FINAL
Site Inspection
Quality Assurance Project Plan Addendum
Camp Rilea
Warrenton, Oregon

Perfluorooctanesulfonic Acid (PFOS) and
Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

October 2021

Prepared for:

Army National Guard Bureau
111 S. George Mason Drive
Arlington, VA 22204

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AOI	area of interest
APP	Accident Prevention Plan
amsl	above mean sea level
ANG	Air National Guard
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
bgs	below ground surface
Census	United States Census Bureau
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CoC	chain of custody
CPR	cardiopulmonary resuscitation
CSM	conceptual site model
DA	Department of the Army
DL	detection limit
DO	dissolved oxygen
DoD	Department of Defense
DOE	Department of Energy
DPT	direct-push technology
DQI	data quality indicators
DQO	data quality objectives
DUA	Data Usability Assessment
ELAP	Environmental Laboratory Accreditation Program
ERB	equipment rinsate blank
FOSA	perflourinated sulfonamides
FRB	field reagent blank
GCAL	Gulf Coast Analytical Laboratories, LLC
GPS	global positioning system
HAZWOPER	hazardous waste operations and emergency response
HDPE	high-density polyethylene
HQ	Hazard Quotient
IDQTF	Intergovernmental Data Quality Task Force
IDW	investigation-derived waste
ISC	instrument sensitivity check
LC/MS/MS	liquid chromatography tandem mass spectrometry

LOD	limit of detection
LOQ	limit of quantitation
LW	Lake and Wetland
MAES	Multiple Award Environmental Services
mg/L	milligrams per liter
MPC	measurement performance criteria
MR	Military Reserve
MS/MSD	matrix spike/ matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
NOAA	National Oceanic and Atmospheric Administration
NS	Natural Shorelands
NTU	nephelometric turbidity units
OAR	Oregon Administrative Rules
ODEQ	Oregon Department of Environmental Quality
OMD	Oregon Military Department
OPR	Open Space Parks and Recreation
ORARNG	Oregon Army National Guard
ORP	oxidation-reduction potential
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Administration
OWRD	Oregon Water Resources Department
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFTeA	perflourotetradecanoic acid
PID	photoionization detector
PILs	Pollution Initiation Levels
PPE	personal protective equipment
PQAPP	Programmatic UFP-QAPP
PVC	poly-vinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RA-1	Residential Agriculture 1
RA-5	Residential Agriculture 5
RI	Remedial Investigation
RV	recreational vehicle

SDG	sample delivery group
Shaw	Shaw Environmental, Inc.
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
TCRA	Time Critical Removal Action
TO	Task Order
TOC	total organic carbon
TPP	Technical Project Planning
TSA	technical system audit
UCL	upper confidence limit
UCMR3	Unregulated Contaminant Monitoring Rule 3
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTES	Unit Training Equipment Site

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1. Introduction

1.1 Project Authorization

This is the Installation-Specific Addendum to the Army National Guard (ARNG) per- and polyfluoroalkyl substances (PFAS) Site Inspection (SI) Programmatic Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP). This SI UFP-QAPP Addendum addresses specific SI activities to be completed at Camp Rilea in Warrenton, Oregon.

The ARNG G9 is the lead agency in performing *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide*. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor AECOM Technical Services, Inc. (AECOM) under Contract Number W912DR-12-D-0014, Task Order (TO) W912DR17F0192, issued 11 August 2017. Programmatically, the ARNG is assessing the potential environmental impacts primarily from aqueous film forming foam (AFFF) and similar chemical releases suspected at their properties related to processes that used PFAS (e.g., fire training, firefighting, and metal plating).

The SI project elements will be performed by AECOM in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; US Environmental Protection Agency [USEPA], 1980), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] Part 300; USEPA, 1994), and in compliance with US Department of the Army (DA) requirements and guidance for field investigations, including specific requirements for sampling for PFOA, PFOS, and perfluorobutanesulfonic acid (PFBS), and the group of related compounds known in the industry as PFAS. The term PFAS will be used throughout this plan to encompass all PFAS being evaluated, including PFOA, PFOS, and PFBS, which are the key components of the suspected releases being evaluated, and the other 15 related compounds listed in the TO. This UFP-QAPP Addendum focuses on the SI phase of work specific to Camp Rilea (also referred to as the “facility”) in Warrenton, Oregon.

1.2 SI Purpose

The objective of this SI effort is to identify whether there has been a release to the environment from the Areas of Interest (AOIs) identified in the PA and determine the presence or absence of PFOA, PFOS, and PFBS at or above screening levels (SLs) at the facility.

As stated in the *Federal Facilities Remedial Site Inspection Summary Guide* (USEPA, 2005), an SI has five goals:

1) Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.
2) Determine the potential need for a removal action (i.e., Time Critical Removal Action [TCRA]; applies to drinking water only).
3) Collect or develop data to evaluate the release.
4) Collect additional data to develop the conceptual site model (CSM) in preparation for an effective Remedial Investigation (RI).

5) Collect data to determine whether the release is more than likely the result of activities associated with the Department of Defense (DoD).

In addition to the USEPA identified goals of an SI, the ARNG SI effort will also aim to evaluate whether the concentrations can be attributed to on-facility or off-facility sources that were identified within 4 miles of the installation as part of the PA (e.g., fire stations, major manufacturers, other DoD facilities).

1.3 QAPP Addendum Organization

Elements of every ARNG PFAS SI are addressed in the SI Programmatic UFP-QAPP (PQAPP) (AECOM, 2018). The PQAPP is comprehensive and is consistent with the USEPA's intent that the UFP-QAPP be the primary planning document for an entire project (Intergovernmental Data Quality Task Force [IDQTF], 2005a-c). This QAPP Addendum, in combination with the PQAPP elements, meets the requirements set forth in the UFP for QAPPs (IDQTF, 2005a-c) *and USEPA Requirements for Quality Assurance Project Plans* (USEPA, 2001).

This QAPP Addendum was prepared to include the detailed information specific to the SI at Camp Rilea. For ease of review, material from the PQAPP is included in this deliverable alongside the Camp Rilea-specific worksheets. **Table 1-1** below describes the components that are covered under the PQAPP and those that are covered under this UFP-QAPP Addendum.

Table 1-1: Comparison of PQAPP to QAPP Addendum

QAPP Addendum Worksheets	Applicable Document
Worksheets #1 and #2- Title and Approval Page and QAPP Identifying Information	**Programmatic/Site-Specific**
Worksheets #3 and #5- Project Organization and QAPP Distribution	**Programmatic/Site-Specific**
Worksheets #4, #7, #8- Personnel Qualifications and Sign-off Sheet	**Programmatic/Site-Specific**
Worksheet #6- Communication Pathways	**Programmatic/Site-Specific**
Worksheet #9- Technical Project Planning Session Summary	**Site-Specific**
Worksheet #10- Conceptual Site Model	**Site-Specific**
Worksheet #11- Project/ Data Quality Objectives	**Site-Specific**
Worksheet #12- Measurement Performance Criteria	**Programmatic**
Worksheet #13- Secondary Data Uses and Limitations	**Programmatic**
Worksheets #14 and #16- Project Tasks and Schedule	**Site-Specific**
Worksheet #15- Screening Limits and Laboratory- Specific Detection/ Quantitation Limits	**Programmatic**
Worksheet #17- Sampling Design and Rationale	**Site-Specific**
Worksheet #18- Sampling Locations and Methods	**Site-Specific**
Worksheets #19 and #30- Sample Containers, Preservation and Hold Times	**Programmatic**

QAPP Addendum Worksheets	Applicable Document
Worksheet #20- Field Quality Control Summary	**Programmatic/Site-Specific**
Worksheet #21- Field Standard Operating Procedures	**Programmatic**
Worksheet #22- Field Equipment Calibration, Maintenance, Testing and Inspection	**Programmatic**
Worksheet #23- Analytical Standard Operating Procedures	**Programmatic**
Worksheet #24- Analytical Instrument Calibration	**Programmatic**
Worksheet #25- Analytical Instrument and Equipment Maintenance, Testing and Inspection	**Programmatic**
Worksheets #26 and #27- Sample Handling, Custody and Disposal	**Programmatic**
Worksheet #28- Analytical Quality Control and Corrective Actions	**Programmatic**
Worksheet #29- Project Documents and Records	**Programmatic**
Worksheets #31, #32 and #33- Assessments and Corrective Action	**Programmatic**
Worksheet #34- Data Verification and Validation Inputs	**Programmatic**
Worksheet #35- Data Verification Procedures	**Programmatic**
Worksheet #36- Data Validation Procedures	**Programmatic**
Worksheet #37- Data Usability Assessment	**Programmatic**

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QAPP Worksheets #1 & #2: Title and Approval Page and QAPP Identifying Information

Site Name/Project Name: Army National Guard / Multiple Award Environmental Services (MAES) Delivery Order 00014/ Preliminary Assessments (PA) and Site Inspections (SI) for Perfluorooctanesulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites, ARNG Installations, Nationwide

Installation: Camp Rilea, Warrenton, Oregon

Contract Work Assignment Number: USACE Contract No. W912DR-12-D-0014; Delivery Order No. W912DR17F0192

Relevant Plans and Reports from Previous Investigations: Relevant plans and reports from previous investigations are identified in the references cited in the introductory text that precedes these worksheets and in subsequent worksheets, as appropriate.

Mitchell, Claire
Digitally signed by Mitchell, Claire
DN: dc=com, dc=aecomnet, dc=na, ou=AECOMIsolated, ou=USDFARS, ou=AECOMUsers, ou=USSTL1, cn=Mitchell, Claire
Date: 2021.09.08 21:29:05 -04'00'

Investigative Organization Project Manager — Signature / Date
Printed Name / Organization — Claire Mitchell / AECOM Project Manager

Gettier, Sarah
Digitally signed by Gettier, Sarah
Date: 2021.09.09 16:07:39 -04'00'

Investigative Organization Quality Manager — Signature / Date
Printed Name / Organization — Sarah Gettier / AECOM Project QC Officer

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Digitally signed by CONNOLLY.DAVID.M.1292853633
Date: 2021.09.15 08:40:54 -04'00'

Army National Guard — Signature / Date
Printed Name / Organization — David Connolly / ARNG Program Manager

ARNOLD.JAMES.G.1289948895
Digitally signed by ARNOLD.JAMES.G.1289948895
Date: 2021.09.27 13:42:03 -07'00'

Oregon Army National Guard — Signature / Date
Printed Name / Organization — James G. Arnold / Environmental Program Manager

PECK.TIMOTHY.JOSEPH.1252325553
Digitally signed by PECK.TIMOTHY.JOSEPH.1252325553
Date: 2021.09.14 14:55:40 -04'00'

Contract Organization Project Manager — Signature / Date
Printed Name / Organization — Timothy Peck / USACE, Baltimore District

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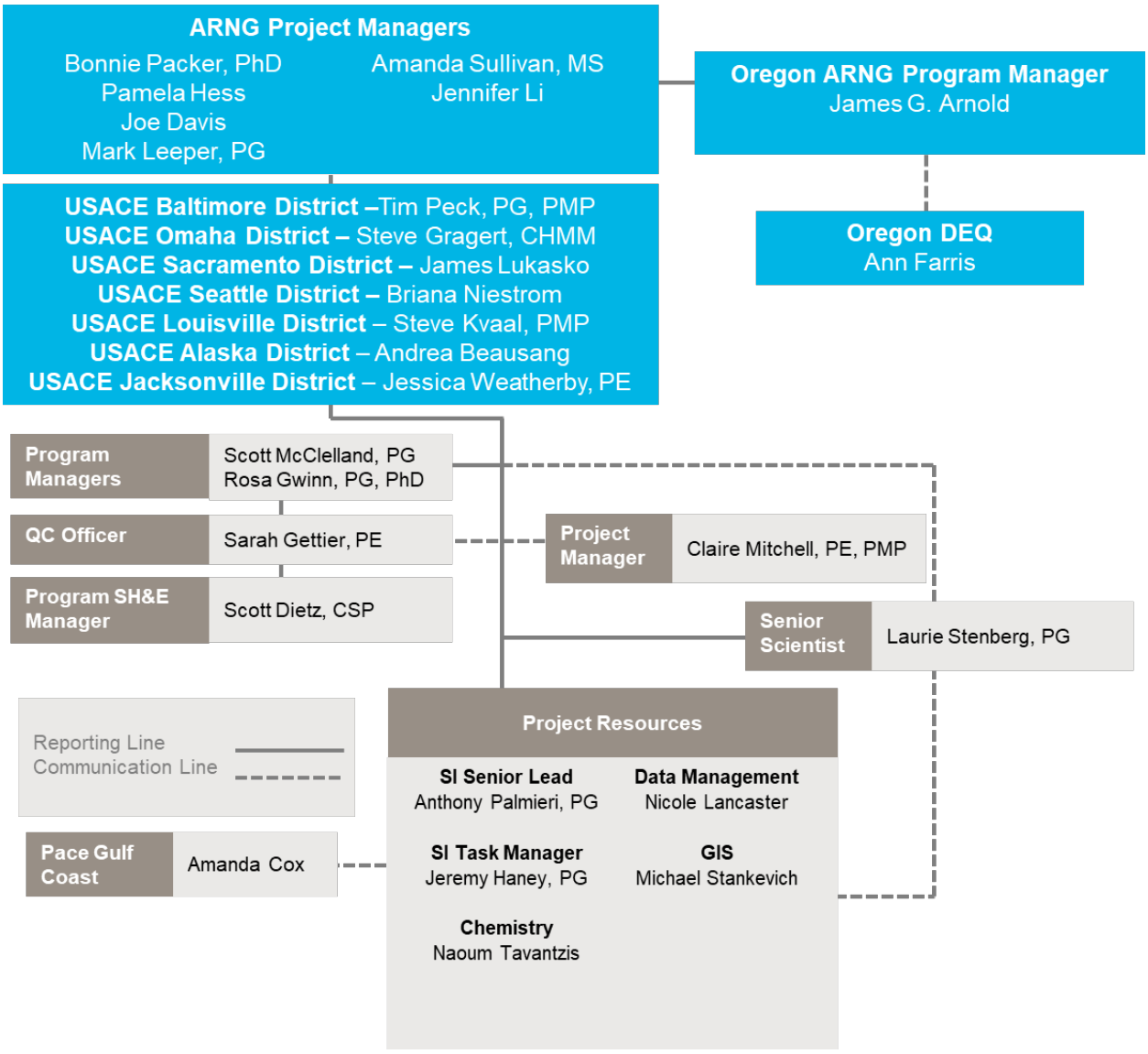
QAPP Worksheets #3 & #5: Project Organization and QAPP Distribution

The organization chart in **Figure 3-1** identifies key project personnel, as well as lines of authority and lines of communication among the ARNG, USACE, and prime contractor (AECOM). The QAPP Addendum will be distributed to all parties noted in the figure below. This organization chart is consistent with the PQAPP with the exception of the state regulatory personnel.

Figure 3-1 Project Organizational Chart



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QAPP Worksheets #4, #7 & #8: Personnel Qualifications and Sign-off Sheet

This worksheet contains a list of the key project personnel who are identified as performing the tasks that are defined in this QAPP Addendum and includes the personnel's organization, project role, education/experience, and specialized training/certifications. The personnel have signed and dated the worksheet to signify that they agree with the information in this QAPP Addendum and agree to implement it.

Name	Organization	Project Role	Education/Experience	Specialized Training / Certifications	Signature/Date
Scott McClelland, PG	AECOM	MAES Program Manager	Education: BA, Geology MS, Geology Experience. 30+ years; executing and managing environmental investigation and remediation projects including program management of USACE Baltimore contracts.	Professional Geologist, KY AECOM Certified PM	Signature available upon request.
Rosa Gwinn, PG, PhD	AECOM	ARNG Program Manager	Education: BA, Geology MS, Geology PhD, Geology Experience: 33+ years; managed 4 ORA Phase II TOs of similar scope, complexity, and duration for USACE and ARNG; experience with PFAS investigations.	Professional Geologist, WA, UT AECOM Certified PM OSHA 40hr HAZWOPER OSHA 8hr Refresher AECOM PFAS Sampling Training	Signature available upon request.
Claire Mitchell, PE, PMP	AECOM	Project Manager	Education: BS, Civil Engineering Experience: 10+ years of environmental engineering experience including task management for PFAS investigations for DoD clients.	Professional Engineer, MO PMP Certification AECOM Certified PM OSHA 40hr HAZWOPER OSHA 8hr Refresher First Aid/ CPR AECOM PFAS Sampling Training	Signature available upon request.

Name	Organization	Project Role	Education/Experience	Specialized Training / Certifications	Signature/Date
Laurie Stenberg, PG	AECOM	Senior Scientist	Education: BA, Geology Experience: 27 years; served as senior scientist for ORA Phase II TOs; experience with PFAS investigations.	Professional Geologist, PA AECOM Certified PM OSHA 40hr HAZWOPER OSHA 8hr Refresher AECOM PFAS Sampling Training	Signature available upon request.
Jacquelyn Harrington, CHMM	AECOM	Senior Scientist	Education: BA, Biology Experience: 27+ years; served as senior scientist for ORA Phase II TOs; MMRP RIs, experience with PFAS investigations.	CHMM AECOM Certified PM OSHA 40hr HAZWOPER OSHA 8hr Refresher OSHA 8hr Supervisor First Aid/CPR AECOM PFAS Sampling Training	Signature available upon request.
Sarah Gettier	AECOM	QC Officer	Education: BS, Civil Engineering, MS Environmental Engineering Experience: 15+ years direct experience developing QAPPs and other environmental planning documents as a technical leader.	OSHA 40hr HAZWOPER OSHA 8hr Supervisor OSHA 8hr Refresher First Aid/CPR AECOM PFAS Sampling Training	Signature available upon request.
Scott Dietz, CSP, STSC	AECOM	Health and Safety Officer	Education: BS, Safety Sciences Experience: 23+ years; managing safety, health, and environment on construction, environmental, and remediation projects including government projects requiring compliance with the USACE Engineering Manual 385-1-1.	CSP STSC OSHA 40hr HAZWOPER OSHA 500 Trainer for OSHA for Construction Industry OSHA 510 OSHA Standards for the Construction Industry OSHA 30hr Construction OSHA 10hr Construction OSHA 8hr Refresher	Signature available upon request.

Name	Organization	Project Role	Education/Experience	Specialized Training / Certifications	Signature/Date
Anthony Palmieri, PG	AECOM	SI Senior Lead	Education: BS, Biology Experience: 14+ years of managing and conducting environmental site investigations, including PFAS, for DoD clients.	Professional Geologist, OR, WA AECOM Certified PM 40hr HAZWOPER OSHA 8hr Refresher 8hr OSHA Supervisor 30hr OSHA Supervisor	Signature available upon request.
Jeremy Haney, PG	AECOM	SI Task Manager	Education: BS, Geology Experience: 17+ years of task management; planning and implementing environmental investigations and remediations; and conducting MMRP SIs, RIs, and TCRAs.	Professional Geologist, OR, WA 40hr HAZWOPER OSHA 8hr Refresher 8hr OSHA Supervisor AECOM PFAS Sampling Training	Signature available upon request.
Robert Kennedy	AECOM	Senior Chemist	Education: BA, Chemistry Experience: 27+ years; served as senior scientist for ORA Phase II TOs; experience with PFAS investigations.	Auditing/Data Review training	Signature available upon request.
Naoum Tavantzis	AECOM	Project Chemist	Education: BA, Environmental Science Masters of Business Administration Experience: 9+ years; project chemist for ORA Phase II TOs; PFAS investigations, data validation, laboratory coordination.	OSHA 40hr HAZWOPER OSHA 8hr Refresher OSHA 8hr Supervisor AECOM PFAS Sampling Training	Signature available upon request.
Michael Stankevich	AECOM	GIS Specialist	Education: BA, Environmental Studies Experience: 9+ years; completed SDSFIE submittals for multiple ARNG installations.	ArcGIS Training	Signature available upon request.

Name	Organization	Project Role	Education/Experience	Specialized Training / Certifications	Signature/Date
Nicole Lancaster	AECOM	Data Management	Education: BS, Marine Biology, MS Chemistry Experience: 10+ years, experience with data validation, data management, laboratory coordination, and field sampling.	OSHA 40hr HAZWOPER OSHA 8hr Refresher First Aid/CPR AECOM PFAS Sampling Training	Signature available upon request.
Gretchen Welshofer	AECOM	Regulatory Specialist	Education: BA, Communication MS, Environmental Science Experience: 27+ years; performing human health risk assessments; expertise in evaluating potential risks and hazards to human health posed by PFAS at DoD facilities; developed technical approach document that helps facilities manage PFAS-affected environmental media and waste streams; expertise in evaluating contaminant fate and transport for validity of exposure pathways.	NA	Signature available upon request.
Sarah Stinger, PG	AECOM	Technical Quality	Education: BS, Geology MS, Geology Experience: 33+ years; performing CERCLA investigations; served as task leader and in QA role for ORA Phase II TOs at multiple ARNG installations.	Professional Geologist, VA, PA, LA AECOM Certified PM OSHA 40hr HAZWOPER OSHA 8hr Refresher	Signature available upon request.
Amanda Martin, MS	AECOM	Technical Quality	Education: BS, Environmental Science; MS, Environmental Science and Engineering Experience: 7+ years; experience with QAPP development and PFAS investigations for DoD clients, including PAs and SIs for the ARNG; SIs and RIs on USACE Baltimore and New England contracts.	OSHA 40hr HAZWOPER OSHA 30hr Construction OSHA 8hr Refresher OSHA 8hr Supervisor First Aid/CPR AECOM PFAS Sampling Training	Signature available upon request.

Name	Organization	Project Role	Education/Experience	Specialized Training / Certifications	Signature/Date
Joe Witte	AECOM	Project Coordinator	Education: BS, Environmental Science and Policy Experience: 4+ years with 2 years direct experience working on ARNG and Army investigations under MMRP and ORA and developing QAPPs.	OSHA 40hr HAZWOPER OSHA 8hr Refresher First Aid/CPR AECOM PFAS Sampling Training	Signature available upon request.
Amanda Cox	Pace Gulf Coast (Formerly GCAL)	Laboratory Project Manager	Education: BS, Biology Experience: 3+ years as Project Manager.	NA	Signature available upon request.
William Perry	Pace Gulf Coast	Laboratory Quality Assurance Specialist	Education: BS, Chemistry American Chemistry Society Program Experience: 30+ years including QAPP development, data validation, laboratory auditing and procurement, laboratory and sampling management, organic analysis and sample preparation management.	Statistics and 17025/TNI/QSM standards	Signature available upon request.

Notes:

AECOM = AECOM Technical Services, Inc.
ARNG = Army National Guard
BA = Bachelor of Arts
BS = Bachelor of Science
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CHMM = Certified Hazardous Materials Manager
CPR = cardiopulmonary resuscitation
CSP = Certified Safety Professional
DoD = Department of Defense
GCAL = Gulf Coast Analytical Laboratories, LLC.
GIS = Geographic Information System
HAZWOPER = Hazardous Waste Operations and Emergency Response
hr = hour
ITRC= Interstate Technology and Regulatory Council
KY = Kentucky
LA = Louisiana
MAES = Multiple Award Environmental Services
MC = munitions constituents
MMRP = Military Munitions Response Program
MO = Missouri
MS = Master of Science
NA = not applicable
NH = New Hampshire
OR = Oregon
ORA = Operational Range Assessment
OSHA = Occupational Safety and Health Administration
PA = Pennsylvania
PE = Professional Engineer
PFAS = per- and polyfluoroalkyl substances
PG = Professional Geologist
PhD = Doctor of Philosophy
PM = Project Manager
PMP = Project Management Professional
QA = quality assurance
QAPP = Quality Assurance Project Plan
QC = quality control

QSM = Quality Systems Manual
RI = Remedial Investigation
SDSFIE = Spatial Data Standards for Facilities Infrastructure and Environment
SI = Site Inspection
STSC = Safety Trained Supervisor Construction
TNI = The NELAC Institute
TO = Task Order
USACE = United States Army Corps of Engineers
UT = Utah
VA = Virginia
WA = Washington

QAPP Worksheet #6: Communication Pathways

Worksheet #6 documents the issues (communication drivers) that trigger the need to communicate with other project personnel or stakeholders. The purpose of **Worksheet #6** is to ensure there are procedures in place for providing the appropriate notifications and generating the appropriate documentation when handling important communications, including those involving regulatory interfaces, unexpected events, emergencies, non-conformances, and stop-work orders.

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, Pathway, Documentation)
Program Manager decisions and modification	USACE, Baltimore District Project Manager	Tim Peck, PG, PMP	410-962-3416 timothy.j.peck@usace.army.mil	Initiate award of work and options. Track project progress through monthly reporting and daily field reporting. Stop work for quality or performance concerns.
	USACE, Omaha District Project Manager	Steve Gragert, CHMM	402-995-2743 steve.p.gragert@usace.army.mil	
	USACE, Sacramento District Project Manager	James Lukasko	916-557-5392 james.i.lukasko@usace.army.mil	
	USACE, Seattle District Project Manager	Briana Niestrom	206-764-3498 Briana.C.Niestrom@usace.army.mil	
	USACE, Louisville District Project Manager	Steve Kvall, PMP	502-315-6316 Steven.Kvaal@usace.army.mil	
	USACE, Alaska District Project Manager	Andrea Beausang	907-753-2557 Andrea.L.Beausang@usace.army.mil	
	USACE, Jacksonville District Project Manger	Jessica Weatherby, PE	904-232-2178 Jessica.A.Weatherby@usace.army.mil	

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, Pathway, Documentation)
Program Technical Review	ARNG Project Managers	Bonnie Packer, PhD Pamela Hess Joe Davis Mark Leeper, PG Amanda Sullivan, MS Jennifer Li	703-607-7977 bonnie.m.packer.ctr@mail.mil 208-880-9734 pamela.s.hess.mil@mail.mil 615-791-1139 joe.b.davis36.ctr@mail.mil 804-516-3529 mark.s.leeper.ctr@mail.mil 304-642-6000 Amanda.d.sullivan7.ctr@mail.mil 301-717-6939 Jennifer.j.li@colostate.edu	The AECOM PM will obtain ARNG technical review and concurrence of the QAPP and project documents and any field modifications/QAPP changes as necessary. All approved modifications will be included in QAPP revisions (prior to field work). ARNG technical review and comments will be incorporated into the QAPP and project documents and a record of ARNG comments saved in project files for documentation.
Installation interface	ORARNG	Kelly Toynton, PE	503-584-3872 kelly.a.toynton.nfg@mail.mil	Communicate project scope/schedule and coordinate logistics between project team and installation personnel on an as-needed basis, documented via phone records and emails.
Regulatory agency interface (Oregon Department of Environmental Quality)				Communicate technical approaches and decisions directly to regulatory agencies' representative(s) on an as-needed basis, documented via phone records and emails.
Community/ media interface				Communicate information directly to communities or media on an as-needed basis.
Manage all project phases Field progress reports Field modifications/QAPP changes	AECOM Project Manager	Claire Mitchell, PE, PMP	703-682-9098 claire.mitchell@aecom.com	All materials and information about the project will be forwarded from the AECOM PM to ARNG/ USACE. Any field or laboratory changes will be coordinated with Briana Niestrom (USACE), Joe Davis (ARNG), and James Arnold (ORARNG). The AECOM PM will obtain ARNG/USACE approval/ concurrence for field modifications/ QAPP changes as necessary. All approved modifications will be included in QAPP revisions (prior to field work) or field change request forms (during field work), and resolution/ corrective action identified.

