Uniform Federal Policy-Quality Assurance Project Plan Addendum

USAEC Per- and Polyfluoroalkyl Substances Preliminary Assessment/Site Inspection
Fort McCoy, Wisconsin

September 2019

Contract: W912DR-18-D-0004
Delivery Order: W912DR18F0685

Prepared For:

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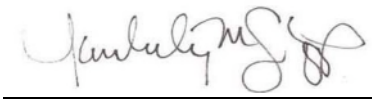
Date:
September 2019

Kevin Engle
Geologist



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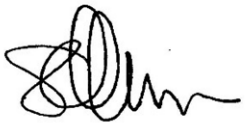

Joseph Quinnan
Global Site Investigation Director
North America Emerging Contaminants Director

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List of Acronyms and Abbreviations

°F	degrees Fahrenheit
AFFF	aqueous film-forming foam
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	United States Army
bgs	below ground surface
B.S.	Bachelor of Science
CAS	Chemical Abstracts Service
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CSM	conceptual site model
DoD	Department of Defense
DPT	direct-push technology
DPW	Directorate of Public Works
DQO	data quality objective
DW	drinking water
EB	equipment blank
ELLE	Eurofins Lancaster Laboratories Environmental
FB	field blank
FD	field duplicate
FRB	field reagent blank
FTA	fire training area
FTBP	Fire Training Burn Pit
FTMC	Fort McCoy
GPS	global positioning system
GW	groundwater
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	high density polyethylene
IDW	investigation-derived waste
installation	U.S. Army and Reserve installation
IRP	Installation Restoration Program
LOD	limit of detection
LOQ	limit of quantitation
mph	miles per hour
M.S.	Master of Science
MS	matrix spike
MSD	matrix spike duplicate
N	normal (parent sample)
N/A	not applicable
ng/g	nanogram per gram
ng/L	nanogram per liter
OSHA	Occupational Safety and Health Administration
PA	preliminary assessment
PE	Professional Engineer
PFAS	per- and polyfluoroalkyl substances

List of Acronyms and Abbreviations

PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PG	Professional Geologist
PMP	project management professional
POC	point of contact
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
PSL	project screening level
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
SB	source blank
SE	sediment
SI	site inspection
SO	soil
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SW	surface water
TBD	to be determined
TGI	technical guidance instructions
TOC	total organic carbon
U.S.	United States
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
VAP	vertical aquifer profiling

INTRODUCTION

A Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP; Arcadis U.S., Inc. [Arcadis] 2018b) was developed and submitted as final in October 2018. The PQAPP addresses the per- and polyfluoroalkyl substances (PFAS) preliminary assessment (PA) and site inspection (SI)-phase sampling at active United States Army (Army) and Reserve installations (installations) within the United States (U.S.). Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are two of the most abundant PFAS and are recognized by the United States Environmental Protection Agency (USEPA) as contaminants of emerging concern that present potentially unacceptable human health and environmental impacts. The purpose of this site-specific Quality Assurance Project Plan (QAPP) Addendum is to supplement the PQAPP, detail the planning processes for collecting data, and describe the implementation of the quality assurance (QA) and quality control (QC) activities developed for the PA/SI sampling proposed at Fort McCoy (FTMC) in Monroe County, Wisconsin. The objectives of the PQAPP and this QAPP Addendum are to generate project data that are technically defensible and useful in meeting the project goals. Project goals include identifying the presence or absence of PFAS (including PFOS and PFOA) at areas of potential interest (AOPIs), identifying the presence or absence and the nature of other PFAS, and updating AOPI drinking water conceptual site models (CSMs), which will be detailed in a PA/SI Report.

This QAPP Addendum addresses three primary elements:

- Project management
- General CSM description
- Site-specific investigation design and data acquisition.

The site-specific worksheets in this QAPP Addendum for FTMC supplement the general programmatic information provided in the PQAPP. Site-specific details provided in this QAPP Addendum include sampling locations, media, methodologies, and procedures. Should site conditions warrant deviation from the perscribed procedures in this QAPP Addendum, the stakeholders will be consulted before changes to the sampling plan are made, and a revised QAPP Addendum will be issued.

QAPP ADDENDUM WORKSHEET #1 & #2: TITLE AND APPROVAL PAGE

(UFP-QAPP Manual Section 2.1)
(USEPA 2106-G-05 Section 2.2.1)

1. Project Identifying Information:
    a. Site name/project name: United States Army Environmental Command (USAEC) PFAS PA/SI
    b. Site location/number: Fort McCoy, Fort McCoy, Wisconsin
    c. Contract/work assignment number: W912DR-18-D-0004 / W912DR-18-F-0685
2. Lead Organizations: United States Army Corp of Engineers (USACE), USAEC, and FTMC
    a. USACE Regional Point of Contact (POC), Kansas City District

    _____

    Amanda Chirpich Date
    b. FTMC USAEC Environmental Support Manager

    _____

    Candice Freeman Date
    c. FTMC Directorate of Public Works (DPW) Installation Restoration Program (IRP) Manager

    _____

    Craig Bartholomew Date
3. List plans and reports from previous investigations relevant to this project:

Title	Date
Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan, USAEC PFAS PA/SI, Active Army Installations, Nationwide, USA	October 2018

QAPP ADDENDUM WORKSHEET #4, #7, & #8: PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET

(UFP-QAPP Manual Sections 2.3.2 – 2.3.4)
(USEPA 2106-G-05 Sections 2.2.1 and 2.2.7)

This worksheet is used to identify key site-specific personnel for each organization performing tasks defined in this QAPP Addendum.

LEAD ORGANIZATIONS: USACE, USAEC, and FTMC

Name	Agency	Project Title/Role	Signature[1] (check box)
Candice Freeman	USAEC	Environmental Support Manager	☐
Amanda Chirpich	USACE	Regional POC	☐
Craig Bartholomew	FTMC	IRP Manager	☐

ORGANIZATION: Arcadis

Name	Project Title/Role[1]	Education/Experience	Specialized Training/Certifications	Signature[2] (check box)
Kimberley Schrupp	Deputy Project Manager and Regional Lead	Bachelor of Science (B.S.) Biochemistry, 17 years of experience. This experience includes strategy development and environmental cost estimating for multiple clients including Federal. Previously a task manager for commercial and federal performance-based projects.		☐
Joseph Quinnan	Technical Lead	B.S. Geological Engineering, Master of Science (M.S.) Geological Engineering. 27 years of experience. Global lead for site characterization, North American lead for emerging contaminants.	• Professional Engineer (PE) • Professional Geologist (PG)	☐

Name	Project Title/Role[1]	Education/Experience	Specialized Training/Certifications	Signature[2] (check box)
Kevin Engle	Task Manager, Installation Support, Regional Field Coordinator	B.S. Geology, M.S. Geology, 5 years of experience. Comprehensive Environmental Response, Compensation and Liability Act reporting; site characterization through groundwater, soil, surface water, and sediment sampling (including rotosonic drilling oversight and monitoring well installation); and CSM development.	• Occupational Safety and Health Administration (OSHA): Initial 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) • OSHA: HAZWOPER 8-Hour Refresher 29 Code of Federal Regulation (CFR) 1910.120(e)(8) • OSHA: Site Supervisor • OSHA: 30-Hour Construction Safety • First Aid/ Cardiopulmonary Resuscitation (CPR)	☐
Drew Kehoe	Field Sampling Staff, Installation Support	B.S. Geology, 2 years of experience, Comprehensive Environmental Response, Compensation and Liability Act reporting; site characterization through soil, sediment, surface water, groundwater and biota sampling (including sonic drilling oversight, direct push drilling oversight, and monitoring well installation).	• OSHA: Initial 40-Hour HAZWOPER • OSHA: HAZWOPER 8-Hour Refresher 29 CFR 1910.120(e)(8) • OSHA: Site Supervisor • First Aid/CPR	☐
Kendra Keon	Field Sampling Staff, Site Safety and Health Officer (SSHO)	B.S. Geology, 4 years of experience, Comprehensive Environmental Response, Compensation and Liability Act reporting; site characterization through soil, sediment, surface water, groundwater and biota sampling (including sonic drilling oversight, direct push drilling oversight, and monitoring well installation).	• OSHA: Initial 40-Hour HAZWOPER • OSHA: HAZWOPER 8-Hour Refresher 29 CFR 1910.120(e)(8) • OSHA: Site Supervisor • OSHA: 30-Hour Construction Safety • First Aid/CPR	☐

[1] Field sampling personnel may be subject to change based on staff availability.
[2] Signature check boxes indicate personnel have read and agree to implement this QAPP Addendum as written.

QAPP ADDENDUM WORKSHEET #10: CONCEPTUAL SITE MODEL

(UFP-QAPP Manual Section 2.5.2)
(USEPA 2106-G-05 Section 2.2.5)

Abbreviated and preliminary drinking water CSMs for FTMC AOPIs included in the PA/SI sampling scope of work are presented below. Data collected during the completion of the PA/SI sampling scope of work within this QAPP Addendum will be used to further develop drinking water CSMs for each AOPI in the PA/SI Report for FTMC.

Background Information

FTMC is located in Monroe County in the southwestern quarter of Wisconsin (**Figure 1**). The installation consists of 59,778 acres, occupying part of six townships in Monroe County and is roughly 14 miles long and seven miles wide. The principal towns in Monroe County are Sparta (population 9,522) and Tomah (population 9,169), which are located seven miles southwest and seven miles southeast of FTMC, respectively. The city of LaCrosse, Wisconsin (population 51,719) is located about 35 miles to the west. The installation is divided into north and south post by Wisconsin Highway 21, with U.S. Highway 16, Interstate 90, and two railroad lines crossing east-west on the southern portion of the installation. The general direction of regional groundwater flow is to the southwest towards the La Crosse River (SEC Donohue 1992).

A portion of the drinking water at FTMC is supplied through three potable drinking wells located at the Sparta – Fort McCoy Airport on the installation. These wells were sampled for PFOS and PFOA in 2016, with the results being below detection limits for both compounds. Additional PFAS sampling of groundwater has been conducted at several locations at FTMC including the Fire Training Burn Pits (FTBPs) #1, #2, and #3 and Former Landfill #5. PFOS and PFOA detections have been observed at each of these locations.

Physical Setting

Topography and Climate

FTMC lies on the eastern edge of what is known as the Western Upland of Wisconsin, which has experienced geologic uplift. Erosion has dissected the Western Upland creating long valleys and a rugged landscape with sometimes several hundred feet of elevation change (Fort McCoy 2012).

