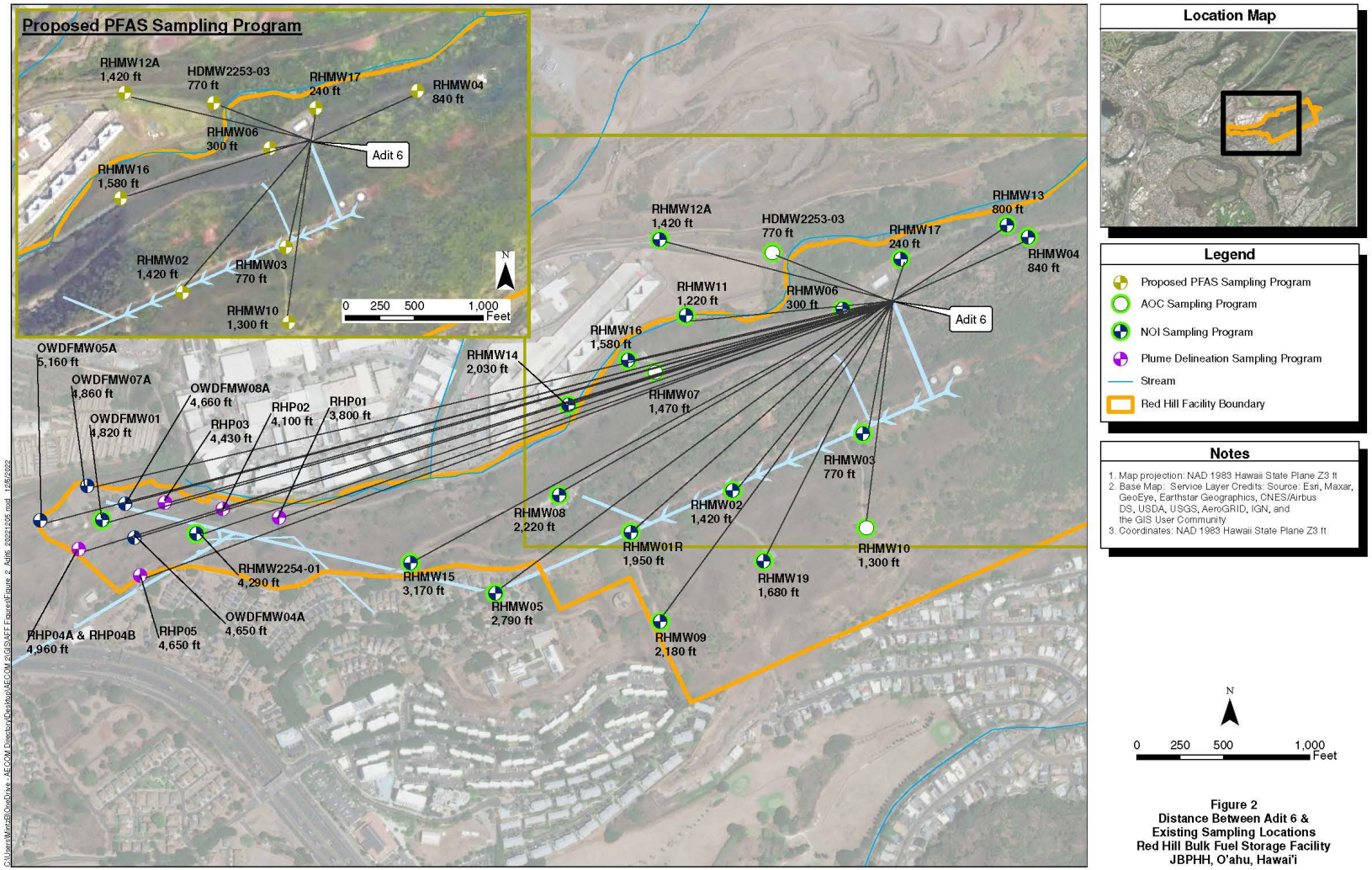

Figure 2
Distance Between Adit 6 &
Existing Sampling Locations
Red Hill Bulk Fuel Storage Facility