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, Pathway, Documentation)
	AECOM SI Senior Lead	Anthony Palmieri	206-438-2417 anthony.palmieri@aecom.com	Support AECOM PM in implementing SI tasks/procedures. Disseminate programmatic information from PM to SI Task Managers. Serve as lead verifier for SI documents.
	AECOM SI Task Manager	Jeremy Haney	971-323-6296 jeremy.haney@aecom.com	Responsible for overseeing preparation of SI QAPP and SI Report. Oversee daily activities and site-related communications. Communicate directly with SH&E manager.
	AECOM QC Officer	Sarah Gettier	301-944-0159 sarah.gettier@aecom.com	Oversee/conduct quality audits to assure field program performed in accordance with approved protocols. Support AECOM PM, Technical Task Manager, and Team Leaders to assure quality reviews are completed on project deliverables, including consistency and conformance with applicable regulatory and DoD guidance and with industry practices. Work with Project Chemist to resolve performance problems with contracted analytical laboratory.
Analytical laboratory modifications and performance problems	AECOM Project Chemist / Data Validator	Naoum Tavantzis	301-267-8761 naoum.tavantzis@aecom.com	Notify AECOM PM and QC Officer in a timely manner of performance problems encountered by the contracted analytical laboratory. PM will secure approval for modifications to the QAPP as necessary from ARNG/ USACE. All approved modifications will be included in Nonconformance and Corrective Action Report.
Data verification issues (e.g., incomplete records) and data validation issues (e.g., non-compliance with procedures)	AECOM Project Chemist / Data Validator	Naoum Tavantzis	301-267-8761 naoum.tavantzis@aecom.com	Verify/validate all analytical chemistry sample results from analytical laboratories with criteria developed in this QAPP and deliver to the PM and the Project QA Managers.
Data review corrective actions	AECOM Project Chemist / Data Validator	Naoum Tavantzis	301-267-8761 naoum.tavantzis@aecom.com	Notify Laboratory PMs to identify resolution/corrective actions.
Sample receipt variances	Pace Gulf Coast	Amanda Cox	225-214-7047 amanda.cox@pacelabs.com	Report all project non-conformances and problems to the AECOM Project Chemist.
Laboratory QC variances				Report all project non-conformances and problems to the AECOM Project Chemist.
Analytical corrective actions				Report all project non-conformances and problems to the AECOM Project Chemist.

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, Pathway, Documentation)
Laboratory modifications and performance problems				Report all project non-conformances and problems to the Pace Gulf Coast PM. Pace Gulf Coast PM will report to AECOM Project Chemist.

Notes:
AECOM = AECOM Technical Services, Inc.
ARNG = Army National Guard
ORARNG = Oregon Army National Guard
DoD = Department of Defense
PM = Project Manager
QA = quality assurance
QAPP = Quality Assurance Project Plan
QC= quality control
SH&E = Safety, Health, and Environment
SI = Site Inspection
USACE = United States Army Corps of Engineers

QAPP Worksheet #9: Technical Project Planning Session Summary

This worksheet serves as a record of future Technical Project Planning (TPP) sessions. The intent is to provide a concise record of participants, key decisions or agreements reached, and action items. Minutes will be approved by all participants prior to being implemented into the QAPP Addendum (TPP Meeting Minutes, **Appendix A**).

AECOM will implement the TPP process as listed in Engineer Manual 200-1-2 (USACE, 2016) including facility meetings in a professional and organized manner to obtain consensus on specific Data Quality Objectives (DQOs) for SI work. Three meetings will be held (in person and/ or teleconference) per the Performance Work Statement as described below:

- TPP Meeting 1 - Discuss DQOs (pre-work plan) and CSM
- TPP Meeting 2 - Finalize work plan technical approach
- TPP Meeting 3 - Verify all data gaps have been filled and finalize SI Report

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QAPP Worksheet #10: Conceptual Site Model

The information presented in this section was gathered during the PA at Camp Rilea. The PA process included the following tasks:

- Reviewed data resources to obtain information relevant to suspected PFAS releases;
- Conducted a site visit on 11 November 2018;
- Interviewed current Camp Rilea personnel (Range Operations Officer, Training Site Manager, Fire Rangers, Public Works Facilities Manager, and Mechanic Unit Training Equipment Site [UTES]) and current Oregon Military Department (OMD) personnel (Environmental Manager, Natural Resources Conservation Manager, Wildland Fire Manager, and Real Estate/Property Manager);
- Completed visual site inspections at known or suspected PFAS release locations and documented with photographs;
- Developed CSM(s) to outline the potential release and pathway of PFAS for the AOIs and the ARNG facility.

The findings of the PA are summarized in this worksheet. Additional details about Camp Rilea can be found in the PA Report (AECOM, 2020).

Facility Location and Description

Camp Rilea is located in Warrenton, Clatsop County, Oregon, approximately 1.4 miles to the southwest of the City of Warrenton and 5.7 miles to the southwest of the City of Astoria. The facility is located west of Highway 101 and includes approximately 3 miles of ocean frontage along the Pacific Ocean (**Figure 10-1**).

The facility is occupied and operated by the Oregon ARNG (ORARNG) as a military training center for military personnel, encompassing 1,750 acres (Mitchell, 2001). Civilians also use certain areas throughout Camp Rilea for recreational purposes throughout the year. Camp Rilea's mission for the federal government is to provide facilities and resources as a training center contributing readiness and military capability for the armed forces of the US and Oregon. Camp Rilea's mission for the State of Oregon is to provide community service support and serve as the regional base for Oregon's North Coast emergency response and recovery operations (Oregon, 2018).

The facility consists of the cantonment area and armory (450 acres), training and range areas (1,400 acres), and a wastewater treatment facility with two sewage lagoons adjacent to a spray irrigation area (20 acres) (DA, 2001). Camp Rilea's cantonment area encompasses dining and support facilities and temporary living facilities; numerous buildings are scattered across the facility for administration, maintenance, medical, petroleum oil and fuel storage, equipment and vehicles storage (including at the UTES facility), and a fire station building (DA, 2001). The Air National Guard (ANG) facility operates on approximately 6.25 acres along the central/eastern Camp Rilea boundary and consists primarily of a building within a fenced area (DA, 2001). Access to Camp Rilea is controlled. Camp Rilea also uses up to 352,000 acres of private and public land for military training under landowner agreements and permits (DA, 2001).

The property which Camp Rilea currently occupies is owned by the State of Oregon, with operations beginning in 1927 (DA, 2001). The facility was formerly known as Camp Clatsop until the name was changed to Camp Rilea in 1959. Numerous improvements were made to the original facility during the 1930s. Prior to World War II, the facility was used as a mobilization site

for the 249th Coast Artillery. After the war, the facility was used as an annual training site by the 237th Air Defense Group (later named the 249th Air Defense Group) and by air defense units from Washington, Nevada, Delaware, and Pennsylvania (Shaw Environmental Inc. [Shaw], 2010; DA, 2001). Camp Rilea has been used by various military units to conduct annual or inactive duty training, including: ARNG infantry, field artillery, and engineering units; Infantry Divisions (2nd, 25th, and 75th); Special Forces Groups (1st, 19th, and 20th); various ANG communications units; Marine Corps; Coast Guard and Navy Reserve Units; Search and Rescue Organizations; Oregon State Defense Force; Oregon State Police and other police organizations; Housing Authority of Portland for Camp Rosenbaum; and by various local and civic organizations.

Facility Environmental Setting

Camp Rilea is situated in the Coast Range of the Pacific Border geologic province of Oregon (Oregon Department of Environmental Quality [ODEQ], 2013; US Department of the Interior [USDOI], 2018). The facility is bordered by the Pacific Ocean to the west, low lying sand dunes to the north and south, and low-lying wetlands and agricultural land to the east. The Coast Mountain Range is located further to the east. The western facility boundary is comprised of sand dunes that parallel the beach from north to south. A series of five sand dune ridges and five interdune areas, oriented north to south, are located throughout the facility; the dunes are separated by lakes and creeks (DA, 2001; URS and Arcadis, 2013).

The facility is moderately hilly throughout, with steeper slopes found in the western portion characterized by sand dunes. Slopes of the sand dunes are less than 10 percent (%). Elevation throughout the facility ranges from sea level at the beach up to 75 feet above mean sea level (amsl) at the sand dunes. Many of the dunes are covered by vegetation (i.e., brush and trees). Elevation along the eastern facility boundary averages 45 feet amsl, with a low of 25 feet amsl in the northeastern portion (DA, 2001; Google Earth, 2018).

Geology

Camp Rilea is located in a geologic area characterized as Dune sand of the Holocene age. Dune sand consists of large areas of windblown sand composed of rock-forming minerals, mostly feldspar and small amounts of quartz. Constituents are characterized as unconsolidated, coarse-detrital sand (US Geological Survey [USGS], 2018a). This geological feature is found along the northern Oregon Coastline, extending south to Tillamook Head (approximately five miles north and 11 miles south of Camp Rilea, respectively) (Frank, 1970).

Dune sand of the Pleistocene and Holocene ages overlies eroded surfaces of the Astoria Formation of the Tertiary age. This rock formation underlies the eastern edge of the dunes and constitutes bedrock of the sand-dune area, characterized as fine grained and tightly compacted, primarily carbonaceous sandstone. The Astoria Formation is a layer up to 1,400 feet thick. Dune sand layers may be greater than 100 feet thick, and these deposits contain the principal aquifers. The geology of the northern Oregon Coast area is characterized by a small extent of alluvium of the Quaternary age, characterized by clay, silt, and sand. Dune sand ranges in size from coarse to very fine, consisting mostly of quartz with lesser amounts of feldspar, magnetite, mica, and rock fragment. Sand is loosely compacted and unconsolidated (Frank, 1970; DA, 2001).

Hydrogeology

Soils beneath Camp Rilea consist of six different series. From west to east across the facility, the soil series are beaches, dune lands, Gearheart fine sandy loam, Heceta-Waldport fine sand, Waldport fine sand, and Warrenton loamy fine sand (URS and Arcadis, 2013; US Department of Agriculture [USDA], 2018). Beaches are present along the entire western border of the facility, at the edge of the Pacific Ocean. Dune lands are present along the entire western boundary of the

facility, east of the beaches. The beaches and dune lands are characterized with high infiltration rates. Warrenton soils are present only in the northeastern portion of the facility. With exception for beaches and dune lands, all the soil series beneath the facility consist of very deep and poorly-drained to excessively-drained soils formed in sand, dune sands, or eolian sands, located in interdunal depressions or on stabilized sand dunes (DA, 2001).

The Dune sands are the primary water-bearing unit in the area (DA, 2001; Frank, 1970). Camp Rilea is situated above the Pacific Northwest basin-fill aquifer, characterized as unconsolidated sand and gravel aquifers at or near the land surface. This type of aquifer is prevalent along stream valleys and in lowlands associated with erosional basins and yields a sufficient supply of fresh water (and saltwater along the Coast) for public drinking via wells and springs. These deposits are mostly alluvial but also consist of eolian, glacial, or volcanic deposits in other areas. The thickness of the deposits in stream valleys is typically less than 250 feet. Permeability of the aquifer is variable, depending on the soil series. The dune sands have saturated thicknesses ranging from 95 to greater than 150 feet, with most of the discharge flowing west towards the ocean (Frank, 1970). Sand and gravel commonly yields groundwater to wells in the range of 20 to 20,000 gallons per minute (USGS, 1994, 2018b, 2018c).

Because precipitation infiltrates Dune sands fairly rapidly, precipitation recharges groundwater and is distributed fairly evenly throughout the dune area. Approximately 5 inches of precipitation raises groundwater levels from their low stages on a monthly basis. Hydraulic gradients near the sides of the Dune sand aquifer steepen, causing groundwater to flow towards discharge areas. Neacoxie Creek receives groundwater recharge throughout the year, and flow increases in a downstream direction (Frank, 1970). Regionally, the water table in the Dune sand fluctuates in association with recharge from precipitation, which is quickly absorbed and stored in the Dune sand. During warm weather months with little to no precipitation (spring and summer), groundwater levels in wells decline. Water level fluctuations in the area are also a result of tidal movements. Perched groundwater in the area is noted seasonally, primarily during the wet months of fall and winter. (Frank, 1970). The aquifer of the Astoria Formation is recharged in the Coast Range to the east of Camp Rilea and discharges at the range margins both to the east and west. Groundwater flow beneath Camp Rilea in the bedrock aquifer is toward submarine recharge zones to the west. With relatively low hydraulic conductivity, there is likely little interaction between the Dune sand and bedrock aquifers (DA, 2001).

The estimated depth to groundwater at the facility (measured historically at several onsite groundwater wells in 2001) ranges from 22.6 to 32.8 feet below ground surface (bgs) (DA, 2001) Groundwater flow beneath Camp Rilea is generally from east to west, towards the Pacific Ocean. However, groundwater flow may vary in localized areas of groundwater recharging to surface water, such as Neacoxie Creek in the eastern portion of the facility (DA, 2001; URS and Arcadis, 2013). Neacoxie Creek flows off-Post to the east, eventually discharging into the Columbia River approximately three miles to the northeast of the facility, and ultimately discharging into the Pacific Ocean (AMEC, 2009). A USGS monitoring well located on the facility at a depth of 135 feet bgs (Site No. CLAT0050230) has groundwater measurements ranging from 10 to 17 feet bgs (USGS, 2018c) (**Figure 10-2**).

Camp Rilea obtains drinking water from two onsite water supply wells located in the central/western portion of the facility, east of the beach (Wells #53837 and #53838) (ODEQ, 2018; Oregon Water Resources Department [OWRD], 2018) (**Figure 10-2**). Both wells were installed in 2011 and completed with 10-inch diameter casing. Well #53837 was drilled to a depth of 172 feet bgs and completed with 20 feet of stainless steel 0.02 slotted screen from 142 to 162 feet bgs. Well #53838 was drilled to a depth of 157 feet bgs and completed with 15 feet of stainless steel 0.02 slotted screen from 132 to 147 feet bgs. Depth to groundwater measurements at wells #53837 and #53838 were 58 feet bgs and 50 feet bgs, respectively (OWRD, 2018).

Public groundwater systems used as drinking water sources are located at off-Post facilities, including the Sunset Lake recreational vehicle (RV) Park (located approximately 0.5 miles to the south of the facility) and the City of Warrenton (located less than 1 mile to the north of the facility) (ODEQ, 2018). Within a 4-mile radius of Camp Rilea, the Clatsop Plains Aquifer is used for private water supplies, and as of 2001, approximately 300 private well users were estimated to be within a 1- to 4-mile radius of the facility (DA, 2001).

The Unregulated Contaminant Monitoring Rule 3 (UCMR3) sampling program was an addition to the 1996 Safe Drinking Water Act that requires the USEPA to issue a new list, every 5 years, of no more than 30 unregulated contaminants to be monitored by public water systems. PFAS were added as part of the UCMR3 list in 2012. The UCMR3 dataset was evaluated to determine which public water systems were sampled for PFAS within a 20-mile radius of the facility; no public drinking water systems were sampled (USEPA, 2017a). PFAS sampling has been performed at Camp Rilea under the direction of the ARNG. The drinking water wells at Camp Rilea were sampled in April 2017 and analyzed for PFAS/PFOA. All PFOA, PFBA, FOSA (perflourinated sulfonamides), and PFTeA (perflourotetradecanoic acid) sample results were reported below laboratory method detection limits. The reported laboratory method detection limits were below the ODEQ Pollutant Initiation Levels (PILs) (Oregon Administrative Rule [OAR 340-045-0100]) and the EPA's drinking water healthy advisory (HA) level (USEPA, 2016a-b).

Hydrology

Camp Rilea is located within the Necanicum River subbasin of the North Coast/Lower Columbia basin. Within this feature, the eastern portion of the facility is located within the Skipanon/River-Frontal Columbia River Watershed, the western portion of the facility is located within the Arch Cape Creek-Frontal Pacific Ocean Watershed, and the southeastern portion of the facility is located in the Lower Necanicum River Watershed (**Figure 10-3**). Rivers in the North Coast subbasin generally begin in the steep terrain of the Coast Mountain Range, located east of Camp Rilea. Rivers to the west of the Coast Mountain Range, near the Pacific Coast, are surrounded by wetlands and agriculture (ODEQ, 2003).

Surface waterbodies at the facility include Neacoxie Creek (including a slough), Sunset Lake, and Slusher Lake. Neacoxie Creek originates south of the facility flowing north paralleling the eastern property boundary (east fork), entering the central/eastern properly and turning 180 degrees to flow south along the eastern property boundary (west fork), before flowing offsite to the east into the Skipanon River, which ultimately discharges to the north into the Columbia River. Sunset Lake is located in the southeastern corner of the property, where drainage flows south to the Necanicum River, ultimately discharging into the Pacific Ocean to the west (DA, 2001). Slusher Lake is located in the south/central portion of the faculty connected to a smaller lake on the adjacent property to the south, discharging to Neacoxie Creek (Frank, 1970; DA, 2001; Shaw, 2010).

Surface stormwater runoff from paved areas of the facility enters a storm drainage conveyance system located throughout the majority of the cantonment area, discharging to an outfall in Neacoxie Creek (west fork), located to the west of the facility. Stormwater throughout unpaved areas of the property infiltrates the sandy soil (DA, 2001; Shaw, 2010). Because precipitation infiltrates Dune sands rapidly, surface water runoff throughout the facility is negligible. Surface water runoff at Camp Rilea would occur during heavy precipitation events where precipitation exceeds the infiltration rate of the sandy soil (Frank, 1970).

Climate

Climate at Camp Rilea is marine temperate. Climate of the North Coast Basin is cool and moist, characterized by mild summers and wet winters, with moderately low temperatures. The area receives heavy rainfall from easterly storms originating in the Pacific Ocean that traverse the

Cascade Mountain Range to the east. The majority of precipitation occurs as rain during the fall and winter, with heavy rainfall experienced between November and March. At least one or two heavy storm events occur annually. Snowfall is rare, and the area experiences a frost-free period for 200 to 240 days, annually. Winds prevail from the northwest during summer months and from the southwest (off the Pacific Coast) during winter months (Frank, 1970; ODEQ, 2003; URS and Arcadis, 2013).

Temperatures recorded for a period of three decades (1961 to 1990) at the Astoria Regional Airport weather station (located approximately 2.8 miles northeast of the facility) ranged from a low of 36 degrees Fahrenheit (°F) in January to a high of 69°F in August, averaging 51°F annually. Precipitation recorded for this same time period ranged from an average low of 1.2 inches in July to an average high of 10.6 inches in December, averaging 6.6 inches annually (ODEQ, 2003).

Temperatures recorded for the most recent time period (2017) at Astoria Regional Airport weather station ranged from a low of 39°F in January to a high of 61°F in August, averaging 51°F for the year. Precipitation for this same year ranged from a low of 0.10 inches in July to a high of 14 inches in March, averaging 7.0 inches for the year (snow was not reported) (National Oceanic and Atmospheric Administration [NOAA], 2018).

Current and Future Land Use

Camp Rilea's mission for the federal government is to provide facilities and resources as a training center contributing readiness and military capability for the armed forces of the US and Oregon. Camp Rilea's mission for the State of Oregon is to provide community service support and serve as the regional base for Oregon's North Coast emergency response and recovery operations (Oregon, 2018).

Access to the facility is controlled. Land use to the north, east, and south is a mixture of residential and agriculture with interspersed sand dunes and wetlands. The Astoria Golf and Country Club is located east of the southeast corner of the facility. The Pacific Ocean is located adjacent to the west. The nearest urban area is Warrenton, 1.4 miles to the northeast.

The facility is zoned by Clatsop County primarily as Military Reserve (MR), with smaller footprints zoned as Residential Agriculture 5 (RA-5), Lake and Wetland (LW), Natural Shorelands (NS), and Open Space Parks and Recreation (OPR) (Clatsop County, 2018). These additional zoning codes are associated with the surface waterbodies on the facility, in addition to the residential/agricultural land that OMD also uses for training (Clatsop County, 2018).

Land to the north of the facility is zoned by the City of Warrenton as Open Space Institutional, Lake and Freshwater Wetland, and R40 - Low Density Residential (City of Warrenton, 2020). Land to the south of the facility is zoned by Clatsop County as LW, OPR, Residential Agriculture 1 (RA-1), and RA-5. Land to the east of the facility is zoned Single Family Residential, RA-5, Agriculture Forest, and LW (Clatsop County, 2018).

According to the 2017 US Census Bureau, the estimated population of Warrenton was 5,600. As of 2018, Warrenton's population increased by 500 since 2010 (US Census Bureau, 2018). The population of Warrenton and other towns in the vicinity of Camp Rilea (particularly Astoria and Seaside) increases during the summer months with vacationers (Clatsop County, 2013). The population of Warrenton is expected to increase to 6,289 by 2030, approximately 13% of the total Clatsop County population (Clatsop County, 2013).

Clatsop County's *Comprehensive Plan* does not specify restrictions for Camp Rilea or future land use changes at Camp Rilea (Clatsop County, 2013). The MR-zoned areas of Camp Rilea are defined by Clatsop County as "*intended to accommodate the immediate foreseeable demand for*

military activities in areas where a commitment to such activities has already occurred through existing uses by the military" (Mitchell, 2001). It is anticipated that Camp Rilea will remain used for military-related uses, including training, in the future. In addition, it is anticipated that the OPR-, RA-5-, LW-, and NS-zoned footprints of Camp Rilea will remain used for their intended purpose, as zoned (Mitchell, 2001).

Areas of Interest and Conceptual Site Models

PFAS-containing materials were potentially released to soil and groundwater within the boundary of Camp Rilea through former storage of firetrucks at the facility. Two AOIs were identified based on preliminary data and assumed groundwater flow directions. These AOIs are described below and presented on **Figure 10-4**.

In general, the potential PFAS exposure pathways are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of toxicological study.

AOI 1 Former Fire Station – Building 7241

AOI 1 is Building 7241, a former fire station currently occupied by Public Works offices. The former fire station dates back to the early 1970s and was operational until at least 1980. Facility personnel interviewed could not confirm if a firetruck were operated or parked at the former station. Given the history of AFFF reportedly contained in the firetrucks parked at the UTES between 1989 and 1995 (refer to AOI 2 below), it is assumed if any firetruck were parked at the former fire station, it would have also contained AFFF. Activities at the former fire station may have included washing the firetruck carrying AFFF, flushing out lines used for AFFF discharge at other locations, and storage of AFFF.

PFAS are water soluble and can migrate readily from soil to groundwater or surface water via leaching and run-off. Based on visual observations conducted during the site visit and online research, no surface water features flow through AOI 1 or the immediate surrounding area downgradient of AOI 1 (USEPA, 2017b; Google Earth, 2018). The AOI is covered by impervious surfaces (pavement and Building 7241), but a small vegetated area, approximately 10% of the AOI, is present. Precipitation infiltrating AOI 1 may cause the migration of PFAS from surface and subsurface soil to groundwater, which is estimated at a depth ranging from 10 to 32 feet bgs (DA, 2001; USGS, 2018c). Precipitation on paved areas likely flows as sheet flow northwest from AOI 1. One catch basin is located just outside the southeast corner of AOI 1 along the South Oregon Street. The catch basin is slightly uphill from potential fire truck parking areas, and on the opposite side of Building 7241 relative to the truck parking areas. Surface flow at the potential fire truck parking areas would not be intercepted by the catch basin.

Around AOI 1, groundwater flow is generally to the west (DA, 2001), but may vary in localized areas where shallow groundwater discharges to surface water, such as Neacoxie Creek located northeast of AOI 1, Neacoxie Slough located north of AOI 1, and Sunset Lake located south of AOI 1 (DA, 2001; URS and Arcadis, 2013). The effect of surface water features on groundwater flow is vertically limited to groundwater above the elevation of the surface water feature and laterally limited to close proximity to the feature. Topography at AOI 1 is primarily flat, at an elevation of approximately 35 feet amsl, with a slight downgradient slope to the north and south (Google Earth, 2018). Wetlands are located near AOI 1 (Clatsop County, 2018; US Fish and Wildlife Service [USFWS], 2018).

Although Camp Rilea obtains drinking water from two onsite water supply wells, the wells are located in the central/western portion of the facility, northwest of AOI 1, and are not interpreted to

be down gradient from the Former Fire Station. Therefore, the groundwater exposure pathway via ingestion is incomplete for site workers, construction workers, trespassers, and on-Post recreational users. Public groundwater systems are used for drinking water sources on properties surrounding the facility, including the Sunset Lake RV Park (located approximately 0.5 miles to the south) and the City of Warrenton (located less than 1 mile to the north). However, these off-Post drinking water sources are not downgradient from AOI 1. Therefore, based on the hydrologic gradient at the facility, the groundwater exposure pathway via ingestion is incomplete for off-Post recreational users and residents.

Ground-disturbing activities to surface soil at AOI 1 may result in installation worker, site worker, off-installation residents (less than 1 mile away), construction worker, and visitor/trespasser exposure to potential PFAS contamination via ingestion or inhalation of airborne particulates. Ground-disturbing activities to subsurface soil could result in site and construction worker exposure to PFAS contamination via ingestion or inhalation of airborne particulates. Therefore, the exposure pathway for ingestion or inhalation of soil is potentially complete for these receptors.

AOI 2 UTES: Former Firetruck Parking – Building 7156

AOI 2 is the UTES Former Firetruck Parking area surrounding Building 7156 in the central/eastern portion of the facility. One firetruck (model 530C) was present on-Post between 1989 and 1995. Another firetruck (model 2500L) was present on-Post from 1995 until an unknown time period. Both firetrucks reportedly contained AFFF with tank capacities of approximately 50 gallons each. AFFF from the former firetrucks was reportedly never deployed on-Post. OMD maintenance personnel performed minor repairs and maintenance of the former firetrucks at the UTES.

PFAS are water soluble and can migrate readily from soil to groundwater or surface water via leaching and run-off. Based on visual observations conducted during the site visit and online research, no surface water features flow through AOI 2. The Neacoxie Slough is located approximately 200 feet to the west and downgradient of AOI 2 (USEPA, 2017b; Google Earth, 2018). Constructed in 1987, the UTES vehicle parking area surrounding Building 7156 was covered by a pervious, gravel surface until paved in approximately 2003. Groundcover within AOI 2 currently includes building footprints, pavement, and grass. Precipitation on the paved area of AOI 2 is captured by a stormwater conveyance system. Precipitation on vegetation infiltrates the soil but can result in sheet flow to the adjacent unpaved areas, resulting in the migration of PFAS from surface and subsurface soil to groundwater, which is estimated at a depth ranging from 10 to 32 feet bgs (DA, 2001; USGS, 2018c).

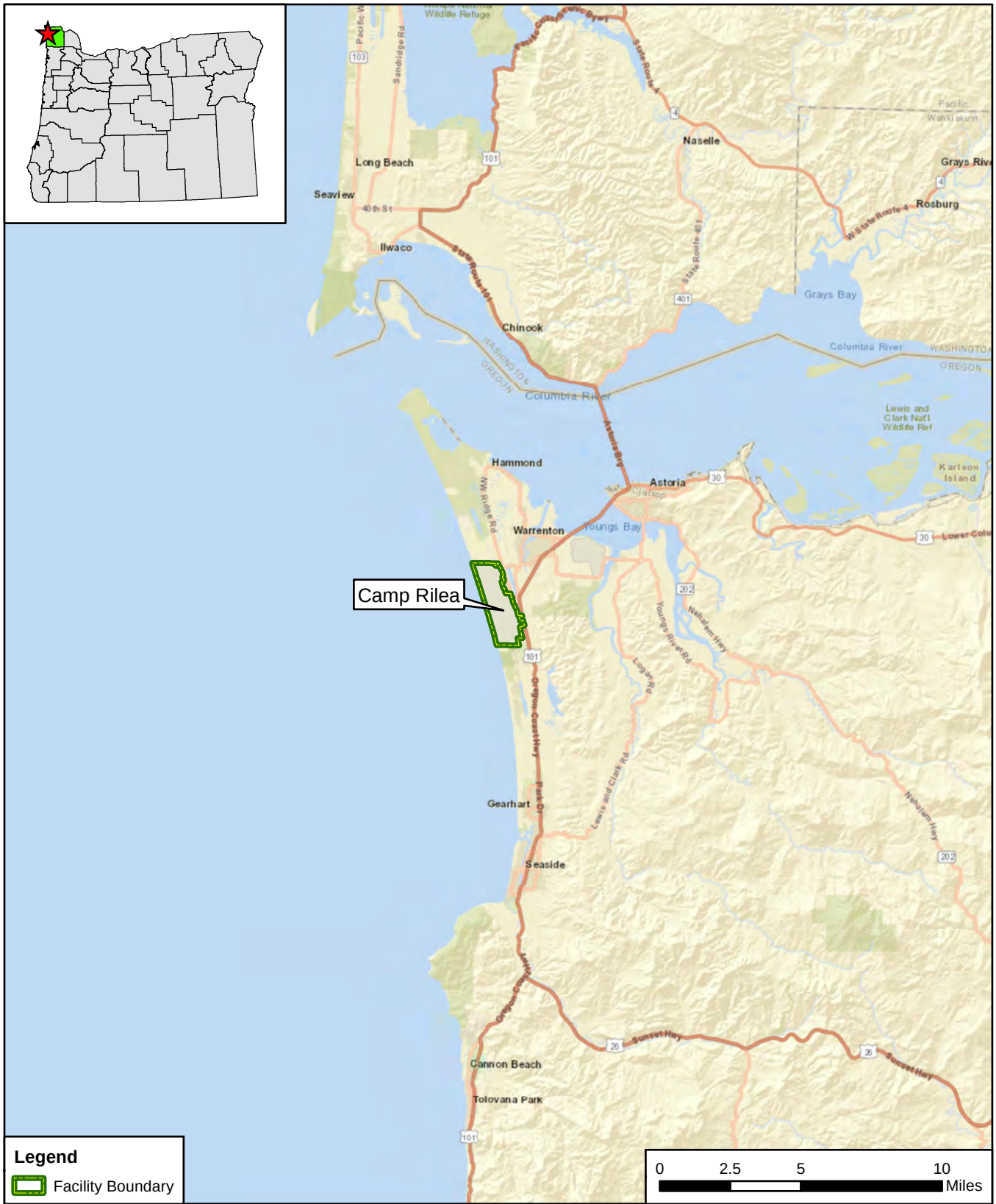
AOI 2 includes four catch basins, generally along the west and north AOI boundary. The westernmost two catch basins are not in parking areas and are on the opposite side of Building 7156 where AFFF was formerly stored. The northwest catch basis near the wash rack area and the easternmost catch basin could potentially capture PFAS if AFFF was stored within AOI 2 after the area was paved and catch basins installed in approximately 2003.