Pressure systems that move from west to east across the continent are the biggest influence on the climate of FTMC and a variety of weather can be expected for all seasons. The total mean annual precipitation is 28.04 inches and the average season snowfall is 39.3 inches. In winter, the average daily temperature is 19.9 degrees Fahrenheit (°F) and the average in the summer is 68.4 °F. The prevailing westerly winds have an average wind speed ranging from a high of 12 miles per hour (mph) in April to a low of 7 mph in August (Monroe County Soil Survey 1984).

Geology and Hydrogeology

Soil beneath FTMC is composed of sand with some silt and clay which can extend up to 120 feet below ground surface (bgs). The upper bedrock units consist of hard limestones and dolomites, which have been eroded away except on some ridge tops. Below the limestones and dolomites lies softer sandstone and shale deposits which are the parent material for most soil deposits on post (Fort McCoy 2012). These soft rock deposits are part of the Cambrian Elk Mound and Tunnel City Groups. The overlying hard limestones and dolomites are part of the Ordovician Prairie du Chien Group.

The two main aquifers of the region are the Sandstone Aquifer and the Unconsolidated Aquifer. The primary aquifer of the region is the Sandstone Aquifer which produces large supplies of water. Below these aquifers are Precambrian crystalline rocks which do not yield significant quantities of water (SEC Donohue 1992).

Known or Suspected Contaminants and Sources

During the PA, nine AOPIs were identified at FTMC, as listed in **Table 1**. A brief history is provided for each AOPI with approximate dates of relevant PFAS release or dates of operation. AOPIs identified during the PA are associated with the use of aqueous film-forming foam (AFFF).

Known AFFF releases to the environment (soil and paved surfaces) at the majority of AOPIs occurred during fire training activities, during deluge system maintenance, from accidental releases from a fire suppression system, and as a result of placement of AFFF contaminated soil which was excavated from the fire training burn pits. Suspected AFFF releases occurred at the Sparta – Fort McCoy Airport in the area of a former fire station where nozzle testing occurred and a crash truck carrying AFFF was stored. Another suspected AFFF release occurred on the tarmac to the southeast of the airport hangars where personnel had recollection of an AFFF release from a crash truck in the early 1990s.

Table 1. Summary of PFAS Relevance at AOPIs

PFAS Source Type	AOPI Name	Relevant Site History
Former or current fire training areas (FTAs) with confirmed or likely use of AFFF	Fire Training Burn Pit #1	Fire training area used for monthly mock drills on a soil pit. Operations ceased in 1987. AFFF use has been confirmed during training activities. PFAS sampling has been conducted on three separate occasions from 2016 to 2017 and the presence of PFOS and PFOA in groundwater has been confirmed.
	Fire Training Burn Pit #2	Fire training areas used for monthly mock drills. FTBP #2 was constructed as a soil pit. It operated from 1982 to 1992 with confirmed AFFF use. Soil from FTBP #2 was excavated and transported offsite. Groundwater data collected in 2016 indicate the presence of PFOS and PFOA in shallow groundwater.

PFAS Source Type	AOPI Name	Relevant Site History
	Fire Training Burn Pit #3	FTBP #3 is a concrete lined pit. It has been in operation since 1995. AFFF use at FTBP #3 ceased in 2017, but training continues using water to extinguish F-24 (Jet Fuel) fires. Groundwater data collected in 2016 indicate the presence of PFOS and PFOA in shallow groundwater.
Accidental Release Areas	2017 AFFF Release	In 2017, approximately 20,000 gallons of an AFFF foam mixture was released due to a failed valve in the fire suppression system.
	Deluge System	The deluge system is located on the southeast portion of the airport property. Annual maintenance is performed on the system which includes flushing AFFF from the lines, potentially causing releases to the ground surface.
	Former Fire Station #2	A former fire station was located at the airport to the south of the current east – west runway. Possible nozzle testing and other training could have occurred here.
	1990s AFFF Release	There was recollection of an AFFF release on the tarmac to the southeast of the airport hangars in the early 1990s.
Waste Management Areas	Former Landfill #5	Former Landfill #5 received excavated soil contaminated with AFFF. Groundwater sampling was conducted at the former landfill in 2018 and confirmed the presence of PFOS and PFOA.
	Wastewater Treatment Plant	There is the potential that the wastewater treatment plant had received water containing PFAS compounds. Sludge from the treatment process has been used by local farmers to stimulate soil.

Based on the historical use of AFFF at the AOPIs, affected media are likely to consist of soil, groundwater, surface water and sediment. Migration pathways include desorption/dissolution from soil to groundwater and surface water. The eight AOPIs proposed for sampling are shown on **Figure 2**. Based on the proximity of FTBP #2 and FTBP #3 to the Sparta – Fort McCoy Airport AOPIs, these AOPIs are grouped together for sampling (**Figure**

3). FTBP #1 and Former Landfill #5 are also in close proximity and are grouped together for sampling (**Figure 4**). Currently, no sampling is recommended in association with the Wastewater Treatment Plant AOPI.

Potential Receptors and Contaminant Exposure Pathways

Potential receptors and contaminant exposure pathways evaluated for drinking water only for each of the installation's AOPIs are presented in the CSMs on **Figure 5** through **Figure 7**. Exposure through direct ingestion is the assumed exposure route for PFAS in drinking water. Based on the historical use of AFFF at the AOPIs, affected media are likely to consist of soil, groundwater, surface water, and sediment. Release and transport mechanisms include dissolution/desorption from soil to groundwater, runoff/dissolution/adsorption with surface water or stormwater, and adsorption/desorption between surface water and sediment. Human exposure pathways are shown as "potentially complete" or "incomplete" on the CSM figures; exposure pathways are only "complete" when the presence of PFAS in the exposure medium has been confirmed and there is no barrier to receptor exposure. Considering the Army's primary concern is for human exposure through direct ingestion of PFAS in drinking water, the remainder of this section summarizes only the potential exposure pathways for groundwater and surface water.

Currently, there are 24 potable wells on FTMC property providing drinking water to various parts of the installation. Three of these wells are located near the Former Fire Station #2, 2017 AFFF Release, Deluge System, and 1990s AFFF Release (collectively referred to as the Sparta – Fort McCoy Airport AOPIs) and in close proximity to FTBP #2 and FTBP #3. Two of these potable wells (6082W and 6081W) are owned by the City of Sparta and provide water to the City of Sparta hangars at the airport. The third potable well (SW-5020) is owned by FTMC. These wells were sampled for PFOS and PFOA in 2016 with the results being below detection limits at all three wells. Due to the close proximity of these wells to six AOPIs (FTBP #2, FTBP #3, and the four Sparta – Fort McCoy Airport AOPIs), there is a potentially complete pathway for PFAS migration from these AOPIs to on-post drinking water sources. There is also a potentially complete pathway for PFAS migration from these AOPIs to off-post drinking water receptors due to the presence of off-post potable wells within 5 miles of the AOPIs (**Figure 5**).

CSMs for the Former Landfill #5 and FTBP #1 are shown on **Figures 6** and **7**, respectively. Due to the distance from these AOPIs to the on-post potable wells and the direction of regional groundwater flow to the southwest, the on-post drinking water exposure pathways are incomplete. However, both of these AOPIs have a potentially complete pathway for PFAS migration to off-post drinking water receptors. Former Landfill #5 and FTBP#1 are both within 5 miles of the installation boundary and within 5 miles of an off-post drinking water receptor in the path of groundwater flow. The surface water exposure pathway for all AOPIs is considered incomplete. The preliminary CSMs will be further detailed in the PA/SI report for FGLY and will be updated based on the results of the SI.

Data Gaps

The following have not been determined and will be investigated as part of this PA/SI:

- Additional presence or absence of PFAS at FTPB #1, Former Landfill #5, FTBP #2, and FTBP #3 in soil, groundwater, sediment and/or surface water downgradient of the AOPIs.

- Initial presence or absence of PFAS at the Sparta – Fort McCoy Airport AOPIs in soil and groundwater.
- Source strength of potential PFAS masses remaining in the soil beneath FTBP #1, FTBP #2, FTBP #3, and the Sparta – Fort McCoy Airport AOPIs.
- An evaluation of the potential for sediment and soil to be sources of PFAS to surface water and groundwater, as an influence to drinking water receptors or presence/absence, and not to evaluate direct contact with sediment or soil.
- For this sampling effort, CSM evaluations only include elements applicable to the primary source and human receptors through an exposure pathway of direct ingestion of drinking water. Complete, potentially complete, and incomplete exposure pathways will be documented. While other potential exposure media will be sampled during this SI, the potential for human exposures to PFAS through non-drinking water pathways has not yet been established and may be evaluated at a future date if it is determined that those pathways warrant further consideration.

Figure 3 shows the sampling locations for groundwater, drinking water, and soil at FTBP #2, FTBP #3 and the Sparta – Fort McCoy Airport AOPIs. **Figure 4** shows the sampling locations for sediment, surface water, groundwater, and shallow soil at FTBP #1 and Former Landfill #5. **Worksheet #17** of this QAPP Addendum provides the rationale and sampling design for the PA/SI sampling scope of work to address the above data gaps. **Worksheets #18** and **#20** of this QAPP Addendum list the proposed sample identifications and required QC samples for each medium.

QAPP ADDENDUM WORKSHEET #11: PROJECT/DATA QUALITY OBJECTIVES

(UFP-QAPP Manual Section 2.6.1)
(USEPA 2106-G-05 Section 2.2.6)

This worksheet states the problem, identifies the goal of the study, identifies information inputs, defines boundaries of the sampling, develops the analytical approach, specifies performance or acceptance criteria, and identifies the developed plan for obtaining data in accordance with USEPA's 7-step data quality objective (DQO) process, *Guidance on Systematic Planning Using the Data Quality Objectives Process* (USEPA 2006). This QAPP Addendum presents the selected investigation design and rationale in **Worksheet #17**, and the sampling summary in **Worksheets #18** and **#20**.