JBPHH, O'ahu, Hawai'i

CUI
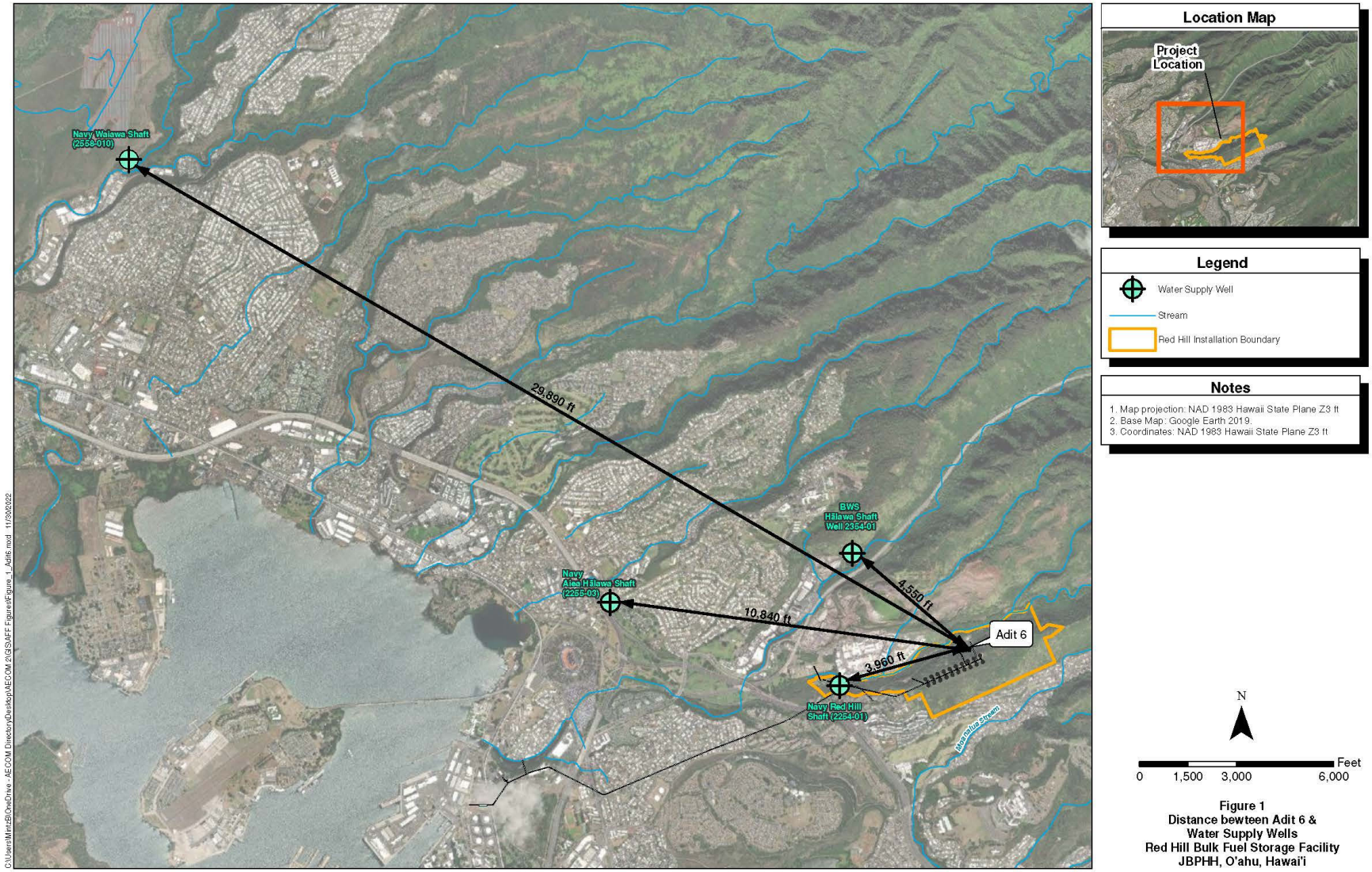
Figure 2. Adit 6 Distance to Drinking Water Wells