Groundwater flow follows the natural topographical gradient. Around AOI 2, subsurface flow is to the west (DA, 2001). However, groundwater flow may vary in localized areas of groundwater recharging to surface water, such as Neacoxie Creek located to the west of AOI 2 (DA, 2001; URS and Arcadis, 2013). Topography at AOI 2 is primarily flat, at an elevation of approximately 50 feet AMSL (Google Earth, 2018). Wetlands are located within the Neacoxie Slough, approximately 200 feet west and 400 feet east of AOI 2 (Clatsop County, 2018; USFWS, 2018).

Camp Rilea obtains drinking water from two onsite water supply wells located in the central/western portion of the facility and to the west and downgradient of AOI 2. These supply wells are downgradient from the UTES area. Therefore, the groundwater exposure pathway via ingestion is potentially complete for site workers, construction workers, trespassers, and on-Post

recreational users. Public groundwater systems are used for drinking water sources on properties surrounding the facility, including the Sunset Lake RV Park (located approximately 0.5 miles to the south of the facility) and the City of Warrenton (less than 1 mile to the north of the facility). However, these off-Post drinking water sources are not downgradient from AOI 2. Therefore, based on the hydrologic gradient at the facility, the groundwater exposure pathway via ingestion is incomplete for off-Post recreational users and residents.

Ground-disturbing activities to surface soil at AOI 2 may result in installation worker, site worker, off-installation residents (less than 1 mile away), construction worker, and visitor/trespasser exposure to potential PFAS contamination via ingestion or inhalation of airborne particulates. Ground-disturbing activities to subsurface soil could result in site and construction worker exposure to PFAS contamination via ingestion or inhalation of airborne particulates. Therefore, the exposure pathway for ingestion of soil is potentially complete for these receptors.



CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Camp Rilea, OR			
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SCALE	1:316,800	CHK BY	MB	5/20/2021
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	5/20/2021

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 10-1

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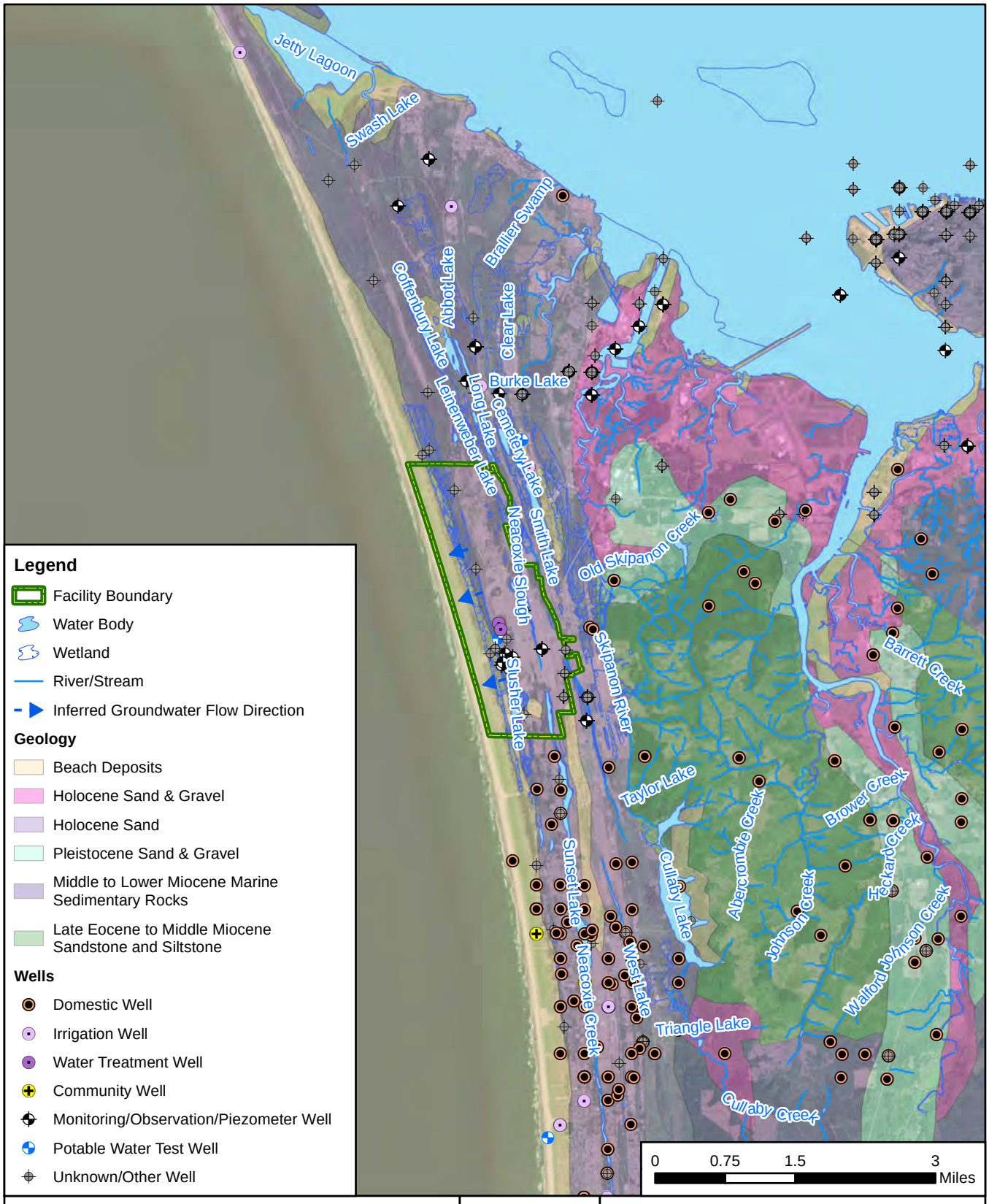

CLIENT	ARNG			
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Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	5/20/2021

Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 10-2

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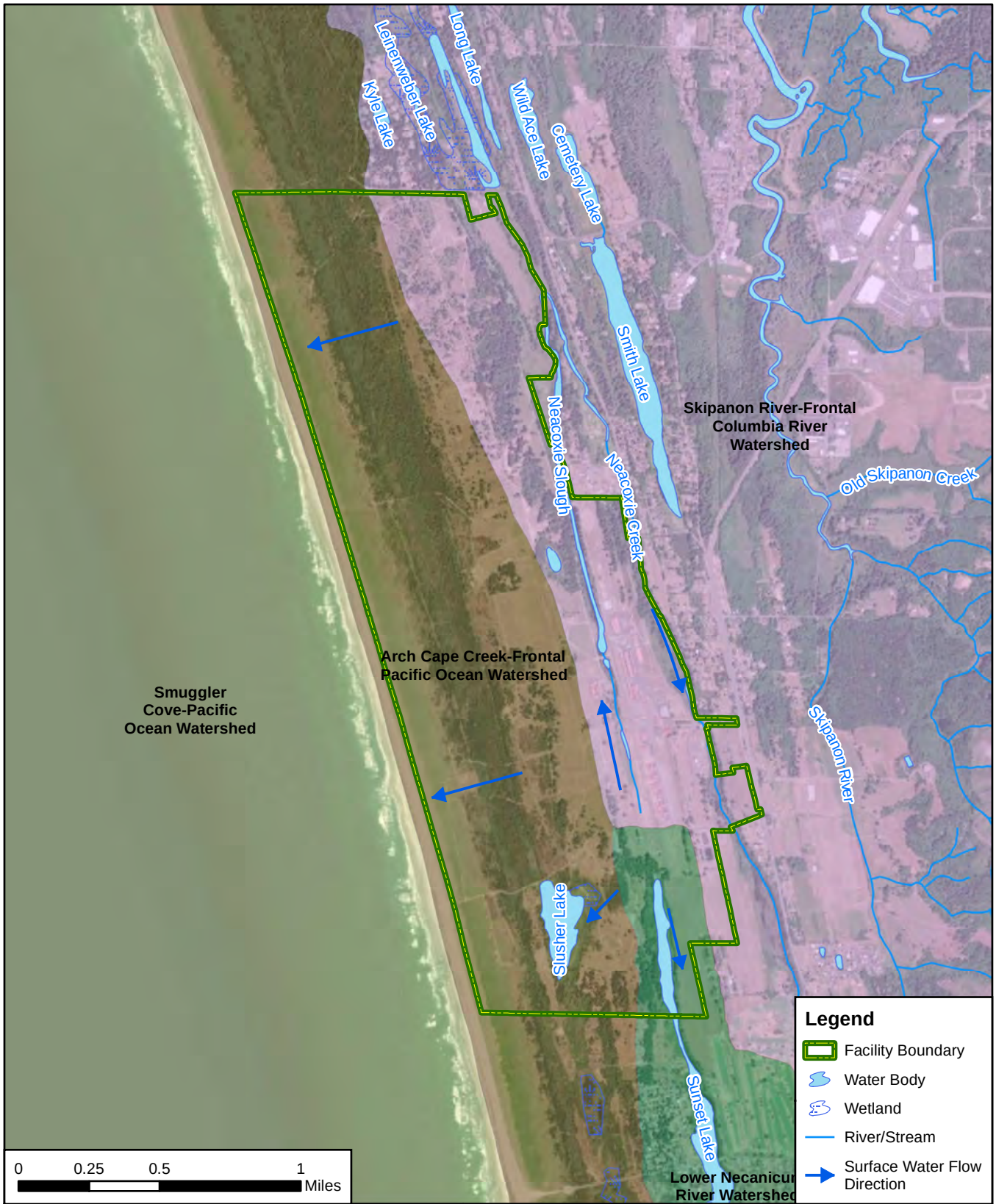

CLIENT	ARNG			
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Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	5/20/2021

Surface Water Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 10-3

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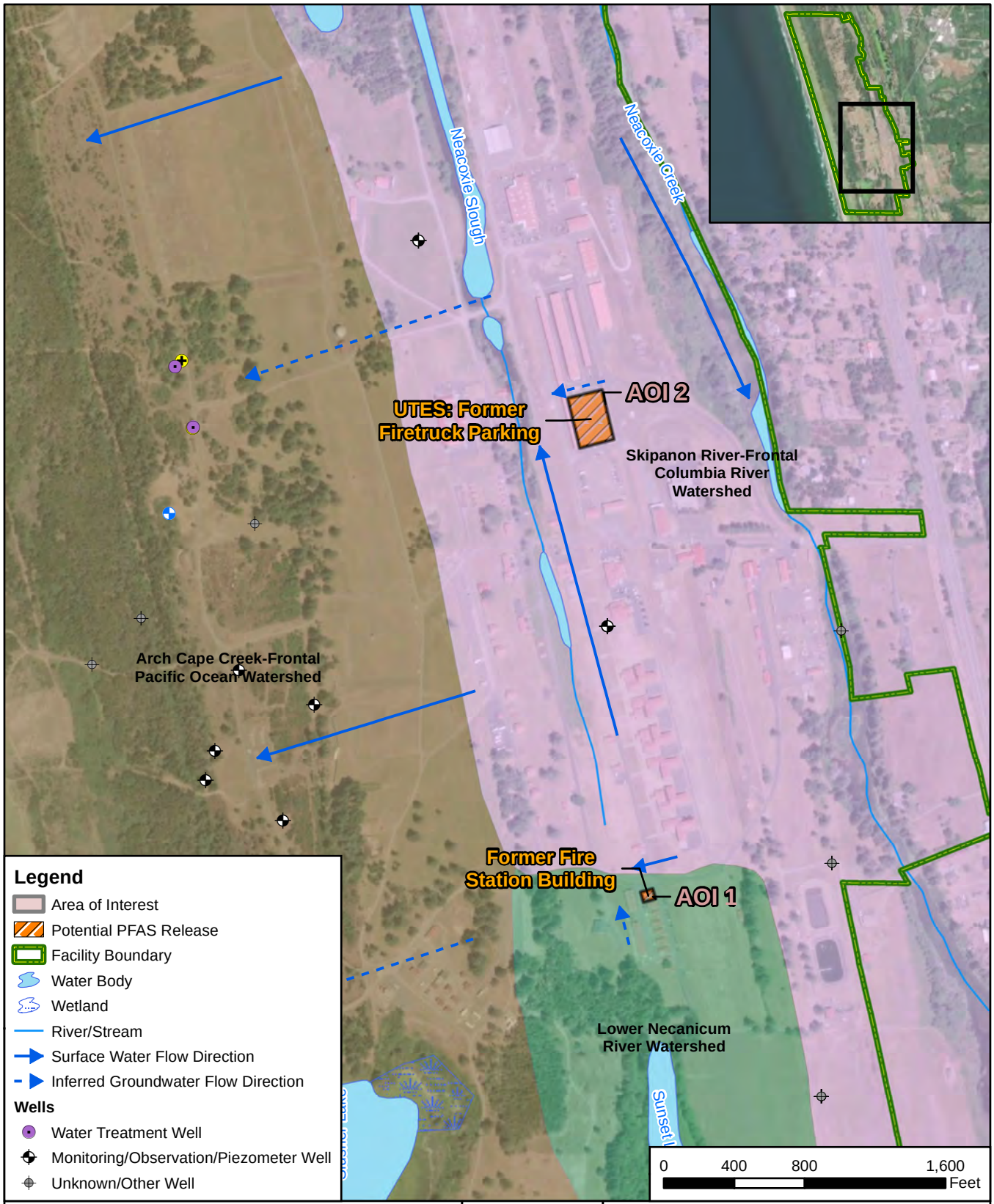

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Camp Rilea, OR			
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Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	5/20/2021

Area of Interest

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 10-4

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QAPP Worksheet #11: Project/Data Quality Objectives

DQOs specify the level of data required to support the decision-making process for a project. Specific DQOs have been established for each site and are described in this UFP-QAPP Addendum. These DQOs follow the USEPA's seven-step iterative process for DQO development. DQOs are influenced by the ongoing project planning discussions with stakeholders and will be updated if new consensus decisions materialize.

The development of DQOs follows the seven steps of USEPA's DQO process:

1. State the Problem

The presence of PFAS, which may pose a risk to human health or the environment, in environmental media at the facility is currently unknown. PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. The regulatory framework for managing PFAS at both the federal and state level continues to evolve. The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the Office of the Secretary of Defense (OSD) dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG program under which this SI will be performed follows this DoD policy. Should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to three compounds: PFOS, PFOA, and PFBS. The SLs were calculated using the USEPA Office of Superfund Sites On-Line Calculator, which was updated on 8 April 2021 based on the release of the final Human Health Toxicity Values for PFBS (USEPA, 2021). The SLs are presented in **Worksheet #15** of this QAPP Addendum.

The following quotes from the DA policy documents form the basis for this project (DA, 2016; DA, 2018):

- "The Army will research and identify locations where PFOS and/or PFOA containing products, such as AFFF, are known or suspected to have been used. Installations shall coordinate with installation/facility fire response or training offices to identify AFFF use or storage locations. The Army will consider fire training areas, AFFF storage locations, hangars/buildings with AFFF suppression systems, fire equipment maintenance areas, and areas where emergency response operations required AFFF use as possible source areas. In addition, metal plating operations, which used certain PFOS-containing mist suppressants, shall be considered possible source areas."
- "Based on a review of site records…determine whether a CERCLA PA is appropriate for identifying PFOS/PFOA release sites. If the PA determines a PFOS/PFOA release may have occurred, a CERCLA SI shall be conducted to determine presence/absence of contamination."
- "Identify sites where perfluorinated compounds are known or suspected to have been released, with the priority being those sites within 20 miles of the public systems that tested above USEPA HA levels" (USEPA, 2016a; USEPA, 2016b).

2. Identify the Goals of the Study

The goals of the SI include the following:

1. Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs at Camp Rilea.
2. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.
3. Determine the potential need for a TCRA (applies to drinking water only). The primary actions that will be considered include provision of alternative water supplies or wellhead treatment.
4. Collect or develop data to evaluate the release.
5. Collect data to better characterize the release for more effective and rapid initiation of an RI, if determined necessary.
6. If PFOA, PFOS, and PFBS are determined to be present, aim to evaluate whether the concentrations can be attributed to on-facility or off-facility sources that were identified within 4 miles of the installation as part of the PA (e.g., fire stations, major manufacturers, other DoD facilities).

3. Identify Information Inputs

Primary information inputs include:

- The PA Report for Camp Rilea;
- Analytical data collected during other environmental sampling efforts at the Camp Rilea;
- Groundwater, surface water, soil, and/or sediment (if applicable) sample data collected in accordance with this QAPP Addendum; and
- Field data collected including groundwater elevation and water quality parameters measured using a multi-parameter water quality meter.

4. Define the Boundaries of the Study

The scope of the SI is horizontally bounded by the property limits of Camp Rilea. Off-facility sampling is not included in the scope of this SI; however, if future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with the property owner(s). The scope of the SI is vertically bounded as follows: groundwater (30 feet bgs), soil from direct-push technology (DPT) borings (30 feet bgs), surface soil (0 to 2 feet bgs), and catch basin sediment, if sufficient quantities are present. The temporal boundaries of the study are limited by seasonal conditions; the field work for the scope will be performed in Winter 2020 or Spring 2021.

5. Develop the Analytic Approach

Samples will be analyzed by a DoD Environmental Laboratory Accreditation Program (ELAP) and National Environmental Laboratory Accreditation Program (NELAP) certified laboratory [i.e., Pace Gulf Coast (formerly Gulf Coast Analytical Laboratories, LLC [GCAL])]. Data will be compared to SLs (**Worksheet #15**), and decision rules as defined in the PQAPP will be applied concerning actions to be taken based on any SL exceedances. Decision rules have been developed for groundwater and soil that will apply to all data collected. These rules will govern response actions based on the results of the SI sampling effort.

The decision rules described in the tables at the end of this section (**Tables 11-1** and **11-2**) identify actions based on the following:

Groundwater:

1. Is there a human receptor within 4 miles of the facility?
2. What is the concentration of PFOA, PFOS, and PFBS at the potential source area?
3. What is the concentration of PFOA, PFOS, and PFBS at the boundary?
4. What does the CSM suggest in terms of source, pathway, and receptor?

Soil:

1. What is the concentration of PFOA, PFOS, and PFBS in shallow surface soil (0-2 feet bgs)?
2. What is the concentration of PFOA, PFOS, and PFBS in soil (i.e., capillary fringe) (15 to 35 feet bgs)?
3. What does the CSM suggest in terms of source, pathway, and receptor?

Soil, groundwater, and catch basin sediment samples will be collected from potential source areas identified in **Worksheet #10**. Based on previous investigations, groundwater is expected to be encountered within the shallow aquifer no deeper than 30 feet bgs. The deeper Astoria Formation will not be subject to drilling during this investigation. Proposed SI sample locations and depths are defined in **Worksheet #17**.

6. Specify Performance/Acceptance Criteria

See **Worksheet #37**.

7. Develop the Detailed Plan for Obtaining Data

See **Worksheet #17** and **#18**.

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Table 11-1: Groundwater Decision Rules

Scenario	PFAS Concentration Range	Response (Off-facility human receptor within 4 miles)	Response (No off-facility human receptor within 4 miles)
Scenario 1	ND	No further action required during SI phase.	No further action required during SI phase.
Scenario 2	> ND (any positive detection) and < SLs	1.) Assess CSM including: - Data reliability and bias - Migration via groundwater flow (i.e., groundwater flow towards potential receptors) - Flow to surface water bodies, drinking water intakes - Distance from boundary to receptor - Aquifer where drinking water well(s) are screened - Estimated timeframe of release(s) 2.) No further action during SI Phase at this time. ARNG may consider need for additional evaluation in the future for groundwater.	1.) Assess CSM as described. 2.) No further action during SI Phase at this time. ARNG may consider need for additional evaluation in the future for groundwater.
Scenario 3	> SLs	1.) Assess CSM as described above and: - Potential off-facility alternative PFAS sources 2.) If exceedance of SLs is near facility boundary and the assessment of the CSM implies unacceptable risk to human health caused by a PFAS release attributable to ARNG activities, ARNG may initiate off-facility sampling protocol. 3.) Proceed to RI.	1.) Assess CSM as described. 2.) Proceed to RI.

Notes:
< = less than
> = greater than
ARNG = Army National Guard
CSM = conceptual site model
ND = non-detect
PFAS = per- and polyfluoroalkyl substances
RI = Remedial Investigation
SI = Site Inspection
SL = screening level

Table 11-2: Soil Decision Rules

Scenario	PFAS Concentration Range	Response
Scenario 1	ND	No further action during SI Phase.
Scenario 2	> ND (any positive detection) and < SLs	1.) Assess CSM including: - Potential for particulate runoff (i.e., transport via surface water) - Nearby receptors and land use (residential or industrial/commercial worker) at the source location (i.e., potential for incidental ingestion) - Depth to groundwater; distance to nearby surface water body - Comparison of soil concentrations to groundwater concentrations at the source or nearby surface water body - Data reliability and bias 2.) No further action for soil during SI Phase at this time. ARNG may consider need for additional evaluation in the future.
Scenario 3	> SLs	1.) Assess CSM as above and: - Comparison of soil concentrations to groundwater concentrations at the source and downgradient at the boundary 2.) Proceed to RI.

Notes:
< = less than
> = greater than
ARNG = Army National Guard
CSM = conceptual site model
ND = non-detect
PFAS = per- and polyfluoroalkyl substances
RI = Remedial Investigation
SI = Site Inspection
SL = screening level

Final PQAPP Worksheet #12: Measurement Performance Criteria

Matrix Groundwater/Surface Water/ Potable Wells
Analytical Group PFAS
Concentration Low

Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for S, A or Both (S&A)
Accuracy/Bias	LCS/LCSD and MS/MSD shall be spiked with all analytes. Analyte recovery limits per Worksheet #15	LCS/LCSD, MS/MSD	A
Precision	Laboratory duplicates analysis should have an RPD <30%	LCS/LCSD, MS/MSD	A
Precision	Values > 5X LOQ: RPD must be ≤30% Values ≤ 5X LOQ: Absolute difference ≤ 2x the LOQ	Field Duplicates	S
Accuracy/ Contamination	No analytes detected > 1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater	Method Blank, Field Reagent Blanks, Equipment Rinsate Blanks	A
Sensitivity	Detection limits ≤ to acceptance criteria Instrument Sensitivity Check concentrations must be within ±30% of their true values.	Detection Limits, Instrument Sensitivity Check	A
Completeness	Completeness criteria will be considered met if 100% of all planned sample data (as requested on CoC in lab reports and EDD; including requested reanalyses) are collected	Reported Sample Data	S & A
Comparability	Based on accuracy and media comparison	Use of standardized SOPs in field and laboratory	S & A
Comparability	Serial dilution preparation (allowed due to known high concentrations of PFAS, notation of 'foamed' on CoC is considered documented approval)	Field shake test	S & A
Representativeness	Samples met conditions per Worksheet #19/30	Laboratory Receipt Checklist, Cooler Temperature Blank	S

Notes:
% = percent
A= analytical
CoC = chain of custody
EDD = electronic data deliverable
LCS/LCSD = laboratory control sample/ laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/ matrix spike duplicate
< = less than
> = greater than
≤ = less than or equal to
QC = quality control
RPD = relative percent difference
S = sampling
SOP = standard operating procedure

Matrix Soil and Sediment
Analytical Group PFAS
Concentration Low

Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Accuracy/Bias	LCS/LCSD and MS/MSD shall be spiked with all analytes. Analyte recovery limits per Worksheet #15	LCS, LCSD, MS, MSD	A
Precision	Laboratory duplicates analysis should have a RPD <30%	LCS/LCSD, MS/MSD	A
Precision	Values > 5X LOQ: RPD must be ≤30% Values ≤ 5X LOQ: Absolute difference ≤ 2x the LOQ	Field Duplicates	S
Accuracy/ Contamination	No analytes detected > 1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater	Method Blank, Field Reagent Blanks, Equipment Rinsate Blanks	A
Sensitivity	Detection limits ≤ to acceptance criteria Instrument Sensitivity Check concentrations must be within ±30% of their true values.	Detection Limits, Instrument Sensitivity Check	A
Completeness	Completeness criteria will be considered met if 100% of all planned sample data (as requested on CoC in lab reports and EDD; including requested reanalyses) are collected	Reported Sample Data	S & A
Comparability	Based on accuracy and media comparison	Use of standardized SOPs in field and laboratory	S & A
Representativeness	Samples met conditions per Worksheet #19/30	Laboratory Receipt Checklist, Cooler Temperature Blank	S

Notes:
< = less than
> = greater than
≤ = less than or equal to
A= analytical
CoC = chain of custody
EDD = electronic data deliverable
LCS/LCSD = laboratory control sample/ laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/ matrix spike duplicate
QC = quality control
RPD = relative percent difference
S = sampling
SOP = standard operating procedure

Final PQAPP Worksheet #13: Secondary Data Uses and Limitations

Secondary data sources, uses, and limitations are tabulated below. Original source documents were reviewed for uncertainty discussions that may identify additional or more suitable data limitations.

Data Type	Source	Data Uses Relative to Current Project	Factors Affecting Reliability of Data and Limitations on Data Use
Meteorological	National Weather Service	Estimates of seasonal fluctuations in precipitation.	Meteorological data is generally for a regional area. Actual site conditions may vary.
Topographic	USGS	Inferred surface water based on local topography at each site. Groundwater flow maps will ultimately rely upon groundwater measurements from monitoring wells.	Topography of some sites may have been altered by building or grading activities.
Soil and groundwater chemistry, groundwater monitoring data, and data gaps identification	Historical site reports	Applicable to the evaluation of historical site conditions in soil and groundwater to supplement data being collected under this delivery order.	The data may not represent current conditions because of the age of some of the data. Reliability of second- or third-party data quality.
Historical site records (i.e., material inventories)	Purchase records, site inventories, onsite records, safety data sheets	Applicable to the evaluation of potential constituents of concern and source areas.	Records may be incomplete or inaccurate.
Periodicals (i.e., news articles)	Local newspapers, magazines or other periodicals	Applicable to the evaluation of the use of potential constituents of concern at off-facility locations or mutual use/ aid agreements with local fire department or other entities.	Records may be incomplete or inaccurate.