Step 1: State the Problem:
Sampling of potable wells at FTMC took place in 2016 and PFOS and PFOA were not detected above laboratory detection limits. Sampling of PFOS and PFOA was conducted from 2016 to 2018 at FTBP #1, FTBP #2, FTBP #3, and Former Landfill #5. Detection of PFOS and PFOA was found during each sampling event at these locations. Additional sampling at FTBP #2 and FTBP #3 is warranted due to the proximity of known PFOS and PFOA impacts to active potable wells. Confirmed and potential releases of AFFF at the Sparta – Fort McCoy Airport AOPIs also has the potential to impact these potable wells. Confirmed PFOS and PFOA impacts at FTBP #1 and Former Landfill #5 upgradient of Squaw Creek. Additional sampling is warranted to confirm the presence/absence of PFAS at or near the creek. The location and extent of sources of PFAS which may have the potential to affect drinking water sources have not been determined at FTMC.
Step 2: Identify the Goal of the Study:
PFOS and PFOA are two emerging contaminants in the class of PFAS that have drinking water health advisory levels (USEPA 2016). The sampling activities as part of this PA/SI for FTMC will be conducted in conformance with Department of Defense (DoD) instructions 4715.07 (DoD 2013) and 4715.18 (DoD 2009) and the DoD Manual 4715.20 (DoD 2012); the DoD Instructions 4715.18 requires DoD components to respond to emerging contaminants like PFOS and PFOA. The primary goals of the sampling activities are to compile sufficient information to determine whether media associated with individual AOPIs on the installation contain detectable levels of PFAS, determine the residual source strength of those media, and refine the AOPI drinking water CSMs through vertical aquifer profiling (VAP) to identify distribution and flow paths. For the purpose of this evaluation, any detections greater than the laboratory limit of detection (LOD) will result in identification of PFAS presence. Complete vertical and horizontal delineation of PFAS contamination in soil and groundwater at FTMC will not be completed in this project phase. Groundwater, soil, sediment, and surface water analytical samples collected for analysis of PFAS will be analyzed for 18 select PFAS constituents (including PFOS/PFOA), as listed in Worksheet #18 of the PQAPP (Arcadis 2018b). Potable well samples collected for analysis of PFAS will be analyzed for 14 select PFAS constituents (including PFOS/PFOA) as listed in **Worksheet #15** of this QAPP Addendum. Only results for PFOS/PFOA concentrations will be used to inform recommendations for follow-up investigations.

Step 3: Identify Information Inputs:

The data needed to accomplish the goals of the sampling activities for this project are as follows:

- All information reviewed to date as part of the PA to identify the AOPIs, including: historical use and personal accounts of historical activities, spill records, previous remedial actions completed, previous analytical data and validation packages
- Observations made during the site reconnaissance and conference calls after site visits, and during the investigation
- New analytical data from sampled media applicable to each AOPI, which may include groundwater, soil, surface water, and sediment, and which may be accomplished through sampling of existing monitoring wells, soil boring advancement, or grab sample collection
- Soil boring description logs that include detailed descriptions where soil borings are advanced.

Sampling will be limited to areas where AFFF (which likely contained PFAS, including PFOS/PFOA) use is documented or areas that may have received PFAS-contaminated material. Parameters and analytical methods are identified in Worksheets #19 and #30 of the PQAPP. Field sample collection methods are summarized in **Worksheet #17** of this QAPP Addendum and in Worksheet #21 of the PQAPP.

Step 4: Define the Boundaries of the Sampling:

Analytical sample collection at FTMC will be completed within or near eight AOPIs: FTBP #1, Former Landfill #5, FTBP #2, and FTBP #3, and the Sparta – Fort McCoy Airport AOPIs (**Figures 3** and **4**). Tentative sample identifications for each medium and location to be sampled are listed in **Worksheet #18** of this QAPP Addendum.

Investigation activities at FTBP #1 will consist of soil, groundwater, surface water, and sediment sampling. Two direct push technology (DPT) soil borings will be advanced within the AOPI boundary. Soil samples at these locations will be collected at the ground surface (0-2 feet bgs) and from the interval directly above the water table, which is estimated to be approximately 15 feet bgs. Two downgradient VAP locations will be advanced to approximately 30 feet bgs. Two groundwater samples will be collected from each of these locations; one from the top of the water table and one from 30 feet bgs. One sediment and one surface water sample will be collected from a location in Squaw Creek, which is located downgradient from FTBP #1. During the same mobilization and after VAP sample collection, the boreholes will be converted into five permanent monitoring wells. Each well will be installed to 30 feet bgs using 2-inch schedule 40 polyvinyl chloride (PVC). Following installation, the wells will be developed using a surge and purge method until the water is visibly clear.

Investigation activities at Former Landfill #5 will consist of groundwater, surface water, and sediment sampling. Three downgradient VAP locations will be advanced to approximately 30 feet bgs. Two groundwater samples will be collected from each of these locations; one from the top of the water table and one from 30 feet bgs. Following completion of the groundwater sample collection, these locations will be converted into monitoring

wells. There are also three sediment/surface water sampling locations along Squaw Creek; one upgradient of and two downgradient of FTBP #1 and Former Landfill #5.

Investigation activities at FTBP #2 and FTBP #3 will consist of soil and groundwater sampling. Two VAP locations within FTBP #2 will be completed to the water table. At each of these locations, one groundwater sample will be collected from the water table, and two soil samples will be collected (one from the ground surface and one from the interval directly above the water table). Four DPT soil borings will be advanced to the water table around FTBP #3. Two soil samples will be collected at each location; one from the ground surface and one from the interval directly above the water table. Additionally, one VAP location downgradient of FTBP #2 and FTBP #3 will be advanced to 30 feet bgs with groundwater samples collected at the water table and the 30 feet bgs interval.

Investigation activities at the Sparta – Fort McCoy Airport AOPIs will consist of soil and groundwater sampling. Investigations will take place in each of the eight AOPIs where known or suspected releases of AFFF took place. One VAP locations will be advanced to 30 feet bgs in each of these areas. Two soil samples will be collected at these four locations; one from the ground surface and one from the interval directly above the water table. Groundwater samples will also be collected at the water table and the 30 feet bgs interval. Two VAP locations will be advanced to the water table at each of these AOPIs. Two soil samples will be collected at each of these locations; one from the surface and one from the interval directly above the water table. One groundwater water sample will also be collected at the water table. Additionally, three potable well samples will be collected from wells in the vicinity of FTBP #2, FTBP #3, and the Sparta – Fort McCoy Airport AOPIs.

Tentative sample identifications for each medium and location to be sampled are listed on **Worksheet #18** of this QAPP Addendum and are shown on **Figures 3** and **4**. Geographic coordinates for the proposed sampling locations are listed in **Attachment 1**. Available well construction details for the proposed existing potable wells to be sampled are included in **Attachment 2**.

Step 5: Develop the Analytic Approach:

Samples will be collected in accordance with the technical guidance instructions (TGI) and standard operating procedure (SOP) documents included as Appendix A to the PQAPP (Arcadis 2018b) and **Attachment 3** of this QAPP Addendum. The samples will be submitted for analysis to Eurofins Lancaster Laboratories Environmental (ELLE). Liquid chromatography/tandem mass spectrometry will be used to analyze samples for PFAS; **Worksheet #15** of this QAPP Addendum identifies the laboratory LODs for PFAS. The LOD is defined as "the lowest concentration for reliable reporting of a non-detect of a specific analyte in a specific method with a specific method at 99 percent confidence" (DoD 2017) and will be used as the project screening levels (PSLs) for this PA/SI.

- If PFAS concentrations are less than the PSLs (i.e., the laboratory LODs), then PFAS are not considered to be present for the purposes of the PA/SI.
- If PFAS concentrations are greater than the PSLs, PFAS are present.

- The final waste characterization and disposal plan for investigation-derived waste (IDW) will be conducted in accordance with Army guidance and state/local regulations. Disposition of IDW is discussed in **Worksheet #17** of this QAPP Addendum.

Step 6: Specify Performance or Acceptance Criteria:

Controls on precision, reporting, and accuracy are provided in Worksheets #12 and #28 of the PQAPP. Field monitoring and detection equipment will be routinely calibrated, as detailed in Worksheet #22 of the PQAPP, to confirm that equipment used is of the proper type, range, accuracy, and precision to provide data compatible with the specified requirements and desired results.

Step 7: Develop the Plan for Obtaining Data:

The detailed sampling plan and rationale for this PA/SI is presented in **Worksheet #17** of this QAPP Addendum. Sampling plans may be revised based on field conditions or site planning meetings.

QAPP ADDENDUM WORKSHEET #13: SECONDARY DATA USES AND LIMITATIONS

(UFP-QAPP Manual Section 2.7)
(USEPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

This worksheet identifies sources of secondary data not generated for the specific purpose of this project, or data generated under a separate QAPP, and summarizes their uses for this project. A full list of references reviewed to complete the PA/SI at FTMC will be provided in the PA/SI Report.

Data Type	Source	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Aerial Imagery	Environmental Systems Research Institute, ArcGIS Online Aerial Imagery	Provided georeferenced aerial photos for figure backdrops.	There are no known limitations on aerial imagery.
Past Site Investigations	2013 Installation Action Plan 2017 Fire Training Burn Pit #1 PFAS Sampling 2016 Fire Training Burn Pit #2 and #3 PFAS Sampling 2018 Former Landfill #5 PFAS Sampling 2016 FTMC Potable Well Sampling	Provided regional site conditions, historical site usage, historical contaminant identification and concentrations, and remedial actions.	Site usage histories may omit records of AFFF procurement and use. Groundwater PFAS data is available for all AOPIs except for the Sparta-Fort McCoy Airport AOPIs. Source strength soil PFAS data is needed for all AOPIs except Former Landfill #5 due to the regulations preventing cap disturbance. Sediment and surface water PFAS data is needed for Former Landfill #5 and FTBP #1.
Installation Personnel Interviews	Various	Provided anecdotal histories of site use, AFFF use, and remedial actions completed.	Several installation personnel who would have worked on site during the peak of AFFF use are retired or out of contact.

QAPP ADDENDUM WORKSHEET #14 & #16: PROJECT TASKS & SCHEDULE

(UFP-QAPP Manual Section 2.8.2)
(USEPA 2106-G-05 Section 2.2.4)

The project schedule is presented below for sampling activities planned at FTMC as part of the PA/SI following completion of previous steps listed in Worksheet #14 & #16 of the PQAPP.

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Installation site visits	Arcadis	24 July 2018	24 July 2018	Field notes (included in PA/SI Report)	Complete
Draft Final QAPP Addendum and Site Safety and Health Plan (SSHP, included as **Attachment 4**)	Arcadis	29 April 2019	14 June 2019	Draft Final QAPP Addendum and SSHP	14 June 2019
Final QAPP Addendum and SSHP	Arcadis	15 July 2019	16 August 2019	Final QAPP Addendum and SSHP	16 August 2019
Coordinating/permitting	Arcadis	N/A	N/A	Site permits	N/A
Mobilization and set up	Arcadis and subcontractors	30 September 2019	11 October 2019	Field notes (included in PA/SI Report)	20 days after QAPP Addendum approval
Sample collection of surface water and sediment	Arcadis	30 September 2019	11 October 2019	Field notes and measurements (included in PA/SI Report)	Submitted in PA/SI Report
Sample collection of drinking water from existing potable wells	Arcadis	30 September 2019	11 October 2019	Field notes and measurements (included in PA/SI Report)	Submitted in PA/SI Report

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Soil boring advancement, sample collection of soil and groundwater, and boring abandonment	Arcadis and subcontractors	30 September 2019	11 October 2019	Field notes and measurements (included in PA/SI Report)	Submitted in PA/SI Report
Sample collection of groundwater samples through DPT and VAP methods	Arcadis and subcontractors	30 September 2019	11 October 2019	Field notes and measurements (included in PA/SI Report)	Submitted in PA/SI Report
Sample Analysis	ELLE	2 October 2019	25 October 2019	Analytical data package and electronic data deliverable	Submitted in PA/SI Report
Preliminary Data Review Teleconference (if requested)	Arcadis	4 November 2019	4 November 2019	Draft data figures and tables (if requested)	To be determined (TBD)
Data Validation	Arcadis	25 October 2019	15 November 2019	Data validation report	Submitted in PA/SI Report
Draft PA/SI Report	Arcadis	15 November 2019	13 February 2020	Draft PA/SI Report	(90 days after data validation)
Final PA/SI Report	Arcadis	13 March 2020	13 April 2020	Final PA/SI Report	13 April 2020

QAPP ADDENDUM WORKSHEET #15: REFERENCE LIMITS AND EVALUATION TABLES

(UFP-QAPP Manual Section 2.6.2.3)
(USEPA 2106-G-05 Section 2.2.6)

This worksheet provides the laboratory-specific limits for the PFAS compounds that will be analyzed, including the typical limit of quantitation (LOQ) and LOD, as provided by the laboratory. The LOQ is "the smallest concentration that produces a quantitative result with known and recorded precision and bias," and the LOD is "the lowest concentration for reliable reporting of a non-detect of a specific analyte in a specific matrix with a specific method at 99 percent confidence" (DoD 2017). For the purposes of this PA/SI, the PSLs are defined as the LOD. Because PSLs are equivalent to the LODs, PSLs will vary slightly depending on batch- or sample-specific LODs reported by the laboratory for each analyte. If PFAS are detected greater than the PSLs, PFAS are present. Concentrations detected between the LOD and LOQ are estimates, and therefore, will be qualified and indicated as such on laboratory analytical reports.

Matrix: Groundwater/Surface water		**Analytical Group: PFASs (ELLE) per DoD QSM 5.1.1 Table B-15 (DoD 2018)**		
Analyte	**CAS Number**	**PSL (ng/L)**	**Laboratory-Specific Limits**	
			LOQ (ng/L)	**LOD (ng/L)**
Perfluorobutanoic acid (PFBA)	375-22-4	6	6	6
Perfluoropentanoic acid (PFPA)	2706-90-3	6	6	6
Perfluorohexanoic acid (PFHxA)	307-24-4	3	3	3
Perfluoroheptanoic acid (PFHpA)	375-85-9	1	1	1
Perfluorooctanoic acid (PFOA)	335-67-1	1	1	1
Perfluorononanoic acid (PFNA)	375-95-1	2	2	2
Perfluorodecanoic acid (PFDA)	335-76-2	3	3	3

Matrix: Groundwater/Surface water		Analytical Group: PFASs (ELLE) per DoD QSM 5.1.1 Table B-15 (DoD 2018)		
Analyte	**CAS Number**	**PSL (ng/L)**	**Laboratory-Specific Limits**	
			LOQ (ng/L)	**LOD (ng/L)**
Perfluoroundecanoic acid (PFUnA)	2058-94-8	2	2	2
Perfluorododecanoic acid (PFDoA)	307-55-1	1	1	1
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	2	2	2
Perfluorotetradecanoic acid (PFTA)	376-06-7	2	2	2
Perfluorobutanesulfonic acid (PFBS)	375-73-5	1	1	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	2	2	2
Perfluorooctane sulfonate (PFOS)	1763-23-1	2	2	2
N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	2991-50-6	3	3	3
N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	2355-31-9	3	3	3
6:2 Fluorotelomer sulfonate	27619-97-2	9	9	9
8:2 Fluorotelomer sulfonate	39108-34-4	6	6	6

Notes:
CAS - Chemical Abstracts Service
LOD – limit of detection
LOQ – limit of quantitation
ng/L – nanogram per liter
PSL – project screening level
QSM – Quality Systems Manual

Matrix: Soil/Sediment		Analytical Group: PFASs (ELLE) per DoD QSM 5.1.1 Table B-15		
Analyte	**CAS Number**	**PSL (ng/g)**	**Laboratory-Specific Limits**	
			LOQ (ng/g)	**LOD (ng/g)**
Perfluorobutanoic acid (PFBA)	375-22-4	0.6	0.6	0.6
Perfluoropentanoic acid (PFPA)	2706-90-3	0.6	0.6	0.6
Perfluorohexanoic acid (PFHxA)	307-24-4	0.6	0.6	0.6
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.6	0.6	0.6
Perfluorooctanoic acid (PFOA)	335-67-1	0.6	0.6	0.6
Perfluorononanoic acid (PFNA)	375-95-1	0.6	0.6	0.6
Perfluorodecanoic acid (PFDA)	335-76-2	1	1	1
Perfluoroundecanoic acid (PFUnA)	2058-94-8	0.6	0.6	0.6
Perfluorododecanoic acid (PFDoA)	307-55-1	0.6	0.6	0.6
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.6	0.6	0.6
Perfluorotetradecanoic acid (PFTA)	376-06-7	0.6	0.6	0.6
Perfluorobutanesulfonic acid (PFBS)	375-73-5	0.6	0.6	0.6
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.6	0.6	0.6
Perfluorooctane sulfonate (PFOS)	1763-23-1	0.6	0.6	0.6
N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	2991-50-6	2	2	2
N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	2355-31-9	2	2	2

Matrix: Soil/Sediment		Analytical Group: PFASs (ELLE) per DoD QSM 5.1.1 Table B-15		
Analyte	CAS Number	PSL (ng/g)	Laboratory-Specific Limits	
			LOQ (ng/g)	LOD (ng/g)
6:2 Fluorotelomer sulfonate	27619-97-2	2	2	2
8:2 Fluorotelomer sulfonate	39108-34-4	2	2	2

Notes:
CAS - Chemical Abstracts Service
LOD – limit of detection
LOQ – limit of quantitation
ng/g – nanogram per gram
PSL – project screening level
QSM – Quality Systems Manual

Matrix: Potable Water		Analytical Group: PFASs (ELLE) per DoD QSM 5.1.1 EPA 537		
Analyte	CAS Number	PSL (ng/l)	Laboratory-Specific Limits	
			LOQ (ng/l)	LOD (ng/l)
Perfluorohexanoic acid (PFHxA)	307-24-4	1.5	2	1.5
Perfluoroheptanoic acid (PFHpA)	375-85-9	1.5	2	1.5
Perfluorooctanoic acid (PFOA)	335-67-1	1.5	2	1.5
Perfluorononanoic acid (PFNA)	375-95-1	1.5	2	1.5
Perfluorodecanoic acid (PFDA)	335-76-2	1.5	2	1.5
Perfluoroundecanoic acid (PFUnA)	2058-94-8	1.5	2	1.5
Perfluorododecanoic acid (PFDoA)	307-55-1	1.5	2	1.5

Matrix: Potable Water		Analytical Group: PFASs (ELLE) per DoD QSM 5.1.1 EPA 537		
Analyte	**CAS Number**	**PSL (ng/l)**	**Laboratory-Specific Limits**	
			LOQ (ng/l)	**LOD (ng/l)**
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	1.5	2	1.5
Perfluorotetradecanoic acid (PFTA)	376-06-7	1.5	2	1.5
Perfluorobutanesulfonic acid (PFBS)	375-73-5	1.3	2	1.3
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	1.4	2	1.4
Perfluorooctane sulfonate (PFOS)	1763-23-1	1.4	2	1.4
N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	2991-50-6	1.5	2	1.5
N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	2355-31-9	1.5	2	1.5

Notes:
CAS - Chemical Abstracts Service
LOD – limit of detection
LOQ – limit of quantitation
ng/l – nanogram per liter
PSL – project screening level
QSM – Quality Systems Manual

QAPP ADDENDUM WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

UFP-QAPP, PFAS Sampling Activities

(UFP-QAPP Manual Section 3.1.1)
(USEPA 2106-G-05 Section 2.3.1)

The DQOs for the sampling are described in **Worksheet #11** of this QAPP Addendum. This worksheet provides the detailed rationale and approach for site-specific sampling at FTMC. This QAPP Addendum has been developed to ensure the amount, type, and quality of data are sufficient to determine which areas and environmental media are impacted with detectable levels of PFAS, determine the source strength of primary and secondary source areas, understand migration pathways, and refine the CSMs for each AOPI.

Environmental data will be collected as presented within this QAPP Addendum and in accordance with the field SOPs provided in Appendix A to the PQAPP at the locations defined in **Worksheet #18** and on **Figures 3** and **4** of this QAPP Addendum, along with the QC sample requirements listed in **Worksheet #20** of this QAPP Addendum. Components of some SOPs may require modification or be superseded by the PFAS TGI (P-10 in Appendix A to the PQAPP) and/or PFAS Sampling and Analysis White Paper (Appendix B to the PQAPP) to accommodate PFAS-specific sampling requirements (Arcadis 2018b). The sampling methods described in the SOPs establish equipment requirements; procedures for equipment and containers before sampling; sampling procedures under various conditions; equipment blank samples and field duplicate collection requirements; and requirements for storing samples to ensure that sample contamination does not occur during collection, transport, and analysis. All field activities will be conducted in accordance with the approved Programmatic Accident Prevention Plan (Arcadis 2018a) and SSHP.