Notes:
USGS = United States Geological Survey

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QAPP Worksheet #14 & #16: Project Tasks and Schedule

The following table describes the main tasks and schedule for the SI:

Task	Start Date	End Date
Pre-mobilization	September 2021	September 2021
Mobilization	September 2021	September 2021
Field Work	October 2021	October 2021
Demobilization	October 2021	October 2021
Data Review/Validation	November 2021	November 2021
Reporting	November 2021	May 2022

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Final PQAPP Worksheet #15: Screening Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Groundwater/ Surface Water/ Potable Wells
Analyte Group: PFAS
Method: PFAS by LC/MS/MS Compliant with QSM 5.3 Table B-15

Analyte	CAS Number	Laboratory Control Spike Lower Control Limit (%)	Laboratory Control Spike Upper Control Limit (%)	Achievable Laboratory Limits		
				DL (ng/L)	LOD (ng/L)	LOQ (ng/L)
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	65	140	0.81	4.0	10
Perfluoroheptanoic acid (PFHpA)	375-85-9	72	130	0.48	4.0	10
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	68	131	0.95	4.0	10
Perfluorononanoic acid (PFNA)	375-95-1	69	130	0.78	4.0	10
Perfluorooctanoic acid (PFOA)	335-67-1	71	133	0.95	4.0	10
Perfluorobutanesulfonic acid (PFBS)	375-73-5	72	130	0.81	4.0	10
Perfluorobutanoic acid (PFBA)	375-22-4	73	129	0.90	4.0	10
Perfluoropentanoic acid (PFPeA)	2706-90-3	72	129	0.85	4.0	10
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	61	135	0.97	8.0	10
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	65	136	0.91	8.0	10
Perfluorodecanoic acid (PFDA)	335-76-2	71	129	0.86	4.0	10
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	71	132	0.98	4.0	10
Perfluorododecanoic acid (PFDoA)	307-55-1	72	134	0.88	4.0	10
Perfluorohexanoic acid (PFHxA)	307-24-4	72	129	0.99	4.0	10
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	65	144	0.99	4.0	10
Perfluoroundecanoic acid (PFUdA)	2058-94-8	69	133	0.95	4.0	10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	64	140	0.94	4.0	10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	67	138	0.90	4.0	10

Notes:
% = percent
CAS = Chemical Abstracts Service
DL= detection limit
LC/MS/MS = liquid chromatography tandem mass spectrometry
LOD = limit of detection
LOQ = limit of quantitation
ng/L = nanograms per liter
PFAS = per- and polyfluoroalkyl substances
QSM =Quality Systems Manual
USEPA = United States Environmental Protection Agency

Matrix: Soil/Sediment
Analyte Group: PFAS
Method: PFAS by LC/MS/MS Compliant with QSM 5.3 Table B-15

Analyte	CAS Number	Laboratory Control Spike Lower Control Limit (%)	Laboratory Control Spike Upper Control Limit (%)	Achievable Laboratory Limits		
				DL (µg/kg)	LOD (µg/kg)	LOQ (µg/kg)
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	68	136	0.194	0.40	1.0
Perfluoroheptanoic acid (PFHpA)	375-85-9	71	131	0.078	0.40	1.0
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	67	130	0.122	0.40	1.0
Perfluorononanoic acid (PFNA)	375-95-1	72	129	0.062	0.40	1.0
Perfluorooctanoic acid (PFOA)	335-67-1	69	133	0.059	0.40	1.0
Perfluorobutanesulfonic acid (PFBS)	375-73-5	72	128	0.071	0.40	1.0
Perfluorobutanoic acid (PFBA)	375-22-4	71	135	0.046	0.40	1.0
Perfluoropentanoic acid (PFPeA)	2706-90-3	69	132	0.054	0.40	1.0
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	61	139	0.097	0.40	1.0
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	63	144	0.196	0.40	1.0
Perfluorodecanoic acid (PFDA)	335-76-2	69	133	0.041	0.40	1.0
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	69	133	0.119	0.40	1.0
Perfluorododecanoic acid (PFDoA)	307-55-1	69	135	0.101	0.40	1.0
Perfluorohexanoic acid (PFHxA)	307-24-4	70	132	0.043	0.40	1.0
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	66	139	0.119	0.40	1.0
Perfluoroundecanoic acid (PFUdA)	2058-94-8	64	136	0.011	0.40	1.0
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	64	140	0.066	0.40	1.0
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	65	137	0.122	0.40	1.0

Notes:
% = percent
µg/kg = micrograms per kilogram
CAS = Chemical Abstracts Service
DL= detection limit
LC/MS/MS = liquid chromatography with tandem mass spectrometry
LOD = limit of detection
LOQ = limit of quantitation
PFAS = per- and polyfluoroalkyl substances
QSM =Quality Systems Manual
USEPA = United States Environmental Protection Agency

Matrix: Soil
Analyte Group: Wet Chemistry

Analyte	Method	Laboratory Control Spike Lower Control Limit (%)	Laboratory Control Spike Upper Control Limit (%)	Achievable Laboratory Limits		
				DL (mg/kg)	LOD (mg/kg)	LOQ (mg/kg)
Total Organic Carbon	9060A	90	110	150	200	250

Notes:
% = percent
DL= detection limit
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligrams per kilogram
NA = not applicable

SLs for Soil and Groundwater

The DoD has adopted a policy to retain facilities in the CERCLA process based on conservative SLs for soil and groundwater, as described in a memorandum from the OSD dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG program under which this SI will be performed follows this DoD policy and should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to three compounds: PFOS, PFOA, and PFBS. The SLs were calculated using the USEPA Office of Superfund Sites On-Line Calculator, which was updated on 8 April 2021 based on the release of the final Human Health Toxicity Values for PFBS (USEPA, 2021).

Analyte	CAS Number	Residential (Soil) (µg/kg)[a,b] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a,b] 2 -15 feet bgs	Tap Water (Groundwater) (ng/L)[a]
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	130	1,600	40
Perfluoroheptanoic acid (PFHpA)	375-85-9	-	-	-
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	-	-	-
Perfluorononanoic acid (PFNA)	375-95-1	-	-	-
Perfluorooctanoic acid (PFOA)	335-67-1	130	1,600	40
Perfluorobutanesulfonic acid (PFBS)[c]	375-73-5	1,900	25,000	600
Perfluorobutanoic acid (PFBA)	375-22-4	-	-	-
Perfluoropentanoic acid (PFPeA)	2706-90-3	-	-	-
N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	-	-	-
N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	-	-	-
Perfluorodecanoic acid (PFDA)	335-76-2	-	-	-
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	-	-	-
Perfluorododecanoic acid (PFDoA)	307-55-1	-	-	-
Perfluorohexanoic acid (PFHxA)	307-24-4	-	-	-
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	-	-	-
Perfluoroundecanoic acid (PFUdA)	2058-94-8	-	-	-
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	-	-	-
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	-	-	-

Notes:

a.) Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. 15 October 2019.

b.) The SLs for soil are based on incidental ingestion of soil applied to the soil intervals reasonably anticipated to be encountered; surface soil (0 to 2 feet bgs for the residential scenario) and subsurface soil (2 to 15 feet bgs for the industrial/commercial worker scenario).

c.) USEPA, 2021. Risk Based Screening Levels Calculated for PFBS in Groundwater and Soil using USEPA's Regional Screening Level Calculator. HQ = 0.1. 8 April 2021.

µg/kg = micrograms per kilogram
bgs = below ground surface
CAS = Chemical Abstracts Service
ng/L = nanograms per liter
OSD= Office of the Secretary of Defense
SL = screening level

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QAPP Worksheet #17: Sampling Design and Rationale

Worksheet #17a-f describes the sampling design, basis for its selection, and field investigation details. Field activities will be completed per the Standard Operating Procedures (SOPs) in **Appendix B**.

The objective of the SI is to identify whether there has been a release to soil and groundwater (if present) at each AOI and determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs. As discussed in **Worksheet #10**, two AOIs were identified at Camp Rilea. Regional groundwater flow at Camp Rilea is predominantly to the west; however, groundwater flow may vary in localized areas of groundwater recharging to surface water, such as Neacoxie Creek in the eastern portion of the facility.

- AOI 1: A former fire station was reportedly in operation from the early 1970s until 1980. A firetruck containing AFFF may have been parked at the form fire station, and additional AFFF may have been stored at the former fire station. Activities at the former fire station may have included washing the firetruck that carried AFFF, flushing out lines used for AFFF discharge at other locations, and storage of AFFF.
- AOI 2: The UTES was formerly used for firetruck parking from 1989 to 1995 (one truck) and 1995 to an unknown time period (one truck). Both trucks reportedly contained AFFF, with tank capacities of approximately 50 gallons each, but AFFF was reportedly never deployed on-Post. Minor firetruck maintenance was performed by OMD maintenance personnel at the UTES.

Environmental media samples will be collected from the AOI in accordance with the applicable CSM, as summarized in **Table 17-1**. Temporary monitoring wells will be installed where PFAS were potentially released and downgradient of the potential source areas.

In instances where deviations from this sampling design and rationale are made due to unforeseen conditions, a Field Change Request Form will be generated to document the change and request feedback from the AECOM Task and Project Managers, USACE, and ARNG.

Sampling Tasks

The field program will include tasks as detailed in the following Worksheet elements:

- **Worksheet #17a** - Mobilization
- **Worksheet #17b** - Direct Push Boring Installation and Soil Sampling
- **Worksheet #17c** - Temporary Groundwater Monitoring Well Installation and Grab Groundwater Samples
- **Worksheet #17d** - Synoptic Water Level Measurements
- **Worksheet #17e** - Surveying
- **Worksheet #17f** – Catch Basin Sediment Sampling
- **Worksheet #17g** - Investigation-Derived Waste Management

Table 17-1: Site Inspection Sample Count

AOI	Potential PFAS Release Area	# of DPT Boring	# of HA Boring Locations	Approximate Depth (feet bgs)	Groundwater Samples	Soil Samples	Sediment Samples
1	Former Fire Station – Building 7241	3	1	30 for DPT; 2 for HA	3	7	0
2	UTES: Former Firetruck Parking	3	0	30 for DPT	3	9	2
Total (not including QC)		**6**	**1**	**-**	**6**	**16**	**2**

Notes:
1) All samples will be analyzed for PFAS.
2) One soil sample per AOI will be analyzed for pH and TOC from a location in the source area. Grain size analysis will be performed in up to one soil sample per AOI where extensive horizontal and vertical clay units are identified by the field geologist, if these conditions are encountered in the field.

AOI = area of interest
bgs = below ground surface
DPT = direct push technology
HA = hand auger
PFAS = per- and polyfluoroalkyl substances
QC = quality control
UTES = Unit Training Equipment Site

QAPP Worksheet #17a
Sampling Design and Rationale
Mobilization

Site Preparation

The site preparation activities for the SI field investigation operations include mobilization of field team personnel and equipment. No vegetation clearance is planned during field investigation activities.

PFAS Site Water Supply Sampling and Sampling Equipment Acceptability

A sample from the potable water source (i.e., decontamination water) will be collected prior to mobilization to confirm that is acceptable for use for during field activities (i.e., equipment decontamination). The water source is acceptable for use if the detected concentration is less than 1/5 the SL. If the decontamination water has concentrations greater than 1/5 the SL, the project team will determine whether the water is acceptable for its intended use based on site-specific factors (i.e., drilling methodology, relevant sample media). If the water is deemed unacceptable, water will be brought onsite from another source confirmed to be PFAS-free through sampling. Quality control (QC) samples will not be collected for the decontamination water sample.

All materials being purchased or rented for field work will be confirmed as acceptable for use in the PFAS sampling environment. A summary of acceptability of materials for use in the PFAS sampling environment is provided in SOP 3-41 (**Appendix B**). As an additional layer of control, prior to the start of field work each day, a PFAS Sampling Checklist will be completed (SOP 3-41, **Appendix B**). The checklist will serve as a reminder to each field team member regarding the allowable materials within the sampling environment. An example of the checklist is provided below.

Example PFAS Daily Sampling Checklist

Team Members		
Yes	No	Description
		Has AECOM PFAS Sampling guidance been reviewed by all team members?
		Comments:
Yes	No	Has AECOM field sampling staff received needed training certification?
		Comments:
Yes	No	Was a briefing held for field sampling staff?
		Comments:
Yes	No	Were additional PFAS sampling instructions given to field sampling staff?
		Comments:
Yes	No	Have personal clothing and PPE requirements been followed by all field sampling staff?
		Comments:
Yes	No	Were lotions and sunscreen used for field sampling staff?
		Comment:
Sample Collection		
Yes	No	Has a PFAS-free water source been identified?
		Comment
		Source of PFAS-free water:
Yes	No	Have all sampling items, parts and equipment been inspected to be free of PFAS?
		Comment:
Yes	No	Has sampling location sequence been communicated to avoid cross-contaminations?
		Comment:
Yes	No	Have drilling fluids been evaluated and shown to be free of PFAS?
		Comment:
Yes	No	Use of PFAS-free decontamination solution?
		Brand name of decontamination solution:
Yes	No	Have all field logs, notebooks, pens, labels been inspected, and do they meet AECOM PFAS sampling guidance requirements?
		Comment:
Yes	No	Have all sample shipping materials (ice, Ziploc® bags) been inspected, and do they meet AECOM PFAS sampling guidance requirements?
		Comment:
Yes	No	Have all blanks arrived at the site and will they be collected to verify cross-contamination?
		Comment:
Document Control		
Yes	No	Have all variances from sampling guidance been documented?
		Comment:
Other Comments:		

Personnel Qualifications

All personnel mobilized to the site will meet applicable Occupational Safety and Health Administration (OSHA) training requirements including hazardous waste operations and emergency response (HAZWOPER) training and medical surveillance requirements as specified in the Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP). Personnel will be required to complete the DoD's *Operations Security Awareness for Military Members, DoD Employees, and Contractors* and *Level 1 Antiterrorism Awareness Training*. Additionally, all AECOM employees that will be performing field work will take an internal PFAS sampling guidance training.

Permits and Notifications

Utility clearance will be conducted by ORARNG with input from the AECOM field team. A minimum of two weeks to coordinate the clearance will be required. AECOM or its drilling subcontractor will contact Oregon 811, the local one-call utility location system. AECOM and the drilling subcontractor will participate in a Camp Rilea orientation prior to initiating work, if required. The determination of the orientation requirement will be made after final intrusive investigation locations are determined. AECOM will also contact the ARNG Environmental Manager at least five business days prior to the scheduled start of the field activities. A site walk will be scheduled with the appropriate ARNG personnel to mark out locations of the subsurface utilities. As a precaution, the first 5 feet of each boring will be pre-cleared using hand tools (e.g., post-hole diggers, augers, etc.) or air knifing methods. All field work will be coordinated with the ARNG Environmental Manager and/or his/her designee.

Health and Safety Requirements

Health and safety requirements for SI field activities are provided in the APP. Field personnel will wear PFAS-free Level D personal protective equipment (PPE). Detailed Activity Hazard Analyses identifying the physical, chemical, and biological hazards that may be encountered at the site and the associated mitigation methods are presented in the SSHP.

All onsite personnel who may be exposed to hazardous conditions will be required to meet training requirements identified in Federal Regulation 29 CFR 1910.120 (HAZWOPER). At least two personnel trained in first aid and cardiopulmonary resuscitation (CPR) will be onsite during field activities. Training certificates for personnel (HAZWOPER 40-hour training; current HAZWOPER 8-hour refresher training; and first aid/CPR) will be maintained onsite by the Site Supervisor.

Personnel and visitors who enter the site will be required to review the APP and SSHP and sign the acknowledgement form. Site workers will be required to sign the daily tailgate safety meeting form and fill out daily Activity Hazard Analysis forms. Safety issues that arise during implementation of field activities will be addressed during tailgate safety meetings held daily before the workday and will be documented in the daily tailgate safety meeting form.

QAPP Worksheet #17b
Sampling Design and Rationale
Direct-Push Boring Installation and Soil Sampling

Soil samples will be collected via hand auger and DPT (SOP 3-17). Hand augers will be used at locations designated for collection of surface soil samples (0 to 2 feet bgs) only. Borings will be advanced using DPT at locations designated for subsurface soil sample collection; however, a hand auger or air knifing will be used to clear the top 5 feet of the boring in accordance with AECOM utility clearance protocols. A GeoProbe® DT45 or DT60 dual-tube sampling system (or equivalent) will be used to collect continuous soil cores to the target depth. Generally, DPT will be used to collect three soil samples per boring, if possible: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 2 feet above the groundwater table, and one subsurface soil sample at the mid-point between the surface and the groundwater table, if the depth to water is up to 30 feet bgs or shallower, or from 13 to 15 feet bgs if the depth to water is greater than 30 feet deep. If refusal is encountered before the desired depth of sample location, one additional attempt will be made adjacent to the original location (within 10 feet of the original boring) to collect a soil sample at the desired depth. If refusal is encountered at 6 feet bgs or shallower, only two samples will be collected per boring: one surface soil sample (0 to 2 feet bgs) and one sample approximately 1 foot above refusal. All drilling materials will be PFAS-free.

It is expected groundwater will be encountered at both AOIs; therefore, target soil sample intervals will be based on the presence of the groundwater table. DPT borings will be advanced to approximately 5 below the groundwater table or a maximum of 30 feet bgs if groundwater is not encountered. Exceptions to the general sample collection methodology include the following:

- One AOI-1 location where a historical release at AOI-1 could have been transported to by stormwater during a heavy precipitation. Surface soil, subsurface soil, and groundwater samples will be collected at the primary stormwater infiltration location, and the analytical results will indicate if potential historical releases could have been transported by stormwater from AOI-1. The absence of PFAS in surface soil, subsurface soil, and groundwater samples from the primary infiltration area for stormwater from AOI-1 would support the conclusion a potential historical AFFF release did not reach the primary stormwater infiltration area and therefore could not reach the potential secondary stormwater infiltration area. The presence of PFAS in surface soil, subsurface soil, and groundwater samples collected from the primary stormwater infiltration area in

addition to PFAS in the surface soil sample from the potential secondary stormwater infiltration area is sufficient to document AFFF transport in stormwater. Only a surface soil sample will be collected from the secondary potential stormwater infiltration area.

- One AOI-1 location approximately 175 feet from the AOI-1 potential source area is uphill from but hydraulically downgradient from AOI-1. There is no pathway for a potential historical AFFF release at AOI-1 to reach ground surface at this location; only a groundwater sample will be collected.

The proposed sample locations are shown on **Figures 17-1**, **17-2**, and **17-3** and described in **Worksheet #18**. The soil sample rationale and target depths for the borings are provided in **Table 17-2** below.

Table 17-2: Soil Sample Rationale and Target Depths for Borings

Area of Interest	Number of Borings	Sample Collection Method	Target Depth (feet bgs)	Rationale
AOI 1	4	DPT and HA	30 and 2	One proposed DPT boring within the AOI: in grassy area southwest of Building 7241. Two proposed DPT boring outside the AOI: one northwest of the AOI and downgradient from the anticipated infiltration area for surface flow originating within the AOI and one west of the AOI down gradient from Building 7241 (groundwater sample only at this location). One proposed HA boring outside the AOI: northwest of AOI within a potential infiltration area for surface flow originating within the AOI (surface soil sample only at this location).
AOI 2	3	DPT	30	One proposed DPT boring within the AOI: in grassy area east of Building 7156. Two proposed DTP borings outside the AOI: one west and downgradient from the AOI and one northwest and downgradient from the AOI.

Notes:
AOI = area of interest
bgs = below ground surface
DPT = direct push technology
HA = hand auger

The soil cores will be continuously logged for lithological descriptions by a field geologist using the Unified Soil Classification System (USCS) per SOP 3-16. A photoionization detector (PID) will be used to screen the breathing zone during boring activities. Observations and measurements will be recorded on field forms and in a non-treated field logbook. Photographs of the boring cores will also be taken. At a minimum, depth interval, recovery thickness, PID concentrations, moisture, relative density, color (using a Munsell soil color chart), and texture (using the USCS) will be recorded. Additional observations to be recorded may include groundwater or perched water depth, organic material, or cultural debris. Although clay layers are not anticipated to be encountered, if a clay layer in excess of 3 feet thick is observed in a boring, boring activities will be terminated to avoid completely penetrating a competent clay layer.

It is anticipated that all borings will be advanced in areas without surface cover; however, if a boring is required in asphalt, it will be abandoned by backfilling with bentonite chips to approximately 6 inches bgs, and the remainder of the borehole will be patched with an asphalt cold patch. Borings into concrete will be avoided, if possible; however, if borings are advanced into concrete, the borings will be abandoned by backfilling with bentonite chips to approximately

6 inches bgs, and the remainder of the borehole will be filled with concrete to provide as flush a surface as possible. The surface at each location will be restored to match the surrounding area.

QC samples will be collected in accordance with **Worksheet #20**. Field duplicate samples will be collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spikes/matrix spike duplicates (MS/MSDs) will be collected at the rate of 5% and analyzed for the same parameters as the accompanying samples. One Field Reagent Blank (FRB) will be collected per sampling event and will be analyzed for PFAS. For non-dedicated sampling equipment, decontamination will be completed after each use (i.e., downhole tool and hand auger decontaminated between intervals sampled for laboratory analysis), and associated equipment rinsate blanks (ERBs) will be collected at a rate of one per twenty samples. ERBs will be analyzed for the same analytes as the associated samples. A temperature blank will be placed in each cooler to ensure that samples are preserved at or below 6 degrees Celsius (°C) during shipment.

Each sample will be collected into laboratory-supplied bottleware and submitted to the laboratory for analysis of selected parameters. Samples will be analyzed for PFAS by liquid chromatography tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual [QSM] 5.3 Table B-15. Additionally, one soil sample per AOI from a location in the source area will be analyzed for total organic carbon (TOC) (USEPA Method 9060A) and pH (USEPA Method 9045D). Additionally, up to one soil sample per AOI will be submitted for grain size analysis with sieve and hydrometer (American Society for Testing and Materials [ASTM] D-422) (i.e., clay content). The grain size analysis will be performed where extensive horizontal and vertical clay units are identified by the field geologist, if these conditions are encountered in the field. Sample containers will be PFAS-free. The laboratory method detection limits (DLs) for these analytes are presented in **Worksheet #15**. Samples will be packaged on ice and transported daily via overnight commercial carrier under standard chain of custody (CoC) procedures to the laboratory (see SOP 3-04).

QAPP Worksheet #17c
Sampling Design and Rationale
Temporary Groundwater Monitoring Well Installation and Grab Groundwater Samples

Boreholes for temporary wells will be created using a Geoprobe® DT45 or DT60 dual-tube sampling system (or equivalent). Once the borehole has been advanced to the specified depth, the temporary well will be constructed of a 5-foot section of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. New PVC pipe will be used for each sampling location. The target screen interval for each location will be the top of the groundwater table, which is expected to be encountered no deeper than 30 feet bgs. The target screen intervals and rationale for the sampling locations are described in **Table 17-3**.

Table 17-3: Groundwater Sample Rationale and Proposed Screen Intervals

Area of Interest	# Temporary wells	Target Screen Interval (feet bgs)	Rationale
AOI 1	3	Top of groundwater table (est. 10-30)	One proposed temporary well within the AOI: in grassy area southwest of Building 7241. Two proposed temporary wells outside the AOI: one northwest of the AOI and downgradient from the anticipated infiltration area for surface flow originating within the AOI; and one west of the AOI and downgradient from the suspected source area.
AOI 2	3	Top of groundwater table (est. 10-30)	One proposed temporary well within the AOI: in grassy area east of Building 7156. Two proposed temporary wells outside the AOI: one west and downgradient from the AOI and one northwest and downgradient from the AOI.

Notes:
AOI = area of interest bgs = below ground surface

A grab groundwater sample will be collected at each temporary well using a peristaltic pump with tubing that has been determined to be PFAS-free (i.e. high-density polyethylene [HDPE] or other PFAS-free material). If the peristaltic pump cannot generate enough hydraulic lift to bring the groundwater to the surface, groundwater samples will be collected using a PFAS-free 0.85-inch Geotech Bladder Pump or other sampling device. Prior to sampling, the temporary well will be purged in order to remove sediment, to the extent reasonable, in an effort to minimize the turbidity of the sample (see SOP 3-37: Grab Groundwater Sampling Techniques for additional details). The degree of purging will be dependent on groundwater recharge within the well. If sufficient groundwater recharge is observed, the well will be purged until the turbidity is ≤ 25 nephelometric turbidity units (NTU), stabilizes at a level above 25 NTU, or for a maximum duration of one hour, whichever occurs first. In wells with limited groundwater recharge, the sample will be collected using the available groundwater.

In addition to turbidity, other water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) will be measured and recorded on the field sampling form every 5 minutes until the above turbidity criteria are met. Water quality parameters will be measured using a water quality meter and flow-through cell (see SOP 3-14: Monitoring Well Sampling and SOP 3-24: Water Quality Parameter Testing for more details). In addition, a subsample of each groundwater sample will be collected in a separate container and undergo a shaker test to identify if there is any foaming. If foaming is observed, the observation will be noted on the CoC to notify the laboratory of potentially high PFAS concentrations in the sample prior to analysis. Any non-dedicated sampling materials will be decontaminated between boring locations.

Each sample will be collected into laboratory-supplied bottleware and submitted to the laboratory for analysis of selected parameters (PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15) (DoD, 2019a) as per SOP 3-41. The laboratory method DLs for these analytes are presented in **Worksheet #15**. QC samples will be collected in accordance with **Worksheet #20**. ERBs will not be prepared or analyzed unless a deviation from this plan requires sample handling using non-dedicated equipment. If non-dedicated sampling equipment is used, ERBs will be collected at a rate of one per twenty samples and will be analyzed for the same analytes as the associated samples. Sample containers will be PFAS-free, and the aqueous samples will not be filtered. Samples will be packaged on ice and transported daily via overnight commercial carrier under standard CoC procedures to the laboratory (SOP 3-04). Temporary wells will be abandoned using bentonite chips at completion of sampling activities and surveying.

QAPP Worksheet #17d
Sampling Design and Rationale
Synoptic Water Level Measurements

Groundwater levels will be used to monitor site-wide groundwater elevations and assess groundwater flow. Synoptic water level elevation measurements will be collected from the newly-installed temporary monitoring wells (as shown on **Worksheet #18**). The wells will be surveyed, and the water level measurement will be taken from the survey mark on the northern side of the well casing.

QAPP Worksheet #17e
Sampling Design and Rationale
Surveying

A small notch will be cut on the northern side of the well casing which will be surveyed by a state-licensed surveyor (see SOP 3-07). The top of casing and ground surface elevation will be surveyed for each newly installed well. Survey data will be collected in the applicable Universal

Transverse Mercator zone projection with WGS84 datum (horizontal) and North American Vertical Datum 1988 (vertical).

QAPP Worksheet #17f
Sampling Design and Rationale
Catch Basin Sediment Sampling

Catch basin sediment samples will be collected from catch basins within or downgradient from AOIs at the facility. The rationale for the sampling locations are described in **Table 17-4**.

Table 17-4: Surface Water and Sediment Sample Rationale

Area of Interest	# Locations	Rationale
AOI 2	2	Samples will be collected from catch basins located areas where potential AFFF releases could be captured.
Total	**2**	

Notes:
AOI = area of interest

Catch basin sediment sampling will be initiated at the catch basins downhill from potential AFFF storage areas. One catch basin is located southeast of AOI 1 but it is uphill from the potential AFFF-containing firetruck parking area and is not a potential pathway for PFAS migration. Four catch basins were installed within the current AOI-2 boundary when the UTES was paved in approximately 2003. Two catch basins are located along the west but are not in parking areas and are on the opposite side of the Building 7156 storage area and general parking area. PFAS transportation from the former AFFF storage area to these catch basins is not probable and sediment sample collection from these two catch basins is not planned. The northwest catch basin near the wash rack area and easternmost catch basin could potentially capture PFAS if AFFF was stored within AOI 2 after the UTES was paved and catch basins installed. Sediment samples will be collected from the latter two AOI 2 catch basis if sufficient sediment is present.

A sediment coring device will then be used to collect the sediment sample from the area with the apparent thickest sediment accumulation. Catch basin sediment will be collected from the full sediment column. The sediment will be transferred to a stainless steel bowl or other PFAS-free container (i.e., 1-gallon Ziploc® bags), from which stones in excess of 1 centimeter will be removed. Sediment samples will not be collected from catch basins with less than 1 inch of sediment. See SOPs 3-10 and 3-22, respectively, for additional details on surface water and sediment sampling. The sediment coring device will be stainless steel or another PFAS-free material.