The areas of focus for this SI were selected based on a review of historical documents and data and information obtained by conducting personal interviews during the PA; these information inputs were used to develop the preliminary drinking water CSMs provided in **Worksheet #10** and on **Figures 2** through **4** of this QAPP Addendum. Soil samples will be collected from 20 locations at FTBP #1, FTBP #2, FTBP #3, and the Sparta – Fort McCoy Airport AOPIs, groundwater samples will be collected from 20 locations throughout all AOPIs, drinking water samples will be collected from three potable wells near FTBP #2, FTBP #3, and the Sparta – Fort McCoy Airport AOPIs, and sediment and surface water samples will be collected from four areas at Former Landfill #5 and FTBP #1. Surface water, sediment, and groundwater will be sampled to identify PFAS presence, type (of the 18 selected constituents as listed in Worksheet #18 of the PQAPP, including PFOS/PFOA), and concentrations. Soil will be sampled to identify PFAS presence, type (of the 18 selected constituents as listed in Worksheet #18 of the PQAPP, including PFOS/PFOA), and concentrations, as well as for total organic carbon (TOC), pH, and grain size (except where otherwise noted, i.e., for VAP sampling). Drinking water will be sampled to identify PFAS presence, type (of 14 selected constituents as listed in **Worksheet #15** of this QAPP Addendum, including PFOS/PFOA), and concentrations. These targeted sampling areas are believed to have the potential for the greatest PFAS concentrations closest to known releases of AFFF. PFAS has been detected in monitoring wells and drinking water wells in Wisconsin during previous investigation activities.

Results of the sampling will be compiled and analyzed by Arcadis and presented in a PA/SI Report. The report will summarize the field effort and present the validated sampling results, including QA/QC.

The planned project schedule to complete the PA/SI for FTMC is provided in **Worksheet #14 & 16** of this QAPP Addendum. The mobilization schedule will be determined upon the finalization of this QAPP Addendum. Necessary permits, forms, or other project documentation, subcontracts, or project equipment will be procured before mobilization. Before conducting intrusive activities, the location of underground utilities will be determined. Utility companies and other responsible authorities will be contacted to locate and mark the locations. No required installation-specific training or additional requirements for installation access have been identified at this time. The investigation team will demobilize once field activities are complete. IDW (including soil cuttings, groundwater purged during sampling, and water from decontamination of drill tooling), will be disposed of on ground surface. Non-IDW wastes will be removed from the site immediately upon completion of each day's field activities. A post-activity inspection will be conducted by the field team lead/regional lead and SSHO identified in the this QAPP Addendum and the attached SSHP (**Attachment 4**) to ensure the location is left clean.

Groundwater Sampling

Groundwater samples will be collected to inform the interpretation of PFAS distribution and migration and update the individual AOPI drinking water CSMs. A total of 30 grab groundwater samples will be collected via DPT from a total number of 20 DPT locations. Grab groundwater samples will be collected at the water table via DPT from 10 discrete direct push points at locations throughout FTBP #2, FTBP #3 and the Sparta – Fort McCoy Airport AOPIs. Two locations will be located on the northern edge of FTBP #2 in the path of groundwater flow. Eight locations will be at confirmed or suspected AFFF release areas at the Sparta – Fort McCoy Airport AOPIs. Additionally, grab groundwater samples will be collected using DPT and VAP technology at the water table and the 30-foot bgs interval at 10 discrete direct push point locations at all AOPIs. Three of these VAP locations are downgradient of Former Landfill #5, two are downgradient of FTBP #1, one is downgradient of FTBP #2 and FTBP #3, and four are in the center of confirmed or suspected AFFF releases at the Sparta – Fort McCoy Airport AOPIs. DPT and VAP boring and sampling will be completed using dual-tube top-down methods accordance with TGI for VAP (P-14 in Appendix A to the PQAPP; Arcadis 2018b). Groundwater samples will be analyzed for select PFAS, and field parameters (temperature, pH, conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential) will be measured during purging and allowed to stabilize (or purged for a maximum of 20 minutes, whichever is sooner) before groundwater sampling to ensure a representative sample is collected and, potentially, to inform the interpretation of analytical data. Coordinates for each borehole's groundwater sampling location will be recorded using a handheld global positioning system (GPS).

Soil Sampling

Soil samples will be collected to inform the interpretation of PFAS distribution, determine residual source strength of potential PFAS release areas, evaluate the potential for those areas to be sources of PFAS to surface water and groundwater as an influence to drinking water, and update the individual AOPI CSMs. Soil samples will be analyzed for select PFAS, TOC, pH, and grain size; soil lithological descriptions will be continuously logged and will be documented on field forms. Soil samples will be collected via DPT drilling methods for VAP (in accordance with the TGI for VAP (P-14 in Appendix A to the PQAPP [Arcadis 2018b]) from 38 discrete points at each of the following AOPIs from a total of 20 DPT sampling points: FTBP #1, Former Landfill #5, FTBP #2, FTBP #3, and the Sparta-Fort McCoy Airport AOPIs (**Figure 6** and **Figure 7**). DPT and VAP boring and sampling will be completed using a dual-tube, top-down method. Soil samples will be collected from the surface and water table to determine residual PFAS source strength at two locations at FTBP#1, four locations at FTBP #3, and 12 locations at the Sparta – Fort McCoy Airport AOPIs. Two

locations at FTBP #2 will only be sampled at the water table, since a previous excavation would have removed any surface soil PFAS impacts. Coordinates for each soil sampling location will be recorded using a handheld GPS.

Surface Water Sampling

Surface water samples will be collected to inform the presence or absence of PFAS in possible secondary source areas. Grab surface water samples will be collected from the following locations: FTBP #1 and Former Landfill #5 (**Figure 4)**. Surface water will be co-located with sediment sampling locations at four locations along Squaw Creek to the west of Former Landfill #5 and FTBP #1. Surface water samples will be collected before sediment sample collection to reduce siltation. Surface water (and sediment) samples will be collected from downstream to upstream to reduce siltation in sequential samples. All surface water samples will be analyzed for select PFAS, and field parameters (temperature, pH, conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential) will be measured during surface water sampling to potentially inform the interpretation of analytical data. Coordinates for each surface water sampling location will be recorded using a handheld GPS.

Sediment Sampling

Sediment samples will be collected to inform the presence or absence of PFAS in possible primary/secondary source areas and evaluate the potential for those areas to be sources of PFAS to surface water and groundwater as an influence to drinking water. Sediment samples will be collected from the following locations: FTBP #1 and Former Landfill #5 (**Figure 4**). Sediment sampling locations will be co-located with surface water sampling locations; therefore, surface water samples will be collected first to reduce siltation. Sediment samples will be collected from the upper 10 centimeters using dedicated Lexan™ tubes, and the sediment will be decanted before bottling for laboratory analysis of select PFAS only. Sediment descriptions will be documented on field forms. Coordinates for each sediment sampling location will be recorded using a handheld GPS.

Potable Water Sampling

Potable water samples will be collected to inform the presence or absence of PFAS in the public water supply. Potable water samples will be collected from wells 6082W, 6081W, and SW-5020, which are located in the vicinity of FTBP #2, FTBP #3, and the Sparta – Fort McCoy Airport AOPIs. Samples will be collected in accordance with the TGI for potable water sample collection found as **Attachment 3**.

Laboratories

ELLE will be used for this study. PFAS analysis for groundwater, soil, sediment, and surface water will be conducted in accordance with the DoD QSM 5.1.1, Table B-15 for the analytes listed in Worksheet #18 of the PQAPP. PFAS analysis of drinking water will be conducted in accordance with EPA Method 537 for drinking water which consists of the 14 analytes (including PFOS/PFOA) listed in **Worksheet #15**. Arcadis will validate the data from the laboratory in accordance with Worksheets #34, #35, and #36 of the PQAPP. A Data Usability Summary Report will be prepared in accordance with the USACE Environmental Quality: Guidance for Evaluating Performance-Based Chemical Data, Engineer Manual 200-1-10 (USACE 2005) that will review precision, accuracy, completeness, representativeness, comparability, and sensitivity. This information will be included in a PA/SI Report.

QAPP ADDENDUM WORKSHEET #18: SAMPLING LOCATIONS AND METHODS

(UFP-QAPP Manual Section 3.1.1 and 3.1.2)
(USEPA 2106-G-05 Section 2.3.1 and 2.3.2)

The tentative sampling locations, identifications, and associated analytes and parameters are summarized below; sampling locations are depicted on **Figure 3** (FTBP #2, FTBP #3 and the Sparta – Fort McCoy Airport AOPIs) and **Figure 4** (FTBP #1 and Former Landfill #5). The PFAS group (18 constituents, including PFOS/PFOA) noted for analysis for groundwater, soil, surface water, and sediment samples in the table below is summarized for all media in Worksheet #18 of the PQAPP. The PFAS group for drinking water consists of 14 constituents, including PFOS/PFOA, which are listed in **Worksheet #15** of this QAPP Addendum. **Worksheet #17** of this QAPP Addendum describes the rationale for the various sampling locations and media. Field activities and sampling procedures will be conducted in accordance with the TGI and SOP documents in Appendix A to the PQAPP (Arcadis 2018b). Additional information on PFAS sampling is available in the PFAS Sampling and Analysis White Paper (Appendix B to the PQAPP; Arcadis 2018b). The frequency requirements for QA/QC samples noted in Worksheet #20 of the PQAPP will be met. In addition to the requirements listed in Worksheet #20 of the PQAPP, a field reagent blank (FRB) associated with drinking water sampling will be collected at a frequency of one per day. **Worksheet #18** of this QAPP Addendum lists the number and type of QA/QC samples anticipated for each matrix based on the sampling plan presented herein; however, the final number and identifications of QA/QC samples listed in the table below are TBD based on progression of daily field activities.

Site Location	Matrix	Sample ID	Depth Interval (Approximate)	Sample Method	Sample Type	Number of Samples	Analytes
FTBP #1	SE	FTMC-FTBP1-1-SE	0-10 centimeters	Grab	N, FD, MS, MSD	4	PFAS
	SW	FTMC-FTBP1-1-SW	N/A	Grab	N, FD, MS, MSD	4	PFAS, field parameters[1]
	SO	FTMC-FTBP1-1-SO-2	0-2 feet bgs	Hand Auger	N, FD, MS, MSD	4	PFAS, TOC, grain size, pH
		FTMC-FTBP1-1-SO-Depth	Water Table	DPT	N	1	
		FTMC-FTBP1-2-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-FTBP1-2-SO-Depth	Water Table	DPT		1	

Site Location	Matrix	Sample ID	Depth Interval (Approximate)	Sample Method	Sample Type	Number of Samples	Analytes
	GW	FTMC-FTBP1-1-GW-Depth	Water Table	VAP	N, FD, MS, MSD	4	PFAS, field parameters[1]
		FTMC-FTBP1-1-GW-30	30 feet bgs		N	1	PFAS, field parameters[1]
		FTMC-FTBP1-2-GW-Depth	Water Table			1	
		FTMC-FTBP1-2-GW-30	30 feet bgs			1	
Former Landfill #5	GW	FTMC-FL5-1-GW-Depth	Water Table	VAP	N, FD, MS, MSD	4	PFAS, field parameters[1]
		FTMC-FL5-1-GW-30	30 feet bgs		N	1	
		FTMC-FL5-2-GW-Depth	Water Table			1	
		FTMC-FL5-2-GW-30	30 feet bgs			1	
		FTMC-FL5-3-GW-Depth	Water Table			1	
		FTMC-FL5-3-GW-30	30 feet bgs			1	
	SE	FTMC-FL5-1-SE	0-10 centimeters	Grab	N	1	PFAS
		FTMC-FL5-2-SE	0-10 centimeters			1	
		FTMC-FL5-3-SE	0-10 centimeters			1	
	SW	FTMC-FL5-1-SW	N/A	Grab	N	1	PFAS, field parameters[1]
		FTMC-FL5-2-SW	N/A			1	
		FTMC-FL5-3-SW	N/A			1	
FTBP #2	SO	FTMC-FTBP2-1-SO-Depth	Water Table	Grab	N, FD, MS, MSD	4	PFAS, TOC, grain size, pH
		FTMC-FTBP2-2-SO-Depth	Water Table		N	1	

Site Location	Matrix	Sample ID	Depth Interval (Approximate)	Sample Method	Sample Type	Number of Samples	Analytes
	GW	FTMC-FTBP2-1-GW-Depth	Water Table	VAP	N	1	PFAS, field parameters[1]
		FTMC-FTBP2-2-GW-Depth	Water Table			1	
		FTMC-FTBP2-3-GW-Depth	Water Table			1	
		FTMC-FTBP2-3-GW-30	30 feet bgs			1	
FTBP #3	SO	FTMC-FTBP3-1-SO-2	0-2 feet bgs	Hand Auger	N, FD, MS, MSD	4	PFAS, TOC, grain size, pH
		FTMC-FTBP3-1-SO-Depth	Water Table	DPT	N	1	
		FTMC-FTBP3-2-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-FTBP3-2-SO-Depth	Water Table	DPT		1	
		FTMC-FTBP3-3-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-FTBP3-3-SO-Depth	Water Table	DPT		1	
		FTMC-FTBP3-4-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-FTBP3-4-SO-Depth	Water Table	DPT		1	
Former Fire Station #2	SO	FTMC-FFS2-1-SO-2	0-2 feet bgs	Hand Auger	N	1	PFAS, TOC, grain size, pH
		FTMC-FFS2-1-SO-Depth	Water Table	DPT		1	
		FTMC-FFS2-2-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-FFS2-2-SO-Depth	Water Table	DPT		1	
		FTMC-FFS2-3-SO-2	0-2 feet bgs	Hand Auger		1	

Site Location	Matrix	Sample ID	Depth Interval (Approximate)	Sample Method	Sample Type	Number of Samples	Analytes
		FTMC-FFS2-3-SO-Depth	Water Table	DPT		1	
	GW	FTMC-FFS2-1-GW-Depth	Water Table	VAP	N	1	PFAS, field parameters[1]
		FTMC-FFS2-2-GW-Depth	Water Table			1	
		FTMC-FFS2-3-GW-Depth	Water Table			1	
		FTMC-FFS2-3-GW-30	30 feet bgs			1	
2017 AFFF Release	SO	FTMC-2017R-1-SO-2	0-2 feet bgs	Hand Auger	N	1	PFAS, TOC, grain size, pH
		FTMC-2017R-1-SO-Depth	Water Table	DPT		1	
		FTMC-2017R-2-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-2017R-2-SO-Depth	Water Table	DPT		1	
		FTMC-2017R-3-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-2017R-3-SO-Depth	Water Table	DPT		1	
	GW	FTMC-2017R-1-GW-Depth	Water Table	VAP	N	1	PFAS, field parameters[1]
		FTMC-2017R-2-GW-Depth	Water Table			1	
		FTMC-2017R-3-GW-Depth	Water Table			1	
		FTMC-2017R-3-GW-30	30 feet bgs			1	
Deluge System	SO	FTMC-DLG-1-SO-2	0-2 feet bgs	Hand Auger	N	1	PFAS, TOC, grain size, pH
		FTMC-DLG-1-SO-Depth	Water Table	DPT		1	

Site Location	Matrix	Sample ID	Depth Interval (Approximate)	Sample Method	Sample Type	Number of Samples	Analytes
		FTMC-DLG-2-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-DLG-2-SO-Depth	Water Table	DPT		1	
		FTMC-DLG-3-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-DLG-3-SO-Depth	Water Table	DPT		1	
	GW	FTMC-DLG-1-GW-Depth	Water Table	VAP	N	1	PFAS, field parameters[1]
		FTMC-DLG-2-GW-Depth	Water Table			1	
		FTMC-DLG-3-GW-Depth	Water Table			1	
		FTMC-DLG-3-GW-30	30 feet bgs			1	
1990s AFFF Release	SO	FTMC-1990R-1-SO-2	0-2 feet bgs	Hand Auger	N	1	PFAS, TOC, grain size, pH
		FTMC-1990R-1-SO-Depth	Water Table	DPT		1	
		FTMC-1990R-2-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-1990R-2-SO-Depth	Water Table	DPT		1	
		FTMC-1990R-3-SO-2	0-2 feet bgs	Hand Auger		1	
		FTMC-1990R-3-SO-Depth	Water Table	DPT		1	
	GW	FTMC-1990R-1-GW-Depth	Water Table	VAP	N	1	PFAS, field parameters[1]
		FTMC-1990R-2-GW-Depth	Water Table			1	
		FTMC-1990R-3-GW-Depth	Water Table			1	

Site Location	Matrix	Sample ID	Depth Interval (Approximate)	Sample Method	Sample Type	Number of Samples	Analytes
		FTMC-1990R-3-GW-30	30 feet bgs			1	
Potable Wells	DW	FTMC-6082W-DW	N/A	Grab	N, FD, MS, MSD	4	PFAS[2], field parameters[1]
		FTMC-6081W-DW	N/A	Grab	N	1	
		FTMC-SW5020-DW	N/A	Grab	N	1	
Equipment Blanks	QA/QC	FTMC-EB-1-MMDDYY	HDPE Tubing	N/A	EB	1	PFAS
		FTMC-EB-2-MMDDYY	Water Level Meter			1	
		FTMC-EB-3-MMDDYY	Hand Auger			1	
		FTMC-EB-4-MMDDYY	Stainless Steel Putty Knife			1	
		FTMC-EB-5-MMDDYY	Drill Casing			1	
		FTMC-EB-6-MMDDYY	Other			1	
Field Blanks	QA/QC	FTMC-FB-1-MMDDYY	N/A	N/A	FB	1	PFAS
		FTMC-FB-2-MMDDYY				1	
		FTMC-FB-3-MMDDYY				1	
Source Blank	QA/QC	FTMC-SB-1-MMDDYY	N/A	N/A	SB	1	PFAS
Field Reagent Blank	QA/QC	FTMC-FRB-1-MMDDYY	NA	NA	FRB	1	PFAS[2]

Notes:
1. Field parameters include temperature, pH, conductivity, dissolved oxygen, turbidity, oxidation-reduction potential.
2. PFAS analysis for drinking water and associated QA/QC samples is analyzed using EPA Method 537 for drinking water and consists of 14 constituents listed on **Worksheet #15** of this QAPP Addendum.

DPT - direct push technology
DW - drinking water
EB - equipment blank
FB - field blank
FD - field duplicate
FRB - field reagent blank
GW - groundwater
HDPE - high density polyethylene
MS - matrix spike
MSD - matrix spike duplicate
N - normal (parent)
N/A - not applicable
QA - quality assurance
QC - quality control
SB - source blank
SE - sediment
SO - soil
SW - surface water
VAP - vertical aquifer profiling

QAPP ADDENDUM WORKSHEET #20: FIELD QC SUMMARY

(UFP-QAPP Section 3.1.1 and 3.1.2)
(USEPA 2106-G-05 Section 2.3.5)

Primary and QA/QC samples will be collected during field activities as noted below at the frequencies prescribed in Worksheet #20 of the PQAPP (Arcadis 2018b). Field blanks (FBs) will be collected at a frequency of 1 per 20 primary samples (not medium-specific). Source blanks (SBs) will be collected from each source of water used for the initial decontamination step. FBs and SBs will be analyzed for the PFAS group only (18 analytes). In addition to the QA/QC samples listed in Worksheet #20 of the PQAPP, FRBs associated with drinking water will be collected at a frequency of one per day. FRBs will be analyzed for the PFAS group only (14 analytes).

Matrix	Analyte/Analytical Group	Normal Samples	FD	MS	MSD	EB	Total # analyses
Groundwater	PFAS	30	2	2	2	1 per piece of relevant equipment per sampling event (4 anticipated)	TBD (40 anticipated)
Soil	PFAS	38	2	2	2	1 per piece of relevant equipment per sampling event (2 anticipated)	TBD (46 anticipated)
	TOC	38	2	2	2	N/A	44
	pH	38	N/A	N/A	N/A	N/A	38
	Grain size	38	N/A	N/A	N/A	N/A	38
Surface Water	PFAS	4	1	1	1	N/A	7
Sediment	PFAS	4	1	1	1	N/A	7
Drinking Water	PFAS[1]	3	1	1	1	N/A	6

Notes:

1. PFAS analysis for drinking water and associated QA/QC samples is analyzed using EPA Method 537 for drinking water and consists of 14 constituents listed on **Worksheet #15** of this QAPP Addendum.