Each catch basin sediment sample will be collected into laboratory-supplied bottleware and submitted to the laboratory for analysis of selected parameters (PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15). Sample containers will be PFAS-free. The laboratory method DLs for these analytes are presented in **Worksheet #15**. QC samples will be collected in accordance with **Worksheet #20**. Samples will be packaged on ice and transported daily via overnight commercial carrier under standard CoC procedures to the laboratory (See SOP 3-03 and SOP 3-04).

QAPP Worksheet #17g
Sampling Design and Rationale
Investigation-Derived Waste Management

Currently, the disposal of PFAS investigation-derived waste (IDW) is not regulated. As such, the IDW will be managed as follows.

Soil IDW (i.e., soil cuttings) generated during SI activities will be containerized in properly labeled 55-gallon drums (See SOP 3-05). The IDW will be stored onsite at a location designated by the Camp Rilea Environmental Manager and ORARNG. ARNG will manage disposal of the solid IDW and will coordinate with ODEQ to ensure proper disposal in accordance with OAR Chapter 340 and the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Liquid IDW (i.e., purged groundwater and decontamination fluids) generated during SI activities will be containerized in properly labeled 55-gallon drums (See SOP 3-05). The liquid IDW will not be sampled and will assume the PFAS characteristics of the associated groundwater samples collected from the source locations. The containerized IDW will be temporarily stored onsite at a location designated by the Camp Rilea Environmental Manager and ORARNG until the analytical results for the associated groundwater samples are available. Liquid IDW drums will only be filled 75% full to account for freeze/thaw cycles. ARNG will manage and dispose of the liquid IDW under a separate contract in accordance with *SOP No. 042A for Treating Liquid Investigation-Derived Material (Purge water, drilling water, and decontamination fluids)* (EA Engineering, Science, and Technology, Inc., 2021). ARNG will further coordinate with the ODEQ to ensure proper disposal is in accordance with OAR Chapter 340 and the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018). AECOM will collect global positioning system (GPS) points (i.e., polygons) around the location where the IDW drums are stored.

Other solids such as spent PPE, plastic sheeting, tubing, rope, unused monitoring well construction materials. Other environmental media generated during the field activities will be disposed of at a licensed solid waste landfill.

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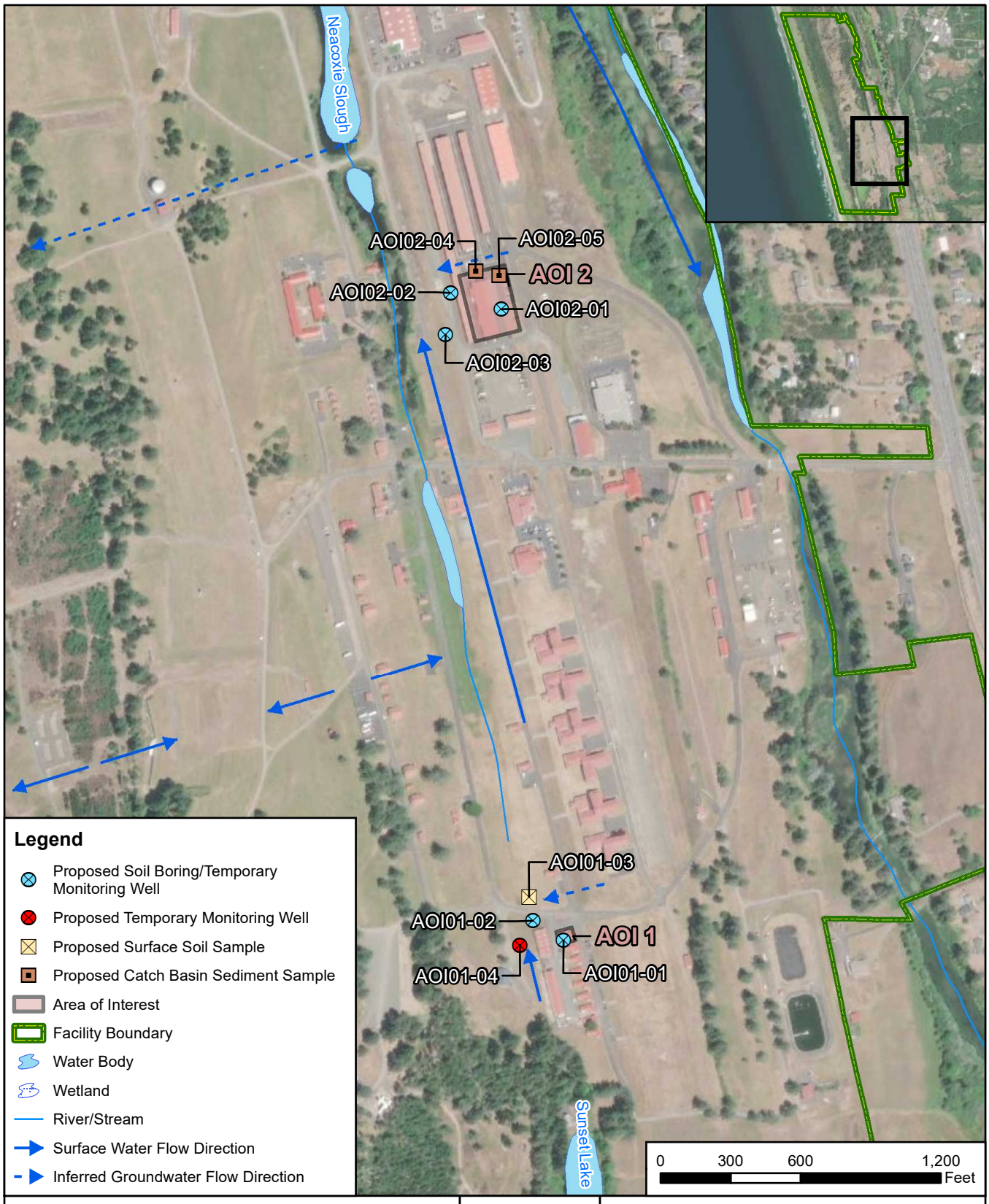

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Camp Rilea, OR			
REVISED	7/28/2021	GIS BY	MS	7/28/2021
SCALE	1:7,200	CHK BY	MB	7/28/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	7/28/2021

N

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 17-1

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CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Camp Rilea, OR			
REVISED	7/27/2021	GIS BY	MS	7/27/2021
SCALE	1:1,200	CHK BY	MB	7/27/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	7/27/2021

Site Inspection
Sample Locations - AOI 1

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 17-2

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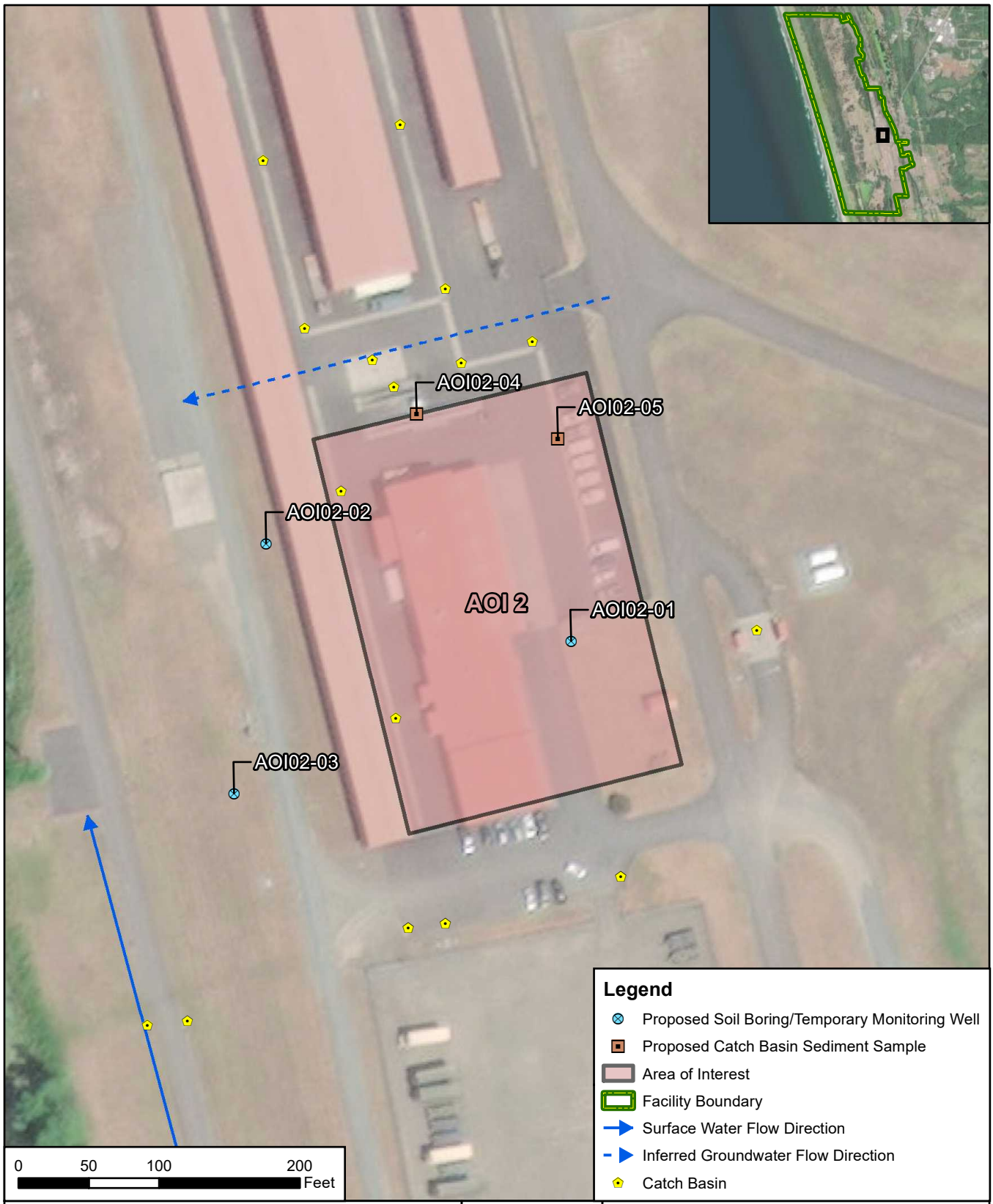

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Camp Rilea, OR			
REVISED	7/28/2021	GIS BY	MS	7/28/2021
SCALE	1:1,200	CHK BY	MB	7/28/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	7/28/2021

Site Inspection
Sample Locations - AOI 2

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 17-3

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QAPP Worksheet #18: Sampling Locations and Methods

The table below describes the samples that will be collected during the SI. Sampling SOPs can be found in **Appendix B**.

AOI	Location Identifier	Sample Identifier	Matrix	Depth (feet bgs)	Type (Sampling Tool)	Analyte/Analytical Group	Sampling SOP
Soil Samples							
All	AOI01-01 AOI01-02 AOI01-03 AOI02-01 AOI02-02 AOI02-03	AOI01-01-SB-[Start Depth]-[End Depth] AOI01-02-SB-[Start Depth]-[End Depth] AOI01-03-SB-[Start Depth]-[End Depth] AOI02-01-SB-[Start Depth]-[End Depth] AOI02-02-SB-[Start Depth]-[End Depth] AOI02-03-SB-[Start Depth]-[End Depth]	Surface Soil	0-2 feet bgs	Hand auger	PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15) Limited Sample Selection (one sample per AOI): TOC (USEPA Method 9060A) pH (USEPA Method 9045D) Limited Sample Selection (up to one sample per AOI): Grain Size/Clay Content (ASTM D-422)	3-21
All	AOI01-01 AOI01-02 AOI02-01 AOI02-02 AOI02-03	AOI01-01-SB-[Start Depth]-[End Depth] AOI01-02-SB-[Start Depth]-[End Depth] AOI02-01-SB-[Start Depth]-[End Depth] AOI02-02-SB-[Start Depth]-[End Depth] AOI02-03-SB-[Start Depth]-[End Depth]	Subsurface Soil	mid-point or 13-15 feet bgs	Geoprobe® Dual-tube Sampling System	See Above	3-21
All	AOI01-01 AOI01-02 AOI02-01 AOI02-02 AOI02-03	AOI01-01-SB-[Start Depth]-[End Depth] AOI01-02-SB-[Start Depth]-[End Depth] AOI02-01-SB-[Start Depth]-[End Depth] AOI02-02-SB-[Start Depth]-[End Depth] AOI02-03-SB-[Start Depth]-[End Depth]	Subsurface Soil	Above groundwater table or bottom of boring	See Above	See Above	3-21
Sediment							
All	AOI02-04 AOI02-05	AOI02-04-SD-[Start Depth]-[End Depth] AOI02-05-SD-[Start Depth]-[End Depth]	Sediment	0–2 feet bgs	Sediment Coring Device	PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15)	3-22

AOI	Location Identifier	Sample Identifier	Matrix	Depth (feet bgs)	Type (Sampling Tool)	Analyte/Analytical Group	Sampling SOP
Groundwater Samples							
All	AOI01-01 AOI01-02 AOI01-04 AOI02-01 AOI02-02 AOI02-03	AOI01-01-GW AOI01-02-GW AOI01-04-GW AOI02-01-GW AOI02-02-GW AOI02-03-GW	Groundwater	Mid-screen	Peristaltic pump	PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15)	3-14
QA/QC Samples							
All	AOI01-01*	AOI01-01-SB-[Start Depth]-[End Depth]-D* AOI01-01-SB-[Start Depth]-[End Depth]-MS* AOI01-01-SB-[Start Depth]-[End Depth]-MSD*	Solid (Soil and Sediment)	TBD	Hand Auger; Geoprobe® Dual-tube Sampling System	PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15) Limited Sample Selection (one sample per AOI): TOC (USEPA Method 9060A) pH (USEPA Method 9045D)	3-21, 3-22
All	AOI01-01*	AOI01-01-GW-D* AOI01-01-GW-MS* AOI01-01-GW-MSD*	Aqueous (Groundwater)	Mid-screen	Peristaltic pump	PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15)	3-14
NA	NA	CR-FRB-01	Water Quality	NA	NA (Pour laboratory-supplied PFAS-free water)	PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15)	3-10
NA	NA	CR-ERB-01 CR-ERB-02	Water Quality	NA	NA (Pour laboratory-supplied PFAS-free water)	PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15)	3-10
NA	NA	CR-DECON-01	Decontamination Water Source	NA	NA (collect from tap or hose)	PFAS (LC/MS/MS compliant with QSM 5.3 Table B-15)	3-10

Notes:
* Locations of field quality control samples (duplicates and MS/ MSDs) will be selected in the field at the rates specified in **Worksheet #20** of this SI QAPP Addendum. The location and sample identifiers listed in **Worksheet #18** are included as examples only.

Notes (continued):
AOI = area of interest
ASTM = American Society for Testing and Materials
bgs = below ground surface
D = duplicate
ERB = equipment rinsate blank
FRB = field regent blank
GW = groundwater
LC/MS/MS = liquid chromatography-tandem mass spectrometry
MS = matrix spike
MSD = matrix spike duplicate
NA = not applicable
PFAS = per- and polyfluoroalkyl substances
QA = quality assurance
QC = quality control
QSM = Quality Systems Manual
SB = soil boring
SOP = standard operating procedure
TBD = to be determined
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

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Final PQAPP Worksheet #19 & #30: Sample Containers, Preservation, and Hold Times

Laboratory: Pace Gulf Coast
7979 Innovation Park Dr.
Baton Rouge, Louisiana 70820
(225) 769-4900
List any required accreditations/certifications: DoD/ELAP; applicable state certification
Back-up Laboratory: NA
Sample Delivery Method: FedEx

Analyte/ Analyte Group	Matrix	Method/SOP	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
PFAS	Aqueous	QSM 5.3 Table B-15/ SOP LCMS-011 (BRTO-0111)	ELAP-01/31/2023 NELAP-6/30/2021	HDPE w/ HDPE screw cap 2 x 125mL	Cool, 0-6°C	14 days from collection to extraction	28 days from extraction to analysis	28 days
PFAS	Solid	QSM 5.3 Table B-15/ SOP LCMS-011 (BRTO-0111)	ELAP-01/31/2023 NELAP-6/30/2021	HDPE w/ HDPE screw cap 1 x 250 mL	Cool, 0-6°C	14 days from collection to extraction	28 days from extraction to analysis	28 days
Total Organic Carbon	Solid	USEPA 9060A, SM 5310 B-2011/WL-057	ELAP-01/31/2023 NELAP-6/30/2021	Polyethylene, Glass 1 x 2oz	Cool, 0-6ºC,	30 days to extraction	7 days from extraction to analysis	28 days
pH	Solid	USEPA 9045D/EXT-032	ELAP-01/31/2023 NELAP-6/30/2021	Polyethylene, Glass 1 x 2oz	None	NA	Immediate	28 days
Grain Size	Solid	ASTM D422/ CA-551	02/01/2022	Polyethylene, Glass 1 x 8oz	Cool, 0-6ºC	None	None	28 days

Notes:
1.) TOC and pH are important for evaluating transport through the soil medium.

°C = degrees Celsius
ASTM = American Society for Testing and Materials
DoD = Department of Defense
ELAP = Environmental Laboratory Accreditation Program
HDPE = high-density polyethylene
LCMS = liquid chromatography/ mass spectrometry
mL = milliliter
NA = not applicable
NELAP = National Environmental Laboratory Accreditation Program
oz = ounce
PFAS = per- and polyfluoroalkyl substances
QSM = Quality Systems Manual
SOP = standard operating procedure
USEPA = United States Environmental Protection Agency

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Final PQAPP Worksheet #20: Field Quality Control Summary

Matrix	Analytical Group	Field Samples	Field Duplicates	Matrix Spikes	Matrix Spike Duplicates	Field Reagent Blanks	Equipment Rinsate Blanks*	Total Samples
Groundwater	PFAS	6	1	1	1	1	0	10
Soil	PFAS	16	2	1	1	0	2**	22
	pH, TOC	2	1	1	1	0	0	5
	Grain Size	2	0	0	0	0	0	2
Catch Basin Sediment	PFAS	2	1	1	1	0	1**	6
Decontamination Water	PFAS	1	0	0	0	0	0	1

Notes:
*Applies only if use of non-dedicated sampling equipment is necessary
** Equipment rinsate blanks for solid matrices are aqueous samples

PFAS = per- and polyfluoroalkyl substances
TOC = total organic carbon

Measurement Performance Criteria Table — Field Quality Control Samples				
QC Sample	**Analytical Group**	**Frequency**	**Data Quality Indicators**	**MPC**
Matrix: Aqueous (Groundwater / Surface Water / Potable Wells)				
Field Duplicate	PFAS	One per 10 field samples	Precision	Values > 5X LOQ: RPD must be ≤30% Values ≤ 5X LOQ: Absolute difference ≤ 2x the LOQ
Matrix Spike/Matrix Spike Duplicate	PFAS	One per 20 field samples[1]	Bias/Accuracy/Precision (lab)	RPD ≤ 30%; Refer to Worksheet #28 for recovery criteria
Equipment Rinsate Blank	PFAS	One per 20 field samples per type of reusable equipment used[2]	Accuracy/ Bias	No target analytes ≥ ½ LOQ, unless target analytes in field samples are > 10x those in rinsate blank. Laboratory-certified PFAS-free water will be used to collect ERBs.
Reagent Blank	PFAS	One per sampling event[3]	Accuracy/ Bias	No target analytes ≥ ½ LOQ, unless target analytes in field samples are > 10x those in rinsate blank
Cooler Temperature Blank	PFAS	One per cooler	Representativeness	Temperature must be above freezing and ≤ 6 °C
Matrix: Solid (Soil and Sediment)				
Field Duplicate	PFAS, TOC	One per 10 field samples	Precision	Values > 5X LOQ: RPD must be ≤30% Values ≤ 5X LOQ: Absolute difference ≤ 2x the LOQ
Matrix Spike/Matrix Spike Duplicate	PFAS, TOC	One per 20 field samples[1]	Bias/Accuracy/Precision (lab)	RPD ≤ 30%; Refer to Worksheet #28 for recovery criteria
Reagent Blank	PFAS	One per sampling event[3]	Accuracy/ Bias	No target analytes ≥ ½ LOQ, unless target analytes in field samples are > 10x those in rinsate blank
Equipment Rinsate Blank	PFAS	One per 20 field samples per type of reusable equipment used[2]	Accuracy/ Bias	No target analytes ≥ ½ LOQ, unless target analytes in field samples are > 10x those in rinsate blank
Cooler Temperature Blank	PFAS	One per cooler	Representativeness	Temperature must be above freezing and ≤ 6°C

Notes:

1.) Analyzed more frequently than one per twenty samples or per sample delivery group.
2.) Only for re-usable equipment, not for disposable equipment/ supplies.
3.) Regardless of matrix.

% = percent
≤ = less than or equal to
≥ = greater than or equal to
°C = degrees Celsius
FRB = field reagent blank
LOQ = limit of quantitation
MPC = measurement performance criteria
PFAS = per- and polyfluoroalkyl substances
QC = quality control
RPD = relative percent difference
TOC = total organic carbon

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Final PQAPP Worksheet #21: Field Standard Operating Procedures

A summary of SOPs is provided in the table below, which can be found in **Appendix B**. All field staff will be trained through AECOM's internal PFAS Sampling Training prior to performing any sampling activities. A summary of the acceptability of certain materials for use in the PFAS sampling environment and a PFAS sampling checklist to be completed daily is provided in SOP 3-41.

Reference Number	Title, Revision Date, and/or Number	Originating Organization	Modified for Project Work?	Comments
3-01	*Utility Clearance*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-02	*Logbooks*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-03	*Recordkeeping, Sample Labeling and Chain of Custody*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-04	*Sample Handling, Storage, and Shipping*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-05	*Investigation-Derived Waste Management*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-06	*Equipment Decontamination*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-07	*Land Surveying*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-09	*Geophysics*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-10	*Surface Water Sampling*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-12	*Monitoring Well Installation*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-13	*Monitoring Well Development*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-14	*Monitoring Well Sampling*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures

Reference Number	Title, Revision Date, and/or Number	Originating Organization	Modified for Project Work?	Comments
3-15	*Monitoring Well and Borehole Abandonment*	AECOM	N	See SOP for detailed procedures
3-16	*Soil and Rock Classification*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-17	*Direct Push Sampling Techniques*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-20	*Operation and Calibration of Photoionization Detector*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-21	*Surface and Subsurface Soil Sampling Procedures*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-22	*Sediment Sampling*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-24	*Water Quality Parameter Testing for Groundwater Sampling*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-33	*Subsurface Soil Sampling by Split Spoon*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-35	*In-Situ Hydraulic Conductivity Testing via Rising or Falling Head Slug Testing*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-37	*Grab Groundwater Sampling Techniques*	AECOM	Y	Modified for PFAS sampling See SOP for detailed procedures
3-41	*Per- and Polyfluoroalkyl Substance Field Sampling Protocol*	AECOM	Y	See SOP for detailed procedures

Notes:
AECOM = AECOM Technical Services, Inc.
N = no
NA = not applicable
PFAS = per- and polyfluoroalkyl substances
SOP = standard operating procedure
Y = yes

Final PQAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Equipment	Calibration Activity	Maintenance Activity	SOP Reference	Testing Activity	Inspection Activity	Title or Position of Responsible Person	Frequency	Calibration Acceptance Criteria	Corrective Action
Horiba U-52 Water Quality Standards (pH, ORP, DO, Conductivity, Temperature, Turbidity)	Calibrate with standard solutions	Per page 8 of SOP 3-24	SOP 3-24	Operational equipment check and calibration	Visually inspect for cleanliness and obvious defects (broken/missing parts)	Field Technician Lead	Prior to use	DO: ±0.3 mg/L of the theoretical oxygen solubility ORP: ±10 mv from the theoretical standard value at that temperature pH: ±0.2 pH Units Specific Conductance: ±5% of the standard Turbidity: 0.1 to 10 NTU: ±10% of the standard 11 to 40 NTU: ±8% of the standard 41 to 100 NTU: ±6.5% of the standard	Minor: Repair Major: Replace instrument
MiniRAE 2000 (PID)	Calibrate with fresh air and isobutylene calibration gas	Per page 4 of SOP 3-20	SOP 3-20	Operational equipment check and calibration	Visually inspect for cleanliness and obvious defects (broken/missing parts)	Field Technician Lead	Prior to use	0-99 ppm ± 0.1 ppm 100-1,999 ppm ± 1.0 ppm 2000-10,000 ppm ± 10 ppm	Minor: Repair Major: Replace instrument
QED MP10 Controller (Bladder Pump Controller Box)	NA	--	SOP 3-14	Operational equipment check	Visually inspect for cleanliness and obvious defects (broken/missing parts)	Field Technician Lead	Prior to use	NA	Minor: Repair Major: Replace instrument

Field Equipment	Calibration Activity	Maintenance Activity	SOP Reference	Testing Activity	Inspection Activity	Title or Position of Responsible Person	Frequency	Calibration Acceptance Criteria	Corrective Action
QED SamplePro (Stainless Steel Submersible Bladder Pump)	NA	Per page 7 of SOP 3-14	SOP 3-14	Operational equipment check	Visually inspect for cleanliness and obvious defects (broken/missing parts)	Field Technician Lead	Prior to use	NA	Minor: Repair Major: Replace instrument
Solinst 101 (Water Level Meter)	NA	Per page 5 of SOP 3-14	SOP 3-14	Operational equipment check	Visually inspect for cleanliness and obvious defects (broken/missing parts)	Field Technician Lead	Prior to use	NA	Minor: Repair Major: Replace instrument
Geotech GeoPump (Peristaltic Pump)	NA	NA	SOP 3-14	Operational equipment check	Visually inspect for cleanliness and obvious defects (broken/missing parts)	Field Technician Lead	Prior to use	NA	Minor: Repair Major: Replace instrument

Notes:
°C = degrees Celsius
DO = dissolved oxygen
mg/L = milligrams per liter
NA = not applicable
NTU = nephelometric turbidity unit
ORP = oxidation-reduction potential
PID = photoionization detector
ppm = parts per million
SOP = standard operating procedure
Temp = temperature
µS/cm = micro Siemens per centimeter

Final PQAPP Worksheet #23: Analytical Standard Operating Procedures

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
LCMS-011 (BRTO-0111)	*Analysis of PFAS, 04/15/20, Revision 07*	Definitive	Water/PFAS Solid/PFAS	Agilent 6460 Triple Quad LC/MS/MS	Pace Gulf Coast	N
ENV-SOP-BTRO-0044 01 (WL-057)	*TOC in Solids*	Definitive	Solid/TOC	Shimadzu TOC-V CSH or TOC-V CPH analyzer	Pace Gulf Coast	N
EXT-032	*pH in Aqueous and Soil/Waste Samples, 10/26/17, Revision 18*	Definitive	Solid/pH	Orion 720A pH Meter, Combination Electrode	Pace Gulf Coast	N
CA-551	*Grain Size Analysis, 04/19, Revision 2.*	Definitive	Solid/Grain Size	Sieve	Katahdin Analytical Services, Inc.	N

Notes:
LCMS = liquid chromatography/ mass spectrometry
LC/MS/MS = liquid chromatography-tandem mass spectrometry
N = no
PFAA = perfluorinated alkyl acids
PFAS = per- and polyfluoroalkyl substances
SOP = standard operating procedure
TOC = total organic carbon
Y = yes

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Final PQAPP Worksheet #24: Analytical Instrument Calibrations

Instrument/ Equipment	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person(s) Responsible for CA	SOP Reference
LC/MS/MS	Calibration Standards	NA	Prior to sample analysis	For analytes which have both linear and branched isomers and have standards available containing both linear and branched isomers, the analytes are calibrated and quantitated using a single continuous baseline to integrate all identifiable isomers.	NA	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	Tune Check	NA	When the masses fall outside of the ±0.5 amu of the true value (as determined by the product ion formulas).	Mass assignments of tuning standard within 0.5 amu of true value.	Retune instrument and verify. If the tuning will not meet acceptance criteria, an instrument mass calibration must be performed and the tune check repeated.	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)