EB - equipment blank
FD - field duplicate
MS - matrix spike
MSD - matrix spike duplicate
N/A - not applicable
TBD - to be determined
TOC - total organic carbon

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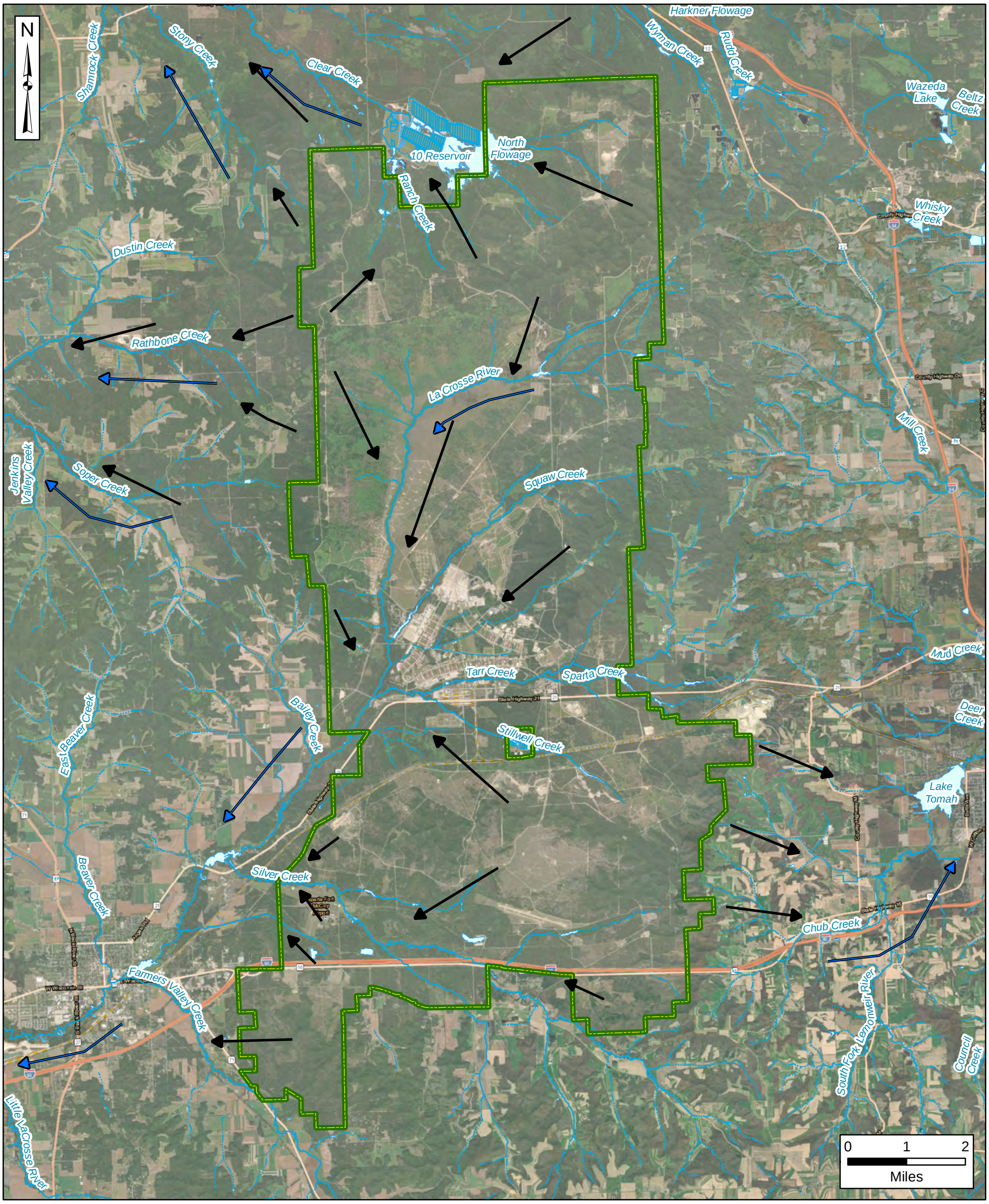
Figures

Quality Assurance Project Plan Addendum
USAEC PFAS Preliminary Assessment/Site Inspection
Fort McCoy, WI

Figure 1
Installation Location



Installation Boundary
Water Body
Stream (Intermittent)
River/Stream (Perennial)
Surface Water Flow Direction
Groundwater Flow Direction

Note:
Groundwater and surface water flow directions are as provided in the Final Operational Range Assessment Program Report for Fort McCoy (Arcadis, 2009).

Data Sources:
AEC, ARID-GEO, 2005
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

Quality Assurance Project Plan Addendum
USAEC PFAS Preliminary Assessment/Site Inspection
Fort McCoy, WI

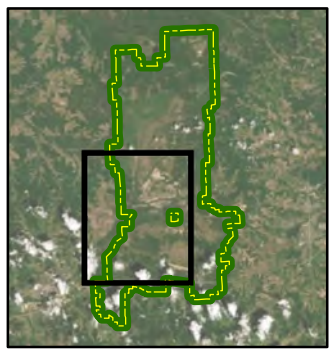


Figure 2
Installation Layout and AOPI Locations

Installation Boundary
AOPI
Water Body
Stream (Intermittent)
River/Stream (Perennial)

Potable Well
Monitoring Well
Other Well (Use Unknown)

AOPI = area of potential interest

Data Sources:
AEC, ARID-GEO, 2005
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

Quality Assurance Project Plan Addendum
USAEC PFAS Preliminary Assessment/Site Inspection
Fort McCoy, WI

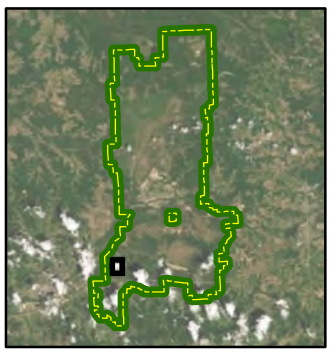


Figure 3
Proposed Sampling Locations: Former Fire Training Burn Pits #2 and #3 and the Sparta - Fort McCoy Airport AOPIs

N

Silver Creek

6082W
6081W

Sparta - Fort McCoy Airport AOPIs

Former Fire Station #2

FTMC-FTBP2-3-GW-30-Depth of interval above Water Table
FTMC-FTBP2-3-GW-30

FTMC-FFS2-1-SO-2
FTMC-FFS2-1-SO-Depth of Interval Above Water Table
FTMC-FFS2-1-GW-Depth of water table

FTMC-FFS2-2-SO-2
FTMC-FFS2-2-SO-Depth of Interval Above Water Table
FTMC-FFS2-2-GW-Depth of Water Table

FTMC-FFS2-3-SO-2
FTMC-FFS2-3-SO-Depth of Interval Above Table Table
FTMC-FFS2-3-GW-Depth of water table
FTMC-FFS2-3-GW-30

SW-5020

FTMC-2017R-1-SO-2
FTMC-2017R-1-SO-Depth of Interval Above Water Table
FTMC-2017R-1-GW-Depth of water table

2017 AFFF Release

FTMC-DLG-1-SO-2
FTMC-DLG-1-SO-Depth of Interval Above Water Table
FTMC-DLG-1-GW-Depth of Water Table

FTMC-2017R-3-SO-2
FTMC-2017R-3-SO-Depth of Interval Above Water Table
FTMC-2017R-3-GW-Depth of water table
FTMC-2017R-3-GW-30

FTMC-DLG-3-SO-2
FTMC-DLG-3-SO-Depth of Interval Above Water Table
FTMC-DLG-3-GW-Depth of Water Table
FTMC-DLG-3-GW-30

FTMC-2017R-2-SO-2
FTMC-2017R-2-SO-Depth of Interval Above Water Table
FTMC-2017R-2-GW-Depth of water table

Deluge System

FTMC-1990R-1-SO-2
FTMC-1990R-1-SO-Depth of Interval Above Water Table
FTMC-1990R-1-GW-Depth of water table

FTMC-FTBP2-1-GW-Depth of Water Table
FTMC-FTBP2-1-SO-Depth of interval above Water Table

FTMC-DLG-2-SO-2
FTMC-DLG-2-SO-Depth of Interval Above Water Table
FTMC-DLG-2-GW-Depth of Water Table

FTMC-FTBP2-2-GW-Depth of Water Table
FTMC-FTBP2-2-SO-Depth of interval above Water Table

Former Fire Training Burn Pit #2

FTMC-1990R-3-SO-2
FTMC-1990R-3-SO-Depth of Interval Above Table Table
FTMC-1990R-3-GW-Depth of water table
FTMC-1990R-3-GW-30

1990s AFFF Release

FTMC-1990R-2-SO-2
FTMC-1990R-2-SO-Depth of Interval Above Water Table
FTMC-1990R-2-GW-Depth of water table

FTMB-FTBP3-1-SO-2
FTMB-FTBP3-1-SO-Depth of interval above Water Table

FTMB-FTBP3-3-SO-2
FTMB-FTBP3-3-SO-Depth of interval above Water Table

FTMB-FTBP3-2-SO-2
FTMB-FTBP3-2-SO-Depth of interval above Water Table

FTMB-FTBP3-4-SO-2
FTMB-FTBP3-4-SO-Depth of interval above Water Table

Former Fire Training Burn Pit #3

0 200 400
Feet

Installation Boundary
AOPI
AFFF Release Area
Groundwater Flow Direction
Potable Well
Monitoring Well
2016 Soil Boring

Proposed Sampling Locations

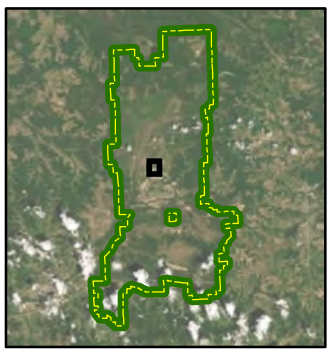
Soil (surface / water table)
Soil (surface / water table) & VAP (water table / 30)
Soil (surface / water table) and VAP (water table)
VAP (water table / 30')
VAP (water table) and soil (water table)