Instrument/ Equipment	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person(s) Responsible for CA	SOP Reference
LC/MS/MS	Minimum five-point initial calibration for all analytes (ICAL)	5.0 – 100 ppb on column	Initial calibration prior to sample analysis	The isotopically labeled analog of an analyte (Extracted Internal Standard Analyte) must be used for quantitation if commercially available (Isotope Dilution Quantitation). Commercial PFAS standards available as salts are acceptable providing the measured mass is corrected to the neutral acid concentration. Results shall be reported as the neutral acid with appropriate CAS number. If a labeled analog is not commercially available, the Extracted Internal Standard Analyte with the closest retention time or chemical similarity to the analyte must be used for quantitation. (Internal Standard Quantitation) Analytes must be within 70-130% of their true value for each calibration standard. ICAL must meet one of the two options below: Option 1: The RSD of the RFs for all analytes must be ≤ 20%. Option 2: Linear or nonlinear calibrations must have r2 ≥ 0.99 for each analyte.	Repeat calibration if criterion is not met	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	Second source calibration verification	50 ppb on column	Once after each initial calibration	All analytes must calculate to be within 70-130% of true value and extracted internal standard must calculate to be within 50-150% of true value.	Remake standard, recalibrate if necessary	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	Retention Time Windows	NA	Prior to sample analysis	Established with the first CCV of the day or the average of the ICAL on days when calibration is performed. See Table 3 of LCMS-011 for RT Windows.	Perform maintenance on pump or column. Recalibrate, if necessary, to re-establish retention times.	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)

Instrument/ Equipment	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person(s) Responsible for CA	SOP Reference
LC/MS/MS	Tune check	Agilent ESI-L Low Concentration Tuning Mix	Daily, prior to sample analysis, only once per analytical batch. No time constraints.	Manufacturer recommended criteria which include delta and FWHM tolerance checks of 6 m/z's over the spectrum of the detector.	Retune instrument and repeat check tune. Maintenance may be required.	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	LOD/LOQ verification	Various, see Table 3 of LCMS-010	Quarterly	LOD meets method qualitative requirements or is at least 3x higher than noise; LOQ is recovered within LCS criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	ICV	NA	Once after each ICAL, analysis of a second source standard prior to sample analysis.	Analyte concentrations must be within ±30% of their true value.	Correct problem, rerun ICV. If problem persists, repeat ICAL.	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	CCV	5ppb and 50ppb on column	Prior to sample analysis, after every 10 field samples, and at the end of the analytical sequence.	Concentration of analytes must range from the LOQ to the mid-level calibration concentration. Analyte concentrations must be within ±30% of their true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)

Instrument/ Equipment	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person(s) Responsible for CA	SOP Reference
LC/MS/MS	Mass Spectral Acquisition Rate	NA	Each analyte, Extracted Internal Standard (EIS) Analyte.	Calibrate the mass scale of the MS with calibration compounds and procedures described by the manufacturer. Mass calibration range must bracket the ion masses of interest. The most recent mass calibration must be used for every acquisition in an analytical run. Mass calibration must be verified to be ±0.5 amu of the true value, by acquiring a full scan continuum mass spectrum of a PFAS stock standard.	NA	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	Calibration, Calibration Verification, and Spiking Standards	5ppb and 50ppb on column	Instrument must have a valid mass calibration prior to any sample analysis. Mass calibration is verified after each mass calibration, prior to initial calibration (ICAL).	Standards containing both branched and linear isomers must be used when commercially available. PFAS method analytes may consist of both branched and linear isomers, but quantitative standards that contain the linear and branched isomers do not exist for all method analytes. For PFAS that do not have a quantitative branched and linear standard, identify the branched isomers by analyzing a qualitative standard that includes both linear and branched isomers and determine retention times, transitions and transition ion ratios. Quantitate samples by integrating the total response (i.e., accounting for peaks that are identified as linear and branched isomers) and relying on the initial calibration that uses the linear isomer quantitative standard.	NA	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)

Instrument/ Equipment	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person(s) Responsible for CA	SOP Reference
LC/MS/MS	ISC	NA.	Prior to analysis and at least once every 12 hours.	Analyte concentrations must be at LOQ; concentrations must be within ±30% of their true values.	Correct problem, rerun ISC. If problem persists, repeat ICAL.	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	Instrument Blanks	NA.	Immediately following the highest standard analyzed and daily prior to sample analysis.	Concentration of each analyte must be ≤ ½ the LOQ. Instrument Blank must contain EIS to enable quantitation of contamination.	If acceptance criteria are not met after the highest calibration standard, calibration must be performed using a lower concentration for the highest standard until acceptance criteria is met. If sample concentrations exceed the highest allowed standard and the sample(s) following exceed this acceptance criteria (>1/2 LOQ), they must be reanalyzed.	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	Retention Time Window	NA	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)
LC/MS/MS	Retention Time (RT Window Width	NA	Every field sample, standard, blank, and QC sample	RT of each analyte and EIS analyte must fall within 0.4 minutes of the predicted retention times from the daily calibration verification or, on days when ICAL is performed, from the midpoint standard of the ICAL. Analytes must elute within 0.1 minutes of the associated EIS. This criterion applies only to analyte and labeled analog pairs.	Correct problem and reanalyze samples.	Analyst, Supervisor, QA Manager	LCMS-011 (BRTO-0111)

Instrument/ Equipment	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person(s) Responsible for CA	SOP Reference
LC/MS/MS	Ion Transitions (Precursor →Product)	NA	Every field sample, standard, blank, and QC sample	In order to avoid biasing results high due to known interferences for some transitions, the following transitions must be used for the quantification of the following analytes: PFOA: 413 → 369 PFOS: 499 → 80 PFHxS: 399 → 80 PFBS: 299 → 80 4:2 FTS: 327 → 307 6:2 FTS: 427 → 407 8:2 FTS: 527 → 507 NEtFOSAA: 584 → 419 NMeFOSAA: 570 → 419 If these transitions are not used, the reason must be technically justified and documented (e.g., alternate transition was used due to observed interferences).	NA	NA	LCMS-011 (BRTO-0111)
Shimadzu TOC-V CSH or TOC-V CPH	ICAL	Various	Analyzed and evaluated before any result can be quantitated.	The correlation coefficient must be 0.995 or greater	Correct problem; recalibrate instrument, new calibration verified	Analyst, Supervisor, QA Manager	WL-057 (BRTO-0044)
Shimadzu TOC-V CSH or TOC-V CPH	ICV	10,000 µg & 20,000 µg	Immediately following the ICAL	±10% (90-110% of true value)	Instrument maintenance, reanalysis of ICV or initial calibration or re-preparation of the standards	Analyst, Supervisor, QA Manager	WL-057 (BRTO-0044)

Instrument/ Equipment	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person(s) Responsible for CA	SOP Reference
Shimadzu TOC-V CSH or TOC-V CPH	CCV	10,000 µg	Each day that an ICAL is not performed a CCV must be performed before sample analysis. Also analyze every 10 samples ant at the end of analytical batch	±10 % (90-110% of true value)	Instrument maintenance, reanalysis of ICV or initial calibration or re-preparation of the standards	Analyst, Supervisor, QA Manager	WL-057 (BRTO-0044)
Shimadzu TOC-V CSH or TOC-V CPH	CCB	<250 mg/kg	Analyzed after every 10 samples or more frequently and at the end of analytical batch	Concentration must be less than the LOQ	Correct problem; recalibrate instrument	Analyst, Supervisor, QA Manager	WL-057 (BRTO-0044)
Orion 720 pH Meter	Calibrate meter	1.00-13.00	Daily before use	92-108%	Recalibrate meter	Analyst, Supervisor QA Manager	EXT-032
Orion 720 pH Meter	QC Check Buffer	8.00	Immediately after calibration and with every 20 samples	0.05 pH units of the true value	Recalibrate meter	Analyst, Supervisor, QA Manager	EXT-032

Notes:
% = percent
µg = micrograms
amu = atomic mass unit
CCB = continuing calibration blank
CCV = continuing calibration verification
DL = detection limit
ESI = electrospray Ionization

ICAL = initial calibration
ICV = independent calibration verification
ISC = instrument sensitivity check
LCMS = liquid chromatography/ mass spectrometry
LC/MS/MS = liquid chromatography-tandem mass spectrometry
LCS = laboratory control spike
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram
NA = not applicable
OSD = Office of the Secretary of Defense
PFOA = perfluorooctanoic acid
PFOS = perfluorooctanesulfonic acid
ppb = parts per billion
QA = quality assurance
QC = quality control
RSD = relative standard deviation
SOP = standard operating procedure
SL = screening level
S/N = signal to noise

Final PQAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing and Inspection

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
LC/MS/MS	Clean ESI Chamber	NA	NA	Weekly or as needed	NA	NA	Analyst	LCMS-011 (BRTO-0111)
LC/MS/MS	Backflush Analytical Column and Hold Column for Solvent Cleaning	NA	Peak Asymmetry	As needed	NA	NA	Analyst	LCMS-011 (BRTO-0111)
Shimadzu TOC-V CSH or TOC-V CPH	Change injection needle, change catalyst	TOC	Monitor instrument performance via Continuing Calibration Verification	As needed or replace as necessary, loss of sensitivity or failing resolutions, erratic response	No maintenance is required as long as instrument QC meets criteria	Perform instrument maintenance, clean injection needle, change catalyst	Analyst, Supervisor, QA Manager	WL-057 (BRTO-0044)

Notes:
ESI = electrospray ionization
LCMS = liquid chromatography/ mass spectrometry
LC/MS/MS = liquid chromatography-tandem mass spectrometry
NA = not applicable
QC = quality control
SOP = standard operating procedure
TOC = total organic carbon

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Final PQAPP Worksheet #26 & #27: Sample Handling, Custody, and Disposal

Sampling Organization: AECOM
Laboratory: Pace Gulf Coast
Method of sample delivery (shipper/carrier): FedEx
Number of days from reporting until sample disposal: 60 Days

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	AECOM	SOP 3-03 *Recordkeeping, Sample Labeling and Chain of Custody*
CoC form completion	AECOM	
Packaging	AECOM	SOP 3-04 *Sample Handling, Storage, and Shipping*
Shipping coordination	AECOM	
Sample receipt, inspection, & log-in	Pace Gulf Coast	SAD-001 *Sample Receiving and LIMS Log-In*
Sample custody and storage	Pace Gulf Coast	SAD-002 *Sample Chain of Custody and Sample Integrity*
Sample disposal	Pace Gulf Coast	GEN-009 *Waste Collection, Storage, Disposal*

Notes:
AECOM = AECOM Technical Services, Inc.
CoC = chain of custody
GEN = Quality Control Standard Operating Procedure
LIMS = Laboratory Information Management System
SAD = Sample Administration Standard Operating Procedure
SOP = Standard Operating Procedure

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Final PQAPP Worksheet #28: Analytical Quality Control and Corrective Actions

Matrix: Soil & Aqueous
Analytical Group: PFAS
Analytical Method: PFAS by LC/MS/MS Compliant with QSM 5.3 Table B-15
SOP Reference: LCMS-011 (BRTO-0111)
Certification Status: DoD/ELAP Certification

QC Sample	Frequency/ Number	Method/SOP Acceptance Limits	Corrective Action	Person(s) Responsible	Measurement Performance Criteria
Aqueous Sample Preparation	Each sample and associated batch QC samples.	Method/SOP Acceptance Limits Solid Phase Extraction (SPE) must be used unless samples are known to contain high PFAS concentrations e.g., Aqueous Film Forming Foam (AFFF). Inline SPE is acceptable. Entire sample plus bottle rinsate must be extracted using SPE. Known high PFAS concentration samples require serial dilution be performed in duplicate. Documented project approval is needed for samples prepared by serial dilution as opposed to SPE.	NA	Analyst, Supervisor, QA Manager	As per Table B-15
Solid Sample Preparation	Each sample and associated batch QC samples.	Entire sample received by the laboratory must be homogenized prior to subsampling.	NA	NA	As per Table B-15
Sample Cleanup Procedure	Each sample and associated batch QC samples. Not applicable to AFFF and AFFF Mixture Samples	ENVI-Carb™ or equivalent must be used on each sample and batch QC sample	NA	NA	As per Table B-15

QC Sample	Frequency/ Number	Method/SOP Acceptance Limits	Corrective Action	Person(s) Responsible	Measurement Performance Criteria
Method Blank	One per preparatory batch, maximum of 20 samples	No analytes detected > ½ LOQ or > 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater.	Correct problem. If required, re-extract and reanalyze MB and all QC samples and field samples processed with the contaminated blank. Samples may be reextracted and analyzed outside of hold times, as necessary for corrective action associated with QC failure. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Analyst, Supervisor, QA Manager	As per Table B-15
LCS	One per preparatory batch, maximum of 20 samples	Blank spiked with all analytes at a concentration ≥ LOQ and ≤ the mid-level calibration concentration. As Per Worksheet #15 and Table C-44 and 45 of QSM 5.3	Correct problem, then re-extract and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available. Samples may be reextracted and analyzed outside of hold times, as necessary for corrective action associated with QC failure.	Analyst, Supervisor, QA Manager	As per Table B-15
Matrix Spike	One per preparatory batch. Not required for aqueous samples prepared by serial dilution instead of SPE.	Sample spiked with all analytes at a concentration ≥ LOQ and ≤ the mid-level calibration concentration. All targets spiked and within the QC limits included in Worksheet #15.	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when lab error is suspected, otherwise, qualify data with narrative.	Analyst, Supervisor, QA Manager	As per Table B-15

QC Sample	Frequency/ Number	Method/SOP Acceptance Limits	Corrective Action	Person(s) Responsible	Measurement Performance Criteria
MSD or MD	For MSD: One per preparatory batch. For MD: Each aqueous sample prepared by serial dilution instead of SPE.	For MSD: Sample spiked with all analytes at a concentration ≥ LOQ and ≤ the mid-level calibration concentration. For MSD: All targets spiked and within the QC limits included in Worksheet #15. RPD ≤ 30% (between MS and MSD or sample and MD).	The data shall be evaluated to determine the source of difference. For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ. The MD is a second aliquot of the field sample that has been prepared by serial dilution.	Analyst, Supervisor, QA Manager	As per Table B-15
Extracted Internal Standards	Every field sample, standard, blank, and QC sample.	Added to solid sample prior to extraction. Added to aqueous samples, into the original container, prior to extraction. For aqueous samples prepared by serial dilution instead of SPE, added to final dilution of samples prior to analysis. EIS Analyte recoveries must be within 50% to 150% of ICAL midpoint standard area or area measured in the initial CCV on days when an ICAL is not performed.	If recoveries are acceptable for QC samples, but not field samples, the field samples must be re-prepped and reanalyzed (greater dilution may be needed). If recoveries are unacceptable for QC samples, correct problem, and reanalyze all associated failed field samples.	Analyst, Supervisor, QA Manager	As per Table B-15
Instrument Internal Standard Analytes (Used for quantitation of drinking water results)	Every field sample, standard, blank, and QC sample.	Added to aliquot of sample dilutions, QC samples, and standards just prior to analysis. Peak areas must be within -50% to +50% of the area measured in the ICAL midpoint standard. On days when ICAL is not performed, the peak areas must be within -50% to +50% of the peak area measured in daily initial CCV.	If peak areas are unacceptable, analyze a second aliquot of the extract or sample if enough extract remains. If there is not enough extract, reanalyze the first aliquot. If second analysis meets acceptance criteria, report the second analysis. If it fails, either analysis may be reported with the appropriate flags.	Analyst, Supervisor, QA Manager	As per Table B-15

QC Sample	Frequency/ Number	Method/SOP Acceptance Limits	Corrective Action	Person(s) Responsible	Measurement Performance Criteria
Post Spike Sample	Only applies to aqueous samples prepared by serial dilution instead of SPE that have reported value of "<LOQ" for analyte(s).	Spike aliquot(s) of sample at the final dilution(s) reported for sample with all analytes that have reported value of "<LOQ" in the final dilution. The spike must be at the LOQ concentration to be reported with the sample (the "<LOQ" value). When analyte concentrations are calculated as "<LOQ", the spike must recover within 70-130% of its true value.	When analyte concentrations are calculated as "<LOQ", and the spike recovery does not meet the 70-130% acceptance criteria, the sample, sample duplicate, and post spike sample must be reanalyzed at consecutively higher dilutions until the criteria is met.	Analyst, Supervisor, QA Manager	As per Table B-15

QC Sample	Frequency/ Number	Method/SOP Acceptance Limits	Corrective Action	Person(s) Responsible	Measurement Performance Criteria
Sample PFAS Identification	All analytes detected in a sample.	The chemical derivation of the ion transitions must be documented. A minimum of two ion transitions (Precursor → quant ion and precursor → confirmation ion) and the ion transitions ratio per analyte are required for confirmation. Exception is made for analytes where two transitions do not exist (PFBA and PFPeA). Documentation of the primary and confirmation transitions and the ion ratio is required. In-house acceptance criteria for evaluation of ion ratios must be used and must not exceed 50-150%. Signal to Noise Ratio (S/N) must be ≥ 10 for all ions used for quantification and must be ≥ 3 for all ions used for confirmation. Quant ion and confirmation ion must be present and must maximize simultaneously (±2 seconds).	NA	Analyst, Supervisor, QA Manager	As per Table B-15

Notes:
% = percent
< = less than
> = greater than
≤ = less than or equal to
≥ = greater than or equal to
AFFF = aqueous film forming foam
CCV = continuing calibration verification
ICAL = initial calibration
LC/MS/MS = liquid chromatography tandem mass spectrometry
LCS = laboratory control spike
LOD = limit of detection
LOQ = limit of quantitation
MD = matrix duplicate
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
QA = quality assurance
QC = quality control
RPD = relative percent difference
SOP = standard operating procedure
SPE = solid phase extraction

Matrix: Soil
Analytical Group: Total Organic Carbon
Analytical Method: USEPA 9060A
SOP Reference: BRTO-0044
Certification Status: DoD/ELAP Certification

QC Sample	Frequency/ Number	Method/SOP Acceptance Limits	Corrective Action	Person(s) Responsible	Measurement Performance Criteria
Method Blank	One per preparatory batch, maximum of 20 samples	Concentration shall not be > 1/2 the LOQ or 1/10 the amount of sample	The source of contamination should be investigated and samples should be reanalyzed. If, additional sample is not available, report with narrative.	Analyst, Supervisor, QA Manager	As per method
LCS	One per preparatory batch, maximum of 20 samples	90-110%	If LCS fails to meet lab criteria, the source of inaccuracy should be investigated and samples reanalyzed. If additional sample is not available, report in a narrative.	Analyst, Supervisor, QA Manager	As per method
MS	One pair per batch (assuming sufficient volume exists) or as specified by client request.	80-120%	If recovery is outside control limits and a lab error suspected, repeat the MS determination. If the LCS is within control limits and the matrix interference is indicated, analyze a post digestion spike and report results with a narrative.	Analyst, Supervisor, QA Manager	As per method
Duplicate/ MSD	One pair per batch (assuming sufficient volume exists) or as specified by client request.	RPD should be ≤20	Investigate the source of the precision error. A source of precision error in the duplicate /MSD may be the homogenous nature of the sample. If lab error is suspected, repeat analysis. If matrix issue is indicated, report with a narrative.	Analyst, Supervisor, QA Manager	As per method

Notes:
% = percent
< = less than
≤ = less than or equal to
DoD = Department of Defense
ELAP = Environmental Laboratory Accreditation Program
LCS = laboratory control spike
LOQ = limit of quantitation
MS/MSD = matrix spike/matrix spike duplicate
QA = quality assurance
QC = quality control
RPD = relative percent difference
SOP = standard operating procedure

Matrix: Soil
Analytical Group: pH
Analytical Method: USEPA 9045D
SOP Reference: EXT-032
Certification Status: DoD/ELAP Certification

QC Sample	Frequency/ Number	Method/SOP Acceptance Limits	Corrective Action	Person(s) Responsible	Measurement Performance Criteria
QC Check Buffer	Before sample analysis, after every 20 samples and at the end of analysis	Within ±0.05 pH of true value	Do not analyze samples without a daily LCS that meets criteria.	Analyst, Supervisor, QA Manager	As per method
Duplicate	One per batch, maximum of 20 samples	Within 0.1 pH unit	Repeat if sample volume allows or narrate results	Analyst, Supervisor, QA Manage	As per method

Notes:
% = percent
DoD = Department of Defense
ELAP = Environmental Laboratory Accreditation Program
LCS = laboratory control spike
QA = quality assurance
QC = quality control
SOP = standard operating procedure

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Final PQAPP Worksheet #29: Project Documents and Records

Sample Collection Documents and Records	Onsite Analysis Documents and Records	Offsite Analysis Documents and Records	Data Assessment Documents and Records	Other
Field Logbook	Field Logbook	Sample receipt, custody, and tracking records	Field sampling audit records	NA
CoC Records	Field Sampling Forms	Sample prep logs	Laboratory audit records	
Air Bills	Equipment Inspection Forms	Equipment calibration logs	Data validation reports	
Custody Seals	Boring Logs	Run logs	Data usability assessment reports	
Corrective Action Forms	Corrective Action Forms	Equipment maintenance test, and inspection logs	Corrective Action Forms	
Field Sampling Forms	Daily Tailgate SH&E Sign In Sheet	Corrective Action Forms	Field Change Request Form	
Sample location and depth data	APP/SSHP Acknowledgement	Reported analytical results		
Field equipment calibration logs	Dig Permits	Data package completeness checklists		
		Sample disposal records		
		Extraction/cleanup records		
		Raw data		
		EQuIS™		
		ROE Agreements		
		Photographic Logs		

Notes:
APP/SSHP = Accident Prevention Plan/ Site Safety and Health Plan
CoC = chain of custody
EQuIS = Environmental Quality Information System
SH&E = Safety, Health, and Environment
NA = not applicable
ROE = right of entry

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Final PQAPP Worksheet #31, #32 & #33: Assessments and Corrective Action

This worksheet is used to document responsibilities for conducting project assessments, responding to assessment findings, and implementing corrective action. Appropriately scheduled assessments allow management to implement corrective action in a timely manner, thereby correcting non-conformances and minimizing their impact on DQOs/Project Quality Objectives.

Assessments:

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Action	Person(s) Responsible for Monitoring Effectiveness of Corrective Action
Project Manager Review	Monthly (for field efforts that are longer than one month)	Internal	AECOM	Project Manager/ AECOM	Field Sampling Team Leader/ AECOM	Field Sampling Team Leader/ AECOM	Project Manager/ AECOM
Review of CoC forms	Daily	Internal	AECOM	Project Chemist/ AECOM	Field Sampling Team Leader/ AECOM	Field Sampling Team Leader/ AECOM	Project Chemist/ AECOM
Laboratory Data Assessment (validation)	Once	Internal	AECOM	Data Validator	Project Chemist/ AECOM	Data Validator	Project Chemist/ AECOM
Daily Quality Control Audits	Daily	Internal	AECOM	Field Sampling Team Leader/ AECOM	Field Sampling Team Leader/ AECOM	Field Sampling Team Leader/ AECOM	QA Officer/ AECOM
Field TSAs	Daily	Internal	AECOM	Field Sampling Team Leader/ AECOM	Field Sampling Team Leader/ AECOM	Field Sampling Team Leader/ AECOM	QA Officer/ AECOM
Field Performance Audits	Weekly	Internal	AECOM	Project Manager/ AECOM or representative	Field Sampling Team Leader/ AECOM	Field Sampling Team Leader/ AECOM	Project Manager/ AECOM

Assessment Response and Corrective Action:

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Timeframe for Response
Field Sampling Audit	Email	Field Sampling Team Leader/AECOM Project Manager	Immediate	Daily QC Report/ Email	Project Quality Manager/ Project Manager	24 hours after notification
Project Manager Review	Email	Field Sampling Team Leader/ AECOM	Immediate	Daily QC Report/ Email	AECOM Project Manager	24 hours after notification
Review of CoC forms	Email	Field Sampling Team Leader/AECOM Project Manager	Immediate	Daily QC Report/ Email	Project Chemist	24 hours after notification
Laboratory Data Assessment (validation)	Written Audit Report	Laboratory QA Manager; AECOM Project Chemist	Within 24 hours after audit	Email	Data Validator	Up to 1 week after notification
Daily Quality Control Audits	Email/ Daily QC Report	Field Sampling Team Leader/AECOM Project Manager	Immediate	Daily QC Report/ Email	AECOM Project Manager	24 hours after notification
Field TSAs	Email/ Daily QC Report	Field Sampling Team Leader/AECOM Project Manager	Immediate	Daily QC Report/ Email	AECOM Project Manager	24 hours after notification
Field Performance Audits	Email	Field Sampling Team Leader	Immediate	Daily QC Report/ Email	AECOM Project Manager	24 hours after notification

Laboratory Assessments: Pace Gulf Coast

Assessment Type	Responsible Party & Organization	Number/ Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
DoD/ELAP Accreditation	PJLA	Every Two Years	NA	Certification	NA
PT samples	Laboratory QAM	Accreditation	Per Accrediting Authority	Per Accrediting Authority	Per Accrediting Authority
Data Review	Naoum Tavantzis, AECOM	Once	45 days after receipt of data	Validation Report	45 days after receipt of data
External Laboratory Audit	PJLA	Bi-annually	NA	Written Audit Report	NA
Internal Laboratory Audit	Pace Gulf Coast	Annually	NA	Written Audit Report	NA

Notes:
AECOM = AECOM Technical Services, Inc.
CoC = chain of custody
DoD = Department of Defense
ELAP = Environmental Laboratory Accreditation Program
NA = not applicable
PJLA = Perry Johnson Laboratories Accreditation
PT = proficiency testing
QA = quality assurance
QAM = Quality Assurance Manager
QC = quality control
TSA = technical system audit

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Final PQAPP Worksheet #34: Data Verification and Validation Inputs

Item	Description	Verification (Completeness)	Validation (Conformance to Specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
4	Field SOPs	X	
5	Laboratory SOPs	X	
Field Records			
6	Field logbooks	X	
7	Equipment calibration records	X	
8	CoC Forms	X	X
9	Sampling diagrams/surveys	X	
10	Drilling logs	X	
11	Relevant correspondence	X	
12	Change orders/deviations	X	
13	Field audit reports	X	
14	Field change request forms	X	
Analytical Data Package			
16	Cover sheet (laboratory identifying information)	X	X
17	Case narrative	X	X
18	Internal laboratory CoC	X	X
19	Sample receipt records	X	X
20	Sample chronology (i.e., dates and times of receipt, preparation, and analysis)	X	X
21	Communication records	X	
22	LOD/LOQ establishment and verification	X	
23	Standards traceability	X	
24	Instrument calibration records	X	X
25	Definition of laboratory qualifiers	X	
26	Results reporting forms	X	X
27	QC sample results	X	X
28	Corrective action reports	X	X
29	Raw data	X	X
30	Electronic data deliverable	X	X

Notes:
CoC = chain of custody
LOD = limit of detection
LOQ = limit of quantitation
QAPP = Quality Assurance Project Plan
QC = quality control
SOP = standard operating procedure

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Final PQAPP Worksheet #35: Data Verification Procedure

This worksheet documents procedures that will be used to verify project data. The procedures apply to both field and laboratory records. Data verification is a completeness check to confirm that all required activities were conducted, all specified records are present, and the contents of the records are complete. As illustrated in the following example, verification often is performed at more than one step by more than one person.

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
CoC forms and shipping forms	CoC, Shipping Documents	CoC forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the CoC should be initialled by the reviewer, a copy of the CoC retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	Appropriate Field Sampling Team Leaders for the individual medias
Review of field logbooks	Field Logbooks	Review for completeness and accuracy.	Appropriate field Sampling Team Leaders
Field sampling TSAs	TSA Reports	Assessment of field sampling process prior to start of, or as close to the start of sampling as possible.	QA Manager or designee
Fixed laboratory analytical data review	Laboratory Data Package	Data controls are compared to this QAPP and DoD QSM v 5.3 (PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15) in a Three-Tiered process using a minimum 100% peer review.	PM or QA Manager
Fixed laboratory TSAs	Laboratory Data Package	ELAP audit and internal quality audits.	QA Manager
Fixed laboratory data verification	Data Validation Reports	100% data verification/validation for water and soil.	AECOM Project Chemist
Fixed laboratory data validation	Data Validation Reports	Calculate and assess laboratory DQIs.	QA Manager, or designee

Notes:
AECOM = AECOM Technical Services, Inc.
CoC = chain of custody
DoD = Department of Defense
DQI = data quality indicator
ELAP = Environmental Laboratory Accreditation Program
PFAS = per- and polyfluoroalkyl substances
PM = Project Manager
QA = quality assurance
QAPP = Quality Assurance Project Plan
QSM = Quality Systems Manual
TSA = technical system audit
USEPA = United States Environmental Protection Agency

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Final PQAPP Worksheet #36: Data Validation Procedures

Data Validator: AECOM

Analytical Group/Method	All Analytical Data
Analytical specifications	WS#24, WS #28 & Laboratory SOPs
Measurement performance criteria	WS #12, WS#15, and WS#28
Percent of data packages to be validated	100%
Percent of raw data reviewed	100%
Percent of results to be recalculated	0%
Validation procedure and qualification	National Functional Guidelines for Organic Superfund Data Review, January 2017 (USEPA, 2017b); Department of Defense General Data Validation Guidelines, November 2019 (DoD, 2019b); Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-15 (DoD, 2020).
Validation code	S2bVEM/S2bVM
Electronic validation program/version	AECOM EarthSoft EQuIS™ Automated Validation Assistant

Notes:
% = percent
AECOM = AECOM Technical Services, Inc.
DoD = Department of Defense
EQuIS = Environmental Quality Information System
SOP = standard operating procedure
USEPA = United States Environmental Protection Agency
WS = worksheet

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Final PQAPP Worksheet #37: Data Usability Assessment

The Data Usability Assessment (DUA) is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment will determine whether project execution and the resulting data DQOs established in **Worksheet #11** were achieved. Both sampling and analytical activities will be considered with the ultimate goal to assess whether the final, qualified results support the decisions to be made with the data.

The following personnel are responsible for participating in the DUA:

- AECOM Project Manager: Claire Mitchell
- AECOM Project Chemist: Naoum Tavantzis
- AECOM SI Task Manager: Jeremy Haney

The DUA will be documented as a discussion within the SI report and refer to the Data Validation Report that will appear in an appendix of the SI Report. The SI Report and DUA will be reviewed by the USACE. The Data Validation Report will follow the procedures given in **Worksheet #36**.

The following steps summarize the processes used to determine whether the collected data are of the right type, quality, and quantity to support the environmental decision-making for ARNG related to PFAS contamination at certain installations and describe how data quality issues will be addressed and how limitations on the use of the data will be handled.

Step 1	**Review the project's objectives and sampling design.** The key components established in the DQOs (**Worksheet #11**) will be reviewed to ensure that they are still applicable. Also, the sampling design and how it was implemented in the field will be reviewed for consistency with the stated objectives. For example, this step in the DUA will: • Reevaluate whether comparison criteria (i.e., SL; **Worksheet #15**) were updated since PQAPP generation and if laboratory quantitation limits (QLs) were sensitive enough for those changes (e.g., QLs remain lower than new criteria). It is important to note several states are in various stages of developing or finalizing limits for PFAS chemicals for different media; therefore, it is critical that SLs are regularly evaluated over the course of the project to ensure the SLs remain current. Additionally, project data must meet the measurement performance criteria (MPC) for sensitivity and project QLs specified in **Worksheets #15 & 28**. • Discuss the limitations and impact on the use of project data if validation reports indicate that project specific sensitivity goals or QLs were not achieved for a specific sampling or laboratory group, dataset or sample delivery group (SDG), matrix, analytical group, or concentration level.
Step 2	**Review the data verification and data validation outputs** Available Quality Assurance (QA) reports, including both field and laboratory generated forms, will be reviewed for deviations from planned activities identified in Step 1 (e.g., number and locations of samples, holding time exceedances, damaged samples, non-compliant proficiency testing sample results, and SOP deviations) and determine their impacts on the data usability. Validated data will be summarized and/or compiled to identify patterns, trends, and anomalies as they relate to the Data Quality Indicators (DQIs) precision, accuracy/bias,

	representativeness, comparability, completeness, and sensitivity. Descriptions of each DQI and examples of how each may be incorporated into the usability report follow.
Step 2 (cont.)	**Precision** Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, percent difference, or range, in either absolute or relative terms. Quality Control (QC) measures for precision include field duplicates, laboratory duplicates, MSDs, analytical replicates, and surrogates. To meet the needs of the data users, SI project data must meet the MPC for precision specified in **Worksheet #12** of this QAPP. Precision errors may be the result of one or more of the following: PFAS cross-contamination, field instrument variation, analytical measurement variation, poor sampling technique, sample transport problems, or spatial variation (heterogeneous sample matrices). To identify the cause of imprecision, the field sampling design rationale and sampling techniques will be evaluated by the reviewer, and both field and analytical duplicate/replicate sample results will be compared. For example, if poor precision is indicated in both the field and analytical duplicates/replicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate results, then the sampling technique, PFAS contamination, field instrument variation, sample transport, medium inhomogeneity, or spatial variability may be the source of error. If data validation reports indicate that analytical imprecision exists for a particular dataset or SDG, then the impact of that imprecision on usability will be discussed in the usability report.
	Accuracy/Bias Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) due to sampling and analytical operations. Examples of QC measures for accuracy include Matrix Spikes, Laboratory Control Samples, and ERBs. A measurement is accurate when the reported value does not differ from the true value or known concentration of the spike or standard. To meet the needs of the data users, project data must meet the MPC for accuracy/bias specified in **Worksheet #12** of this QAPP. The usability report for each installation will: • Discuss and compare data on contamination and accuracy/bias (when bias is observable) for each matrix, analytical group, and concentration level. • Describe the limitations on the use of project data if extensive contamination, inaccuracy, or bias exists, or when inaccuracy is limited to a specific sampling or laboratory group, dataset or SDG, matrix, or concentration level. • Discuss the impact of any qualitative and quantitative trends in bias on the sample data.
	Representativeness Representativeness is the measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition, and it is achieved through a well-designed sampling program and by using standardized sampling strategies, techniques, and analytical procedures. To meet the needs of the data users, project data must meet the MPC for sample representativeness specified in **Worksheet #12** of this QAPP. **Worksheet #28 & 35** discusses how the QA/QC activities (e.g., review of sampling design and SOPs, field sampling Technical System Audits (TSAs), and analysis audits) and QC sample data will be reviewed to assess sample representativeness. For example, if field duplicate precision checks indicate potential spatial variability, additional scoping meetings and subsequent resampling may be needed to collect data that are more representative of a nonhomogeneous site. The usability report for each installation will:

	• Discuss the impact of field duplicate imprecision on site representativeness. For example, when data variability is high among field duplicate datasets (i.e., high relative standard deviation), calculation of the 95% upper confidence limit (UCL) of the population mean is more likely to overestimate the true mean and therefore achieve better statistical coverage. • Discuss the impact of laboratory and field sampling methods on sampling results and how they reflect site conditions.
Step 2 (cont.)	• Discuss the effect of site heterogeneity on sampling results in light of sampling methods used. • Describe the limitations on the use of project data when sampling results are non-representative for all data or for a specific sampling, group, dataset or SDG, matrix, analytical group, or concentration level.
	Comparability Comparability is the degree to which different methods, datasets, and decisions agree or can be represented as similar. Comparability describes the confidence (expressed qualitatively or quantitatively) that two datasets can contribute to a common analysis and interpolation. The SI results will be used as benchmarks for determining comparability for data collected during any future sampling events at the various installations using the same or similar sampling and analytical SOPs. At this time, data will not be compared to other datasets or data using different sampling or analytical SOPs. To ensure future comparability of data generated for the installations, standard sample collection procedures and approved analytical methods will be used. Sample analyses will be performed by the laboratory using approved methods and procedures. Comparability criteria will be considered met for the project if, based on data reviewed, the sample collection and analytical procedures (such as use of alternate preparation if indicated by a positive field shake test) are determined to have been followed or defined to show that variations did not affect the values reported. Deviations to sampling scope will be documented in sampling nonconformance reports which may contain some of the discussion of comparability. The usability reports will describe the limitations on the use of project data when project-required data comparability is not achieved for the overall project or is limited to a specific sampling or laboratory group, dataset or SDG, matrix, analytical group, or concentration level.
	Completeness Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct, normal circumstances. To meet the needs of the data users, project data must meet the MPC for data completeness. Completeness criteria will be considered met if 100% of all planned sample data are collected. As applicable, the usability report may also: • Describe how the amount of valid data will be determined as a percentage of the number of valid measurements for each matrix, analytical group, and concentration level. • Describe how critical data were assessed for completeness when certain sample locations or analytes and matrices are more critical than others in making project decisions. • Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be usable to meet the DQOs (**Worksheet #11**).
	Sensitivity Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory fortified blanks, a DL study, Limit of Detection (LOD)/Limit of Quantitation (LOQ) Verifications, and Instrument Sensitivity Checks (ISC). To meet the needs of the data users, project data must meet the MPC for sensitivity and project QLs specified in **Worksheets #15 & 28** of this QAPP. If appropriate, the usability report may also:

	• Discuss and compare sensitivity and DL/LOD/LOQ from the datasets collected for the project for each matrix, analytical group, and concentration level. • Discuss the impact of a lack of sensitivity or higher DL/LOD/LOQ on data usability, if validation reports indicate that sensitivity goals or DL/LOD/LOQ goals were not achieved.
Step 2 (cont.)	• Describe the limitations on the use of project data when sampling results are non-representative for all data or for a specific sampling, group, dataset or SDG, matrix, analytical group, or concentration level.
Step 3	**Verify the assumptions of the selected statistical method** The use of statistical methods for data assessment for this project will be limited to estimating a 95% UCL (or mean as appropriate for the analyte) for the assessment of risks.
Step 4	**Implement the statistical method** Where statistical methods are used, the underlying assumptions will be assessed during the DUA. The consequences of selecting the incorrect alternative will be discussed, and uncertainty tolerances will be considered.
Step 5	**Document data usability and draw conclusions** The DUA will determine and document whether the data can be used as intended given any deviations and corrective actions that may have occurred. Limitations on data use will be considered and discussed as appropriate, and the performance of the sampling design assessed. Conclusions will be drawn taking any data limitations into consideration and documented in the SI report.

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Appendix A – Technical Project Planning Meeting Minutes (TPP1 and TPP2)

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Meeting Minutes
Camp Rilea – Site Inspection (SI)
Technical Project Planning (TPP) – Meeting 1 and 2
Preliminary Assessments and Site Inspections (PA/SIs) for Perfluorooctanesulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites
Contract No. W912DR-12-D-0014, DO W912DR17F0192
June 30, 2021
0900 – 1020 PDT

Participants			
Name	**Affiliation***	**Phone**	**E-Mail**
Joe Davis	ARNG G9	615-772-4616	Joe.b.davis36.ctr@mail.mil
Benino McKenna	USACE	--	Benino.P.Mckenna@usace.army.mil
Briana Niestrom	USACE	206-472-5611	Briana.C.Niestrom@usace.army.mil
Alison Suess	USACE	--	Alison.M.Suess@usace.army.mil
James Arnold	ORARNG	503-507-9719	james.g.arnold22.nfg@mail.mil
Kelly Toynton	ORARNG	503-559-2775	kelly.a.toynton.nfg@mail.mil
Dan Hafley	Oregon DEQ	503-229-5417	Dan.HAFLEY@state.or.us
Ann Farris	Oregon DEQ	503-687-7361	Ann.M.FARRIS@deq.state.or.us
Todd Hudson	OHA	--	TODD.HUDSON@dhsoha.state.or.us
Gregg Baird	OHA	--	GREGG.C.BAIRD@dhsoha.state.or.us
Jeremy Haney	AECOM	845-405-1512	Jeremy.Haney@aecom.com
Jacquelyn Harrington	AECOM	402-952-2533	jacquelyn.harrington@aecom.com
Melinda Borgens	AECOM	971-323-6271	melinda.borgens@aecom.com

** Notes: ARNG-G9 - Army National Guard-G9; DEQ-Department of Environmental Quality; ORARNG - Oregon Army National Guard; OHA – Oregon Health Authority; USACE-United States Army Corps of Engineers*

Mr. Jeremy Haney (AECOM) welcomed participants and reviewed the purpose of the meeting, outlined the agenda, and led a roundtable of introductions for everyone on the virtual Technical Project Planning (TPP) meeting. The meeting was a combination of TPP1 and TPP2 with the purpose of discussing the Army National Guard (ARNG) Per- and Polyfluoroalkyl Substance (PFAS) Preliminary Assessment (PA)/Site Inspection (SI) program, the Camp Rilea PA findings, and proposed SI approach.

Presentation slides were provided to participants prior to the meeting and are included in **Attachment A**. Key points that supplement the presentation are summarized below.

A safety moment was provided to the participants which covered the safety procedures established in the United States Army Corps of Engineers (USACE) Engineering Manual (EM) 385-1-1. A Programmatic Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) have been prepared in accordance with EM 385-1-1. The site-specific SSHP was developed concurrently with the Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) so that as risks related to the proposed sampling approach were identified, mitigation strategies were developed and documented in the SSHP. Additionally, pandemic awareness and safety protocols have been incorporated into the SSHP to address field work being completed during the Coronavirus Disease 2019 (COVID-19) pandemic.

Programmatic Discussion (Slides 5–8):

- The ARNG PA/SI program is contracted through the Baltimore District of the United States Army Corps of Engineers (USACE) with support from other districts, but is managed by the ARNG.
- The program follows the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) progress.
- The first step in the CERCLA process is the PA, which has been finalized for this facility. The ARNG has performed PAs at approximately 200 facilities across the country to determine the likelihood of release and whether any complete pathways existed to drinking water receptors. The final results of the PAs determine whether a specific site would move to the SI-phase or be recommended for No Further Action, per the CERCLA process.
- The primary goal of the SI is to determine the presence or absence of PFAS at the source areas and facility boundary; nature and extent would be determined during a Remedial Investigation (RI).

- Participants for TPP1 and TPP2 included ARNG, USACE, ORARNG, Oregon DEQ, and AECOM; participants for the future TPP3 meeting will include the addition of other local stakeholders to be determined once the SI reporting phase has begun.

Camp Rilea PA Findings (Slides 9-13):

- The PA findings for Camp Rilea were presented. Information reported in the PA was collected through in-person interviews and a visual site inspection during a one-day site visit in 2018. Two areas of interest (AOI) were identified involving potential PFAS release areas related to the presence of fire trucks and storage of AFFF.
- The potential releases were attributed to two pathways that occurred between 1970s and an unknown date after 1995: firetrucks onsite from as early as the 1970s may have been equipped with AFFF and those firetrucks may have been washed or had their lines flushed.
- The application of AFFF at Camp Rilea was not known to have occurred.
- No adjacent sources were identified during the PA.
- AOI 1 is labeled within the southern portion facility boundary
    - The Fire station operated from the 1970s until 1980
    - Interviewees could not confirm if a firetruck was parked or operated at this location
    - AFFF could have been present in the firetruck
- AOI 2 is labeled within the central portion of the facility
    - Two firetrucks historically parked at this location from 1989 to 1995 and 1995 to an unknown year
    - AFFF stored in unknown volumes on these trucks
    - AFFF was never deployed at the facility
    - Bulk AFFF was stored inside the building within the AOI – type, container volume, and number of containers are unknown
    - Flushing of the lines and the water/foam tanks reportedly occurred off-Post
    - No known releases or leaks

Camp Rilea Overview (Slides 14-17):

- Data quality objectives (DQOs) were presented for the SI. The primary DQOs were to confirm the presence or absence of a PFAS release at a potential source area and to gather data to refine the conceptual site model (CSM). Secondary goals are to determine the presence/absence at the ARNG facility boundary.
- A series of five sand dune ridges and five interdune areas, oriented north to south, are located throughout the facility; the dunes are separated by lakes and creeks. Precipitation infiltrates Dune sands fairly rapidly. Camp Rilea is located in a geologic area characterized as Beach deposit and Dune sand of the Holocene age consisting of large areas of windblown unconsolidated, coarse-detrital sand
- Camp Rilea is situated above the Pacific Northwest basin-fill aquifer, characterized as unconsolidated sand and gravel aquifers at or near the land surface. The Dune sands are the primary water-bearing unit in the area. The depth to bedrock is estimated to be at least 100 feet below ground surface.
- Historical data from on-facility monitoring wells indicate groundwater was encountered between 22.6 to 32.8 feet below ground surface, but generally increases with elevation (expecting not greater than about 25 feet bgs). The inferred direction of groundwater flow is to the west, towards the Pacific Ocean, but localized shallow groundwater in the immediate vicinity of surface water features will towards the surface water body.
- Camp Rilea obtains drinking water from two onsite water supply wells located in the central/western portion of the facility, east of the beach. Wells are screened from 142 to 162 feet bgs and from 132 to 147 feet bgs.
- The sources of the releases at AOI 1 and AOI 2 are the fire trucks potentially containing AFFF which may have resulted in PFAS releases to paved or unpaved surfaces and then to surface or subsurface soil, and potentially to ground water. Through human activities, precipitation and runoff, or leaching and infiltration, the exposure pathways may be potentially complete for:
    - The inhalation of dust by site workers, construction workers, and trespassers or downgradient recreational users
    - Ingestion of surface soil by the same receptors

  - The ingestion of surface water or sediment by site workers, construction workers, off-facility residents, trespassers, or recreational users
  - The ingestion of subsurface soil by site workers or construction workers
  - And the potential ingestion of downgradient groundwater by off-facility residents

Camp Rilea SI Approach (Slides 18-24):

- The scope of work for the SI was presented. The scope of work for the SI is to collect continuous soil cores using Direct Push to the top of the groundwater table, and collect soil samples at the surface, the mid-point of the boring, and the interval immediately above the water table. A temporary well will be developed at each location to collect a groundwater sample. There are 7 sample locations proposed, six of which will have soil and groundwater samples collected.
- There are 4 sample locations proposed for AOI I:
  - AOI01-01, within AOI-01 in grassy area west of the former Fire Station (surface soil sample, subsurface soil samples, and groundwater sample to be collected)
  - AOI01-02 is downhill from former fire station at the primary stormwater infiltration area where a historical release could have been transported to by stormwater during a heavy precipitation (surface soil sample, subsurface soil samples, and groundwater sample to be collected)
  - AOI01-03 is north of AOI01-02 in a potential secondary stormwater infiltration area (surface soil sample only to be collected) (The absence of PFAS in surface soil, subsurface soil, and groundwater samples from AOI01-02 would support the conclusion a potential historical AFFF release did not reach the primary stormwater infiltration area and therefore could not reach the potential secondary stormwater infiltration area.)
  - AOI01-04 is uphill from the former fire station by hydraulically downgradient from AOI-01 (groundwater sample only to be collected – no pathway for direct release to surface soil or infiltration to subsurface soil).
- There are 3 boring locations proposed for AOI 2.
  - AOI02-01, in grassy area near the center of AOI-2
  - AOI02-02 is west of AOI-2 and downhill and downgradient form formerly unpaved area
  - AOI02-03 is west of AOI-2 and downhill and downgradient form formerly unpaved area
- The plan is to conduct 6 borings for sampling and gauging and collect one additional surface soil sample. There will be 6 groundwater samples collected and 16 soil samples collected. One sample of the water that will be used for decontamination of the drill rig will be collected for analysis to ensure it's PFAS-free
- Prior to abandoning the temporary monitoring wells, a local surveyor will collect top of casing and ground surface elevations to be used in the development of a groundwater surface contour map.
- The PFAS analyte list, which includes 18 PFAS compounds, was presented. Analysis will be completed by a DoD-Environmental Laboratory Accreditation (ELAP)/National Environmental Laboratory Accreditation Program (NELAP)-certified laboratory. A Level IV deliverable will be received from the laboratory, and data will undergo Stage 2b data validation as defined in the DoD General Data Validation Guidelines.
- A general outline of the schedule was presented. The Final UFP-QAPP will be provided with the responses to Oregon DEQ comments in September 2021. The field investigation is tentatively planned for October 2021.
- Under normal circumstances, the team would field-verify the proposed locations during a site reconnaissance walk conducted after the TPP meeting; however, that is not possible given the current travel restrictions due to the COVID-19 pandemic. Instead, the site walk will be performed during the mark-out and utility clearing.

Open Discussion (Slide 25):

- ORDEQ asked if the SLs correspond to DEQ's RSLs, if leaching to GW RSLs are used for screening, and if there will be eco screening? The OHA is developing eco screening values for PFAS. AECOM responded that the SLs used in the SI correspond to the RSLs; the leaching to GW RSLs are not incorporated programmatically into the SIs but are for the RIs; eco screening is not conducted in the SI

but will for the RI. OHA responded that the proposed eco screening values for PFAS are guidelines for drinking water, not regulatory, and have not been made official yet.

- ORDEQ asked if well logs for onsite wells were reviewed to understand the lithology and know where groundwater is. AECOM responded with yes.
- ORDEQ asked if there are catch basins in/near the AOIs? Suggested that catch basins be sampled also and not put too much weight on a lack of detection in soil. ORDEQ is not a fan of discrete soil sampling and is recommending localized composite and incremental sampling. ORDEQ understands it may not be possible for this project but will be disinclined to approve discrete soil sampling unless there are no other choices. ORDEQ would like to see good spatial coverage in groundwater sampling and it looks like the scope of sampling addresses that. Joe Davis indicated that of the 30 SIs completed to-date, the exceedances have been in groundwater and RI work followed.
- ORDEQ asked if TOP Assay will be included in RI phase? Although there is no guidance on what to do with results yet. Joe Davis responded that additional PFAS compounds will be analyzed for in the RI phase.
- ORDEQ stated they are comfortable with the current proposed sampling schedule and will prepare comments to the Draft Final QAPP and provide in July. Not anticipating changes that would alter the scope.
- AECOM asked DEQ if Pace Gulf Coast (DoD-certified lab) is appropriate for analysis. ORDEQ responded yes since they are certified but must ensure that detection limits are appropriate and below EPA's Health Advisory level. AECOM and Joe Davis responded that yes the lab is certified and detection litis are listed in the QAPP.
- The team discussed document distribution for the Final SI UFP-QAPP. ORDEQ asked that a PDF be emailed to all contacts at DEQ and OHA and a single hard copy be sent to Ann Farris (DEQ).
- The team discussed performing utility markups and a site walk, asking if ORDEQ is interested in participating, targeting one week prior to sampling (targeting end of Aug 2021). ORDEQ is interested and would like to be onsite but will need to check on budget. COVID restrictions are starting to lift so the possibility to attend is more likely.
- Finally, the team discussed management of IDW. AECOM stated IDW will be drummed and analyzed prior to disposal. Joe Davis stated incineration was the original preferred option but there is a moratorium from the DoD at this time on incineration, and landfilling is not preferred due to potential long-term liability. Since its non-haz waste, the IDW can be stored for longer time periods. ORDEQ is not a fan of incineration, prefers Subtitle C landfill, but will follow the lead on what DoD deems is appropriate.

The presentation ended at 1020 and the phone line was closed.

Attachment A - TPP 1 & 2 Briefing Slides

Camp Rilea
Warrenton, OR
Site Inspection
Oregon Army National Guard

Technical Project Planning (TPP) Meeting 1 & 2

Preliminary Assessments and Site Inspections (PA/SI) for Perfluorooctanesulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites

30 June 2021

Agenda

- Introductions
- Safety Moment
- TPP Meeting Goals
- Army National Guard (ARNG) PA/SI Overview
- Camp Rilea ARNG PA Results
- Camp Rilea SI Overview
- Stakeholder Involvement
- Questions and Open Discussion

Introductions

- ARNG G9
  - Dave Connolly, PFAS Program Manager
  - Bonnie Packer, Nationwide Project Manager
  - Joe Davis, SI Project Manager
- United States Army Corps of Engineers (USACE)
  - Tim Peck, Nationwide Program Manager
  - Briana Niestrom, SI Project Manager
  - Ben McKenna, SI Tech Lead/Hydrogeologist
- Oregon Army National Guard (ORARNG)
  - James Arnold, Environmental Program Manager
  - Kelly Toynton, Remediation Project Manager
- Oregon Department of Environmental Quality (Oregon DEQ)
  - Ann Farris, Environmental Cleanup Project Manager
- AECOM Technical Services, Inc.
  - Jeremy Haney, SI Task Manager
  - Anthony Palmieri, SI Senior Lead

Safety Moment
Site Safety Procedures

- SI will follow USACE Engineering Manual (EM) 385-1-1 requirements:
  - Accident Prevention Plan addresses all component plans for EM 385-1-1, including Construction Support during drilling operations
  - Site Safety and Health Plan (SSHP) addresses project participants, training, and hazard identification and mitigation
- Health and safety documents prepared during SI planning phase
  - SSHP has been revised to incorporate COVID-19 updates and protective measures

TPP Meeting Goals

- TPP1:
  - Provide an overview of the ARNG PA/SI Program
    - Regulatory framework
  - Discuss PA Findings
  - Define objectives for SI data collection
  - Encourage stakeholder involvement
  - Review project schedule
  - Capture action items
- TPP2: Discuss proposed SI approach
- TPP3: Discuss SI findings
- Participants:
  - TPP1 and 2: ARNG, USACE, Oregon DEQ
  - TPP3: ARNG, USACE, Oregon DEQ, other local stakeholders

ARNG PA/SI Overview

Work Phases

Notes: *Current stage of activity

- Follows the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Process
- An interim removal action can be conducted or a No Further Action determination can be made at any phase

ARNG PA/SI Overview

- Activities centrally contracted through USACE and managed by ARNG G9
  - USACE Baltimore manages the contract, with technical project support from Louisville, Omaha, Sacramento, Jacksonville, and Seattle Districts
  - Project support: chemistry, geology, risk screening
- ARNG evaluated 3,200 facilities in 54 states/territories with state ARNG input
- PA ranking (~200 facilities with potential for release)
  - Likelihood of release
  - Complete pathway to drinking water receptor
  - Priority assigned to facilities with highest likelihood of release near drinking water intake
- PA – facility-wide; SI – areas of interest (AOIs)

ARNG PA/SI Overview

- ARNG / ORARNG
  - Identify potential per- and polyfluoroalkyl substances (PFAS) release locations
  - Provide facility access and points of contact
  - Gather and provide appropriate documents
  - Identify/schedule personnel to interview
  - Supply final PA to the regulatory agencies
- SI Regulatory Involvement
  - CERCLA SI conducted in conjunction with the appropriate regulatory agency

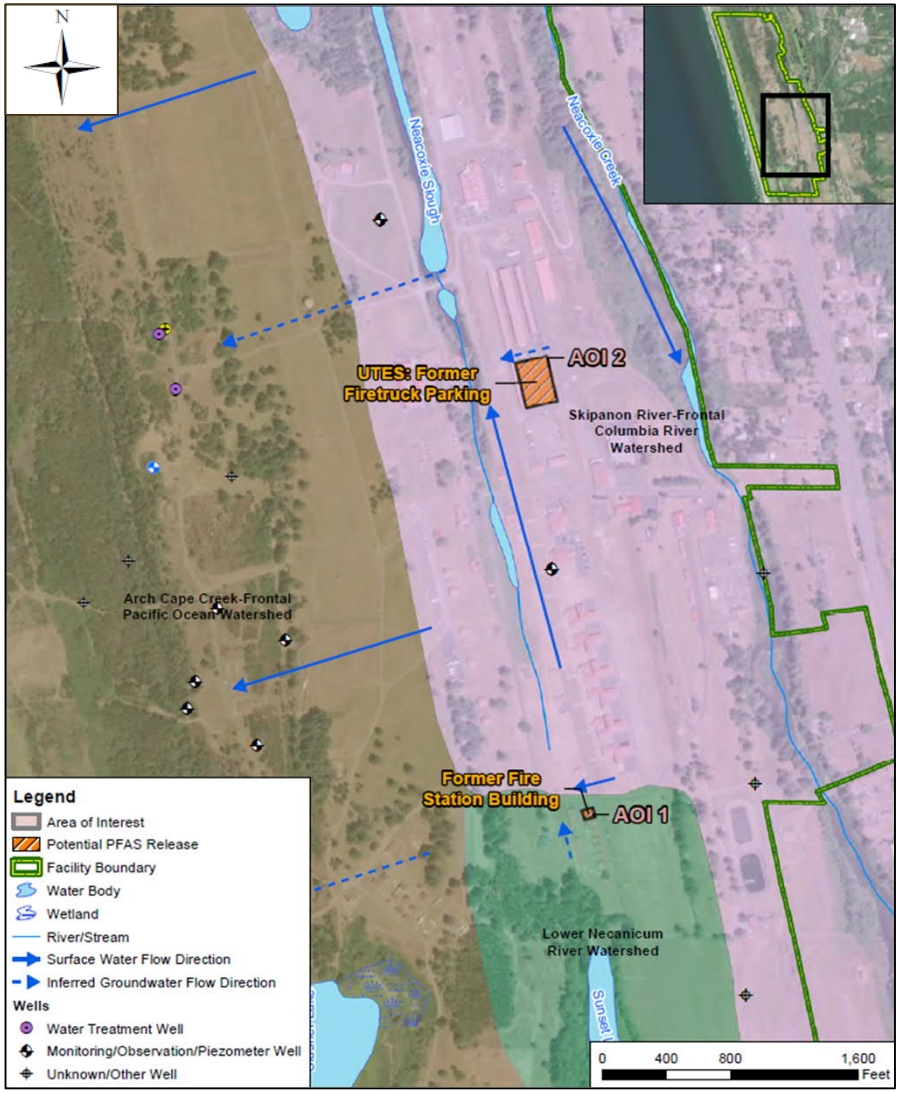
Camp Rilea
ARNG PA Results

- Potential PFAS release areas: 2 identified during the PA and placed in 2 AOIs

- PFAS release attributed to storage of aqueous film forming foam (AFFF) on firetrucks:
  - Firetrucks on site from as early as the 1970s may have been equipped with AFFF
  - Firetrucks may have been washed or had their lines flushed

Camp Rilea

Summary of Findings and AOIs



Camp Rilea PA Findings

AOI 1 – Former Fire Station – Building 7241

- Former Fire Station dates back to the early 1970s to until 1980
- Interviewees could not confirm if a firetruck was parked or operated at this location
- AFFF could have been present in the firetruck

Camp Rilea PA Findings

AOI 2 – Utility Training Equipment Site (UTES)

- Two firetrucks historically parked at this location from 1989 to 1995 and 1995 to an unknown year
- AFFF stored in unknown volumes on these trucks
  - AFFF was never deployed at the facility
  - Flushing of the lines and the water/foam tanks reportedly occurred off-Post
  - No known releases or leaks
- Bulk AFFF was stored inside the building within the AOI – type, container volume, and number of containers are unknown

Camp Rilea SI Overview
Data Quality Objectives (DQOs)

- Primary SI DQOs
  - Confirm the presence/absence of a release
  - Gather data for conceptual site model (CSM):

    Understanding of Source-Pathway-Receptor relationships required for establishing sampling strategy
- Extended SI DQOs
  - Determine the presence/absence at facility boundary
  - Check for alternate sources
  - Measure PFAS at/near receptor, if warranted

Camp Rilea SI Overview
Screening Levels

- Results compared to Office of the Secretary of Defense (OSD) Screening Levels (SLs) for soil and groundwater
  - Memorandum from the OSD dated 15 October 2019
  - SLs for groundwater based on direct ingestion
  - SLs for soil based on incidental ingestion; 0-2 ft compared to Residential SL, 2-15 ft compared to Industrial SL, >15 ft not compared to either SL
- AOIs exceeding OSD SLs will proceed to the next phase under CERCLA (i.e., Remedial Investigation)

Analyte	Residential (Soil) (µg/kg)[a,b] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a,b] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a,b]
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	1,900	25,000	600

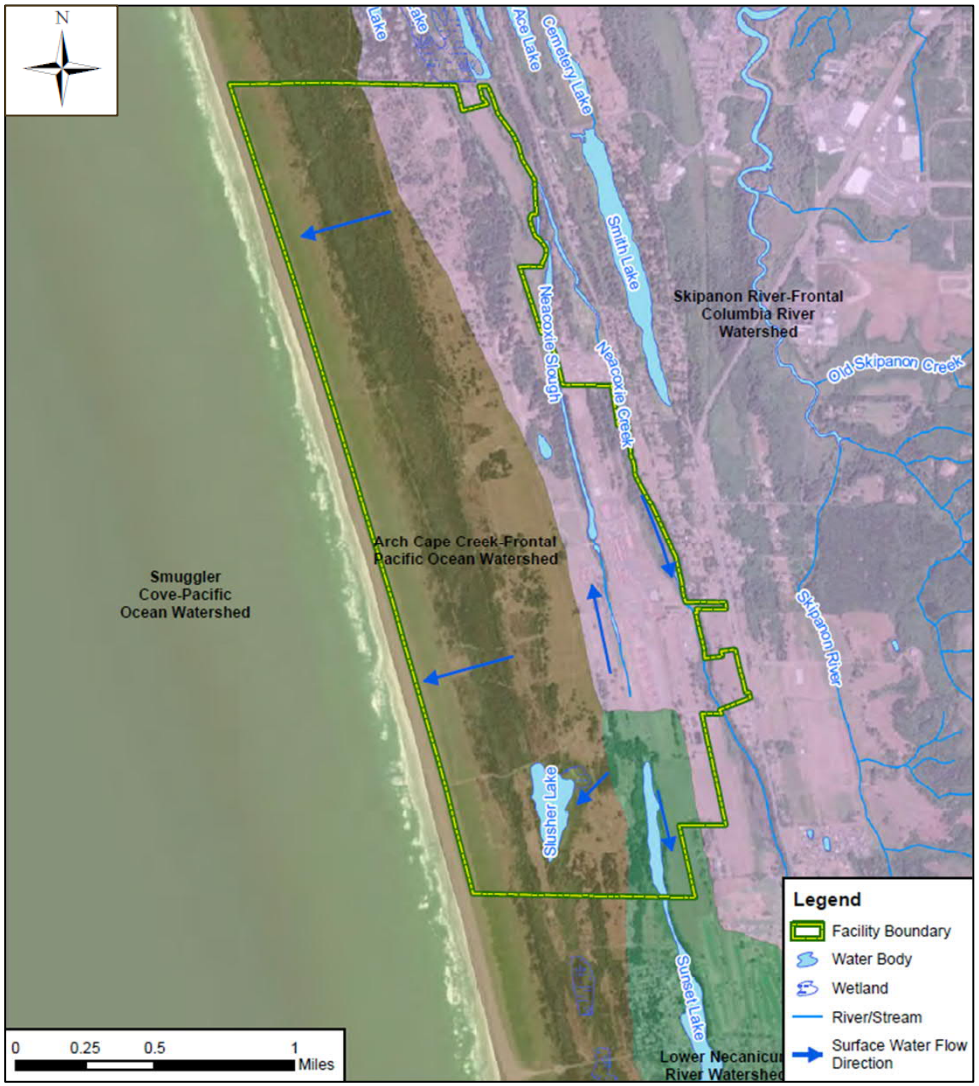
Notes:

a.) Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 15 October 2019.

b.) USEPA, 2021. Risk Based Screening Levels Calculated for PFBS in Groundwater and Soil using USEPA's Regional Screening Level Calculator. HQ = 0.1. 8 April 2021.

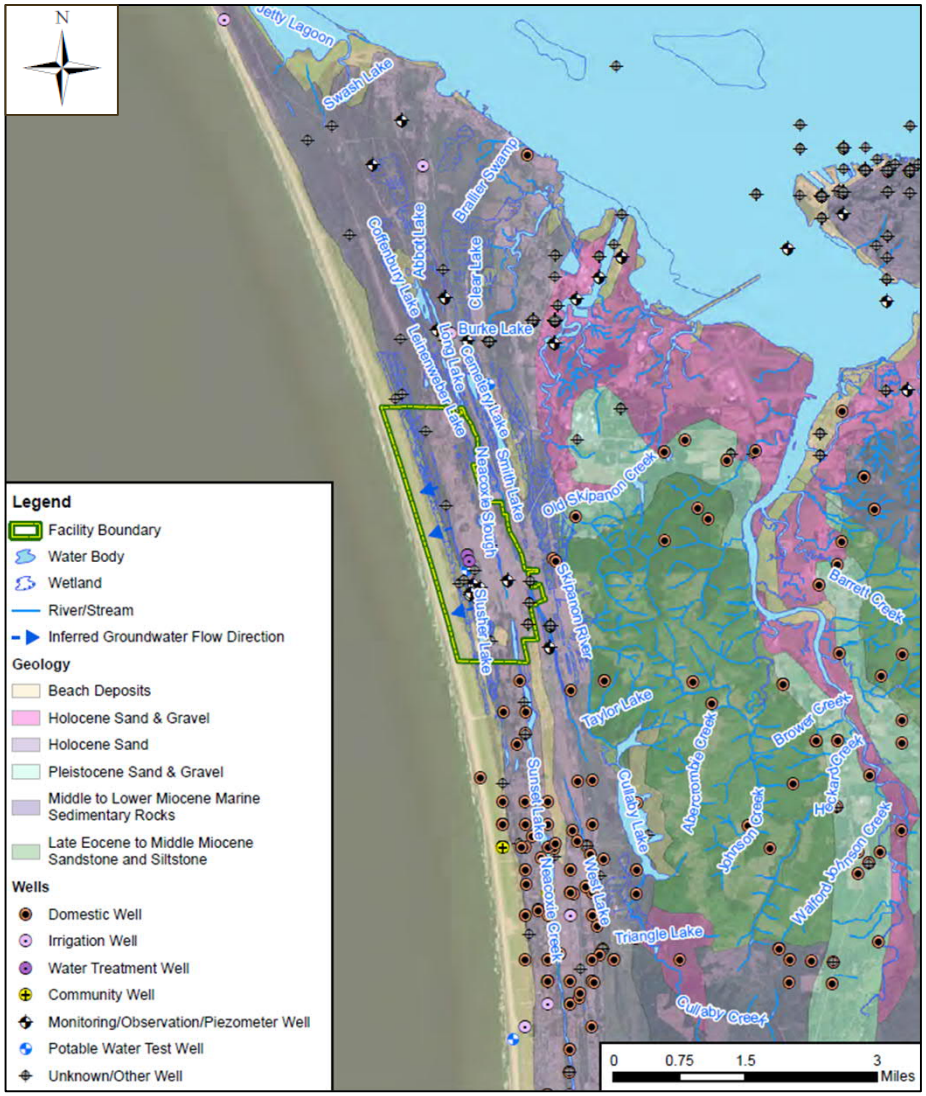
Camp Rilea SI Overview

CSM – Surface Water Features

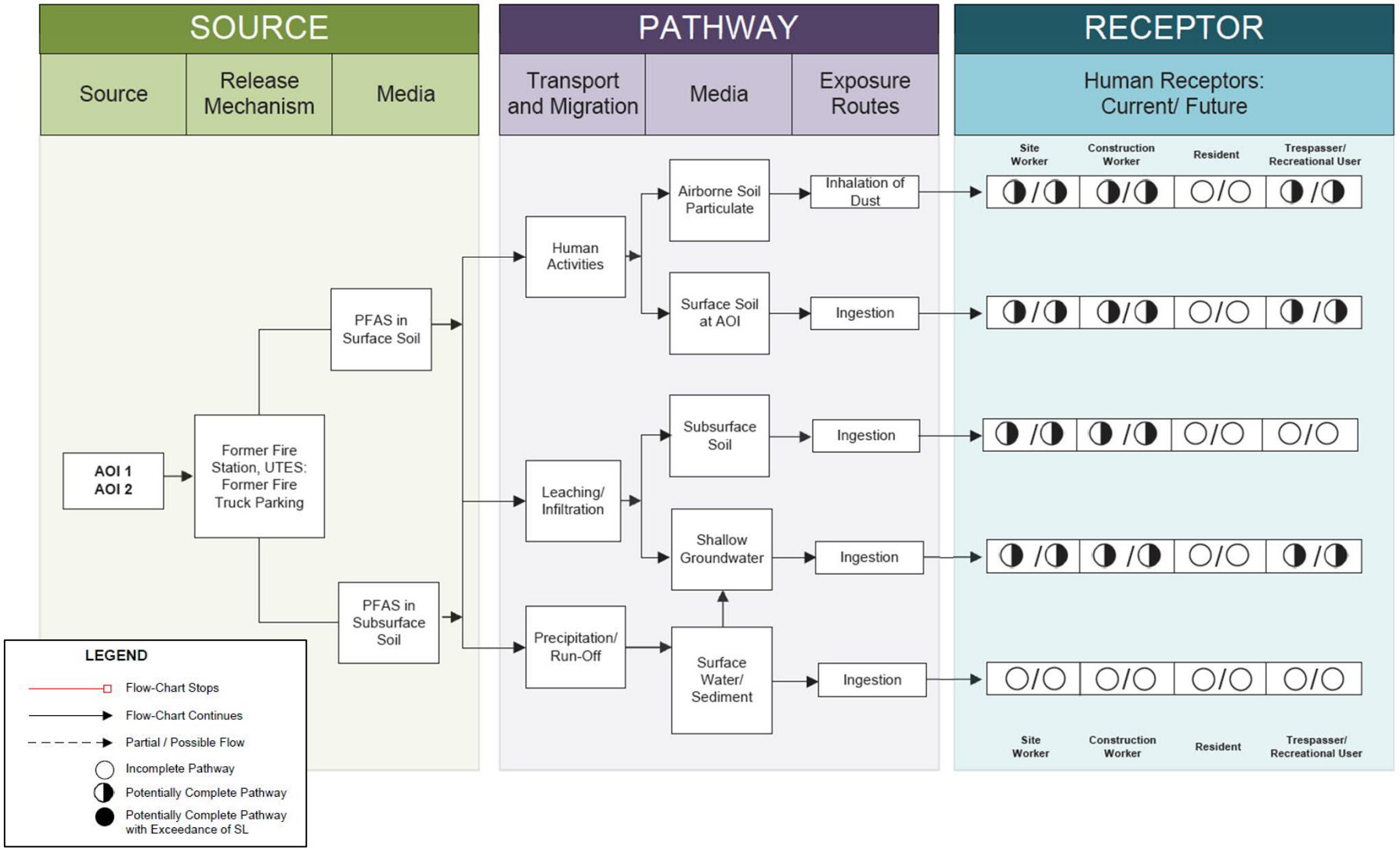


Camp Rilea SI Overview

CSM – Groundwater Features



Camp Rilea SI Overview
CSM

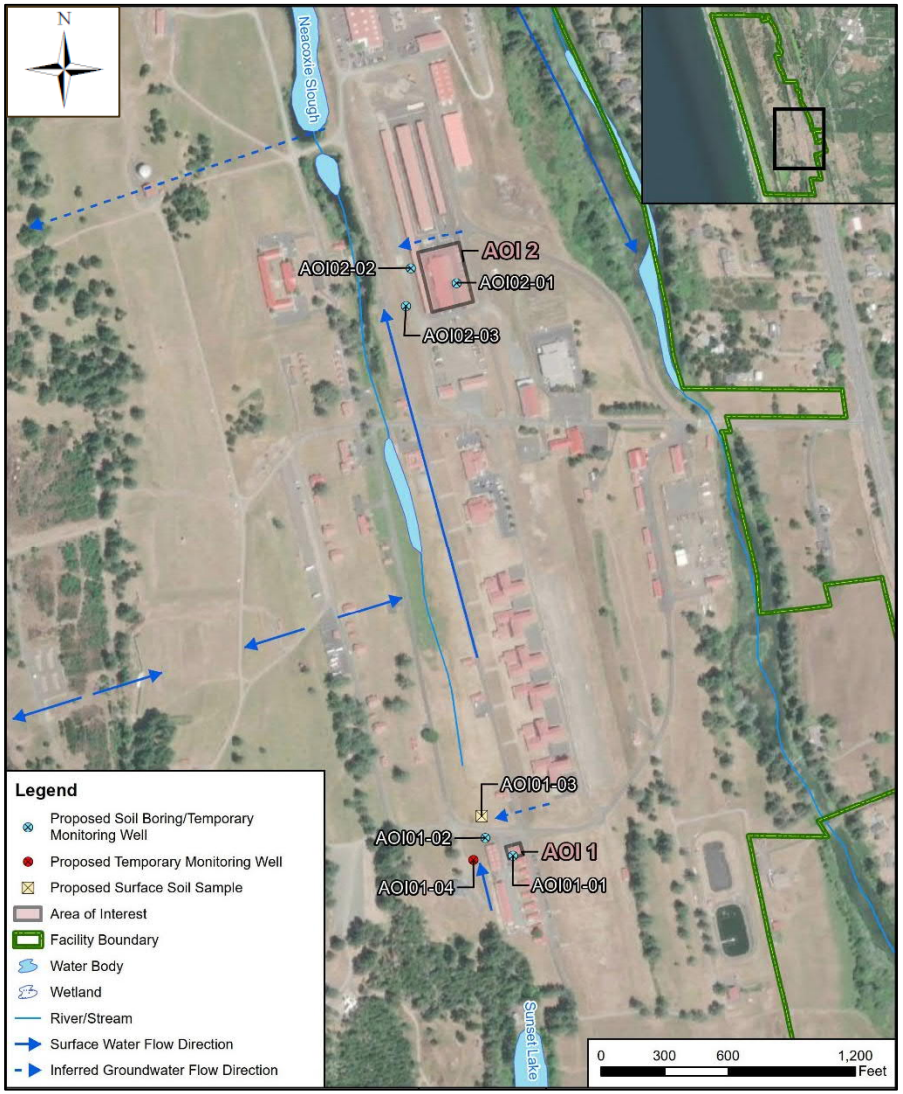


Camp Rilea SI Overview
Planning and Sampling

- Finalize Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) Addendum
  - Draft Final submitted on 4 June 2021
  - Final to be submitted following the TPP 1&2 meeting
- Continuous soil cores to target depth
  - Soil samples collected at surface, mid point, above water table for new temporary well locations
- Collect a groundwater sample from each temporary well
- Collect surface soil sample from infiltration area
- Survey of temporary wells to assess groundwater gradient

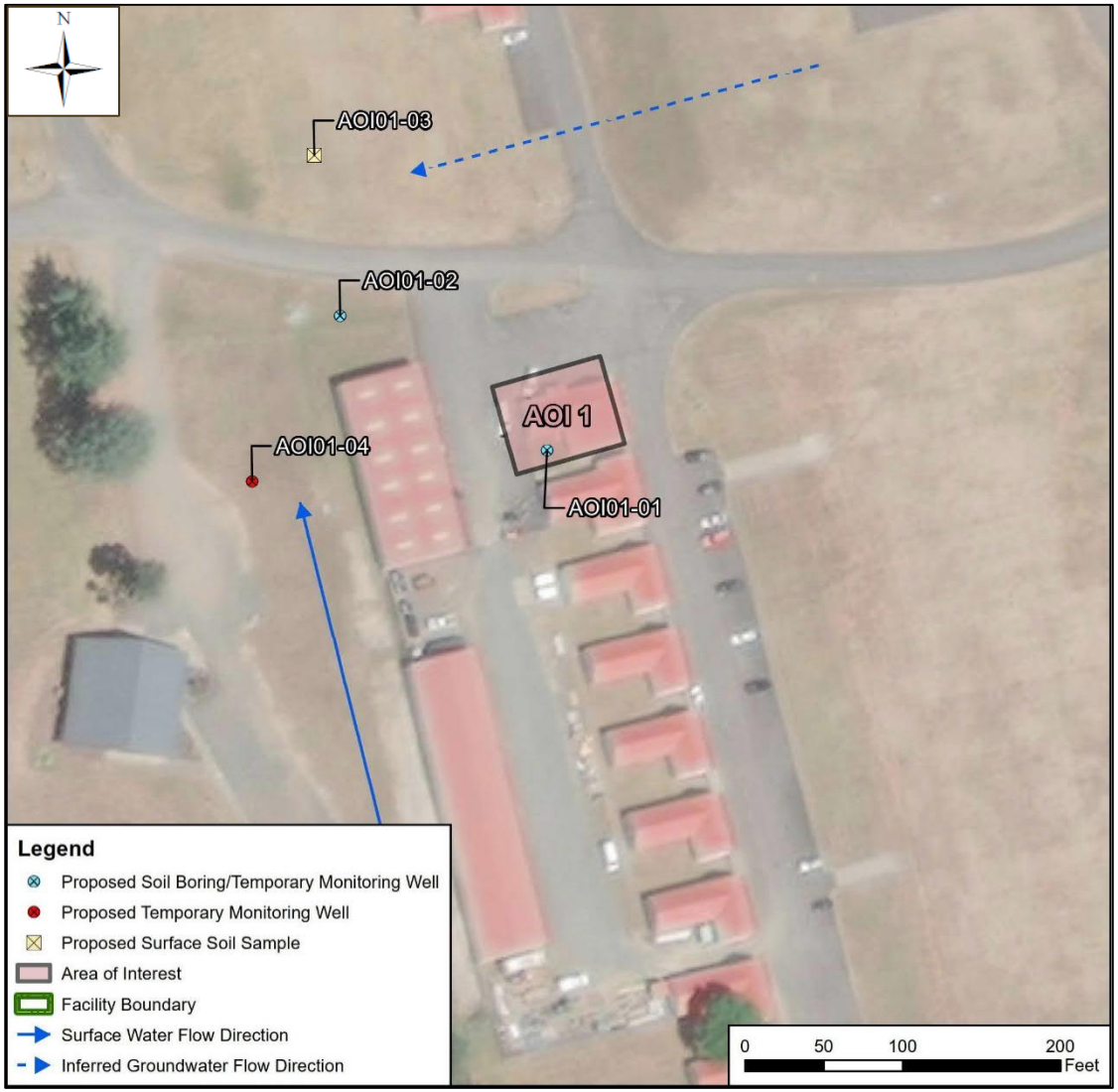
Camp Rilea SI Overview

Proposed Sampling Locations



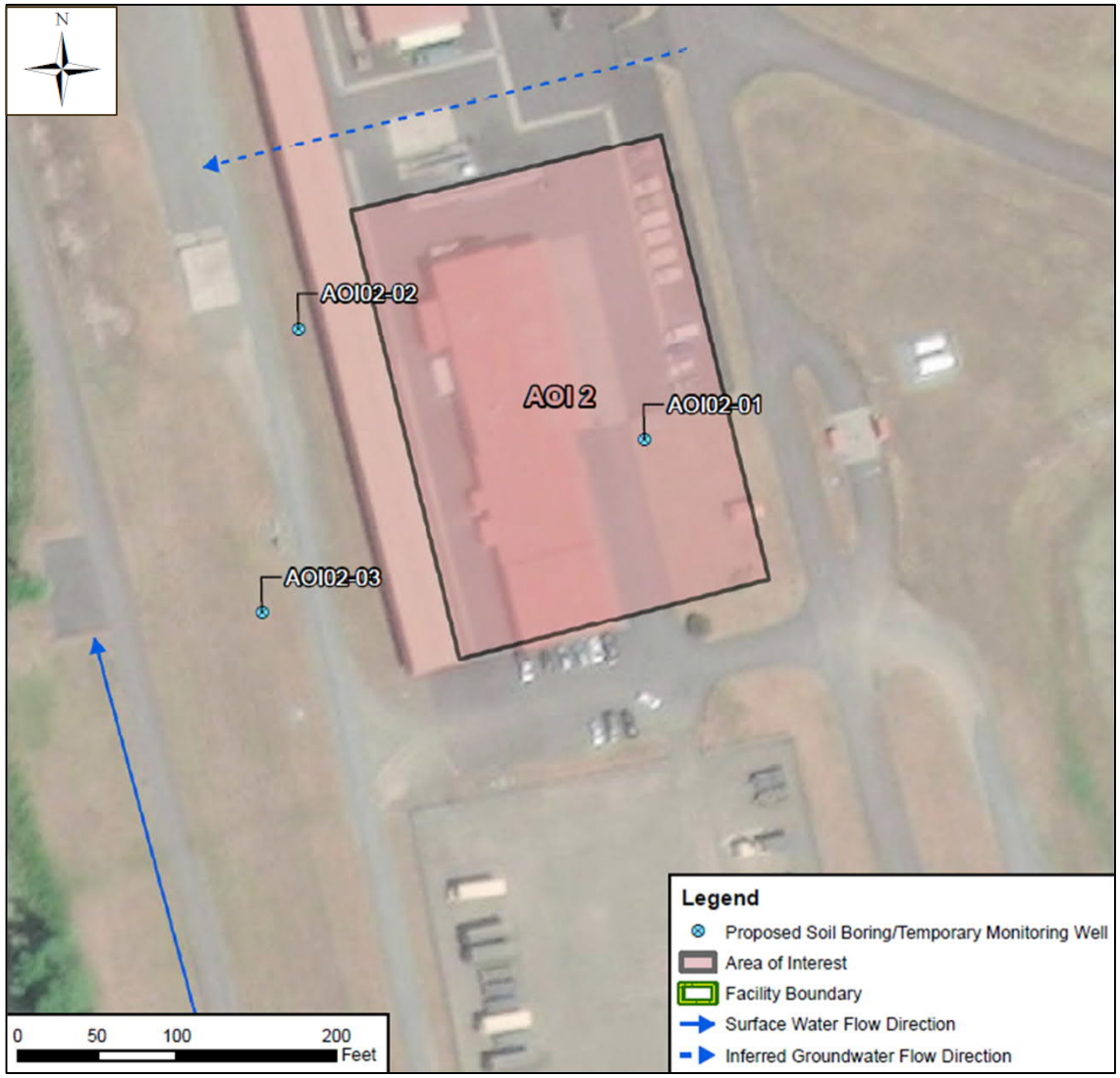
Camp Rilea SI Overview

AOI 1 - Proposed Sampling Locations



Camp Rilea SI Overview

AOI 2 - Proposed Sampling Locations



Camp Rilea SI Overview

AOI	# of DPT Boring Locations	Target Depth(s) for Borings	Soil Samples	Target Interval(s) for GW samples	Groundwater Samples	Surface Soil Samples	Decontamination Water Samples
1	3	30 ft	7	Mid-screen	3	1	1*
2	3	30 ft	9	Mid-screen	3		

*Decontamination water sample not associated with any given AOI

- Sample locations will be refined in the field
  - Confirm placement is accessible and will meet DQOs at time of the utility mark-out

Camp Rilea SI Overview

Analytical Parameters

Perfluorooctanesulfonic acid (PFOS)	Perfluoroheptanoic acid (PFHpA)
Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)
Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
Perfluorodecanoic acid (PFDA)	Perfluorotetradecanoic acid (PFTeDA)
Perfluorododecanoic acid (PFDoA)	Perfluorohexanoic acid (PFHxA)
Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUdA)
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)

- Analysis completed by Environmental Laboratory Accreditation Program (ELAP)/ National Environmental Laboratory Accreditation Program (NELAP)-certified laboratory
- Level IV data package will be received from the laboratory
- Data will undergo Stage 2b validation as defined in the Department of Defense (DoD) General Data Validation Guidelines

Stakeholder Involvement

- Use TPPs and open communication to encourage stakeholder involvement
- Key involvement topics
  - Proposed approaches
  - Document review time for Oregon DEQ and other stakeholders
- Schedule:
  - Address remaining comments and issue Final UFP-QAPP Addendum: September 2021
  - Field Investigation: October 2021

Questions and Open Discussion

- Coordination
  - Data transfer
  - Utility mark-out and clearance process
  - Report distribution (paper, electronic, portable document format)
  - IDW Handling
  - Site Walk
  - Stakeholder relations
- Schedule

Acronyms

- AFFF – aqueous film forming foam
- AOI – areas of interest
- ARNG – Army National Guard
- CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
- COVID-19 – Coronavirus Disease 2019
- CSM – conceptual site model
- DEQ – Department of Environmental Quality
- DQO – data quality objective
- ELAP – Environmental Laboratory Accreditation Program
- EM – Engineering Manual
- NELAP – National Environmental Laboratory Accreditation Program
- ORARNG – Oregon Army National Guard
- PA – Preliminary Assessment
- PFAS – per- and polyfluoroalkyl substances
- PFOS – perfluorooctanesulfonic acid
- PFOA – perfluorooctanoic acid
- SI – Site Inspection
- SSHP – Site Safety and Health Plan
- TPP – Technical Project Planning
- UFP-QAPP – Uniform Federal Policy-Quality Assurance Project Plan
- USACE – United States Army Corps of Engineers
- UTES – Utility Training Equipment Site

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Appendix B – Standard Operating Procedures

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SOPs available upon request.

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