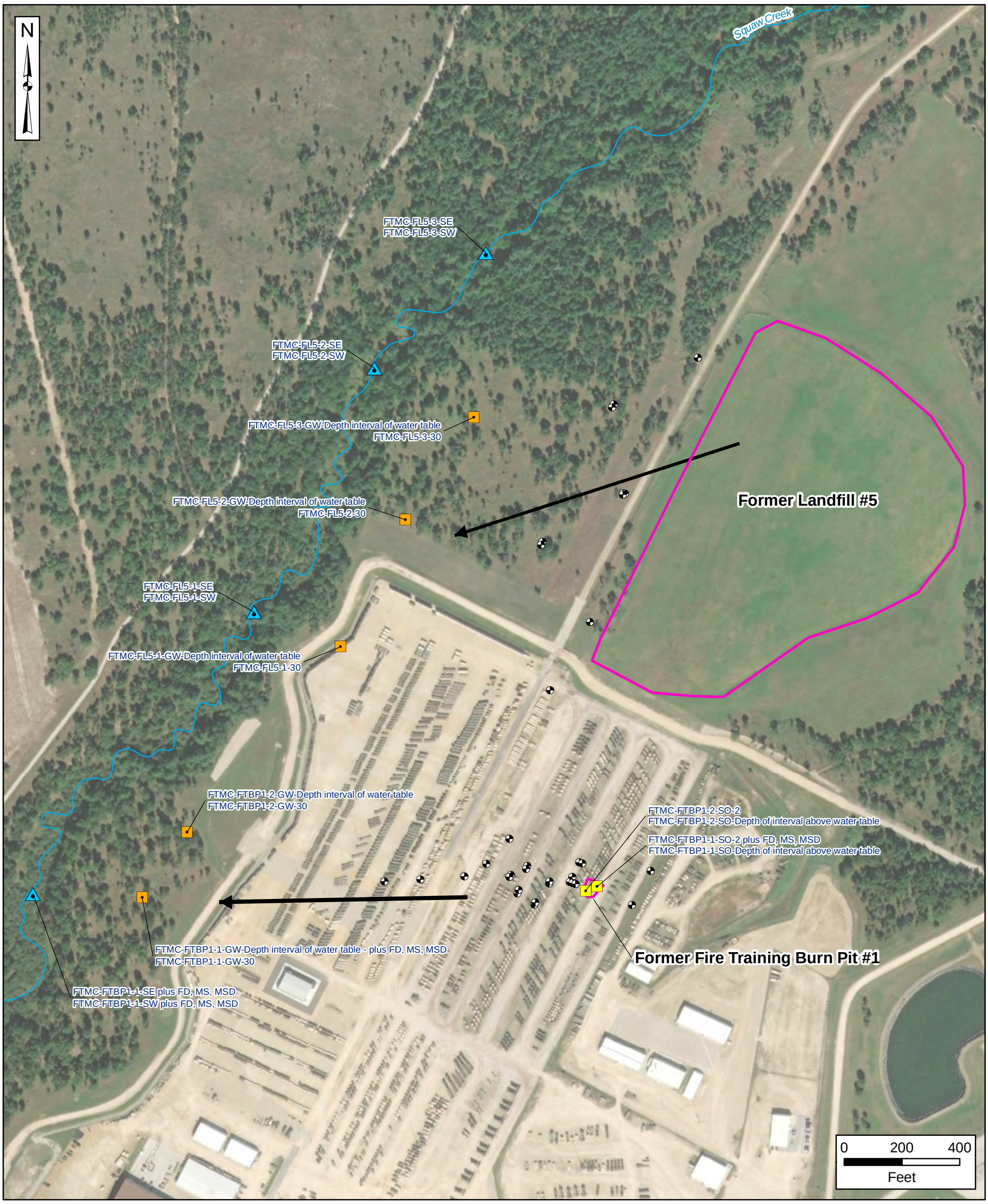
Data Sources:
AEC, ARID-GEO, 2005
Fort McCoy, GIS Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

Quality Assurance Project Plan Addendum
USAEC PFAS Preliminary Assessment/Site Inspection
Fort McCoy, WI

Figure 4
Proposed Sampling Locations:
Former Landfill #5 and Former Fire Training Burn Pit #1





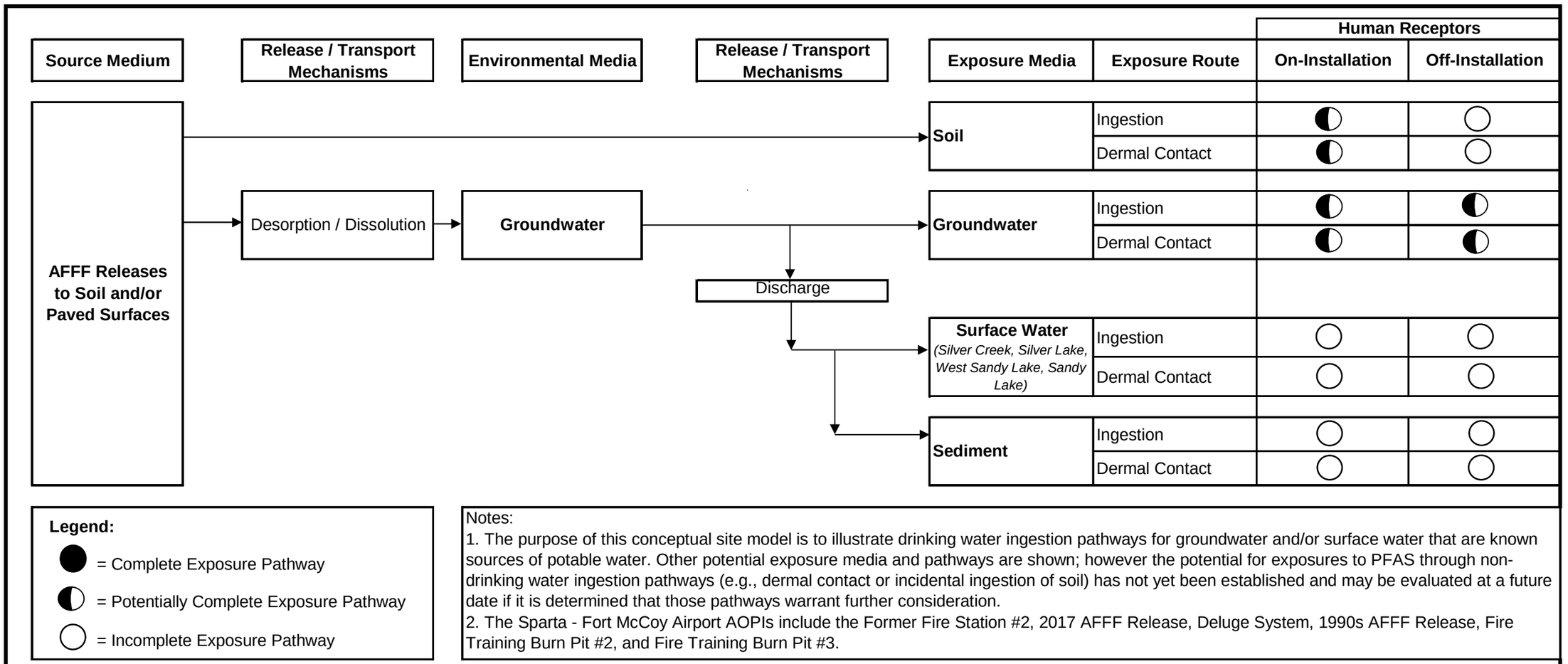
Installation Boundary
AOPI
River/Stream (Perennial)
Groundwater Flow Direction
Monitoring Well

Proposed Sampling Locations

Surface Water / Sediment
Soil (surface / water table)
VAP (water table / 30') / Permanent Monitoring Well

Data Sources:
AEC, ARID-GEO, 2005
Fort McCoy, GIS Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North



Legend:

- = Complete Exposure Pathway
- = Potentially Complete Exposure Pathway
- = Incomplete Exposure Pathway

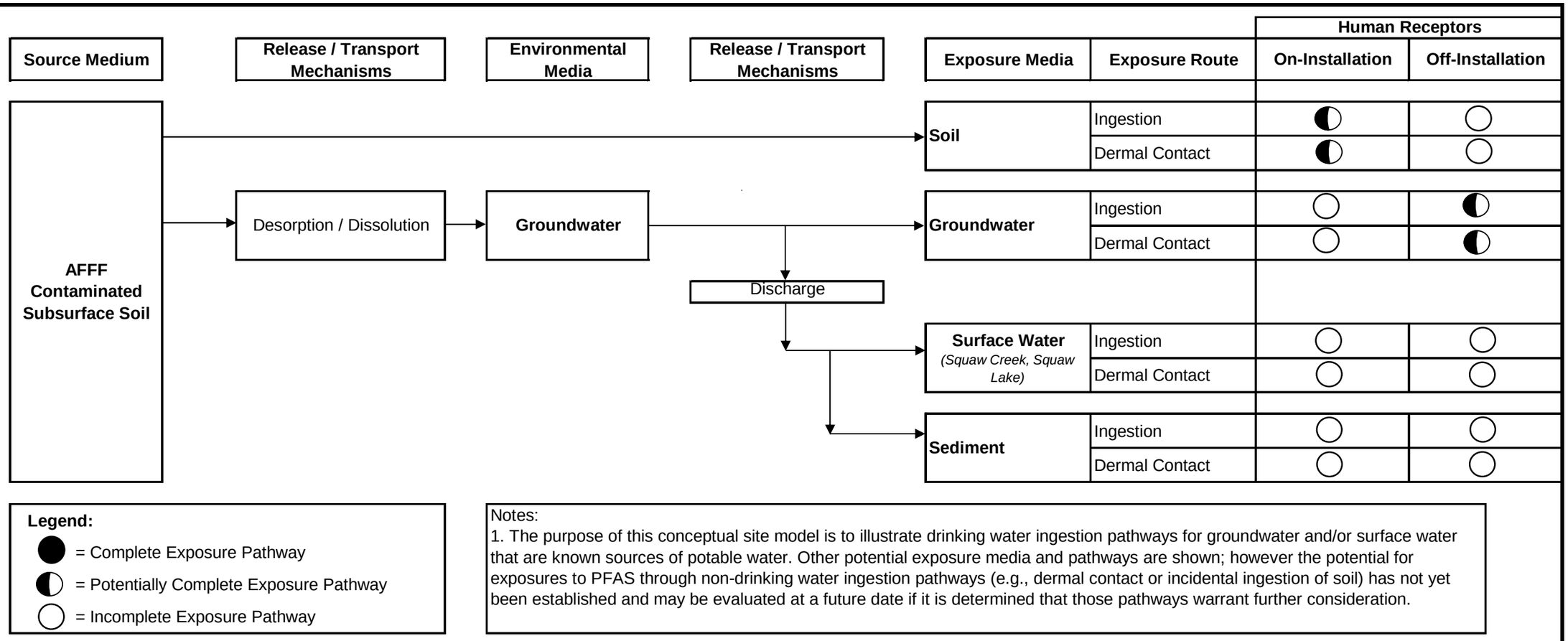
Notes:

1. The purpose of this conceptual site model is to illustrate drinking water ingestion pathways for groundwater and/or surface water that are known sources of potable water. Other potential exposure media and pathways are shown; however the potential for exposures to PFAS through non-drinking water ingestion pathways (e.g., dermal contact or incidental ingestion of soil) has not yet been established and may be evaluated at a future date if it is determined that those pathways warrant further consideration.
2. The Sparta - Fort McCoy Airport AOPIs include the Former Fire Station #2, 2017 AFFF Release, Deluge System, 1990s AFFF Release, Fire Training Burn Pit #2, and Fire Training Burn Pit #3.

ARCADIS

Conceptual Site Model for Drinking Water Pathway - Sparta - Fort McCoy Airport AOPIs
USAEC PFAS Preliminary Assessment / Site Inspection
Fort McCoy, Wisconsin

Figure 5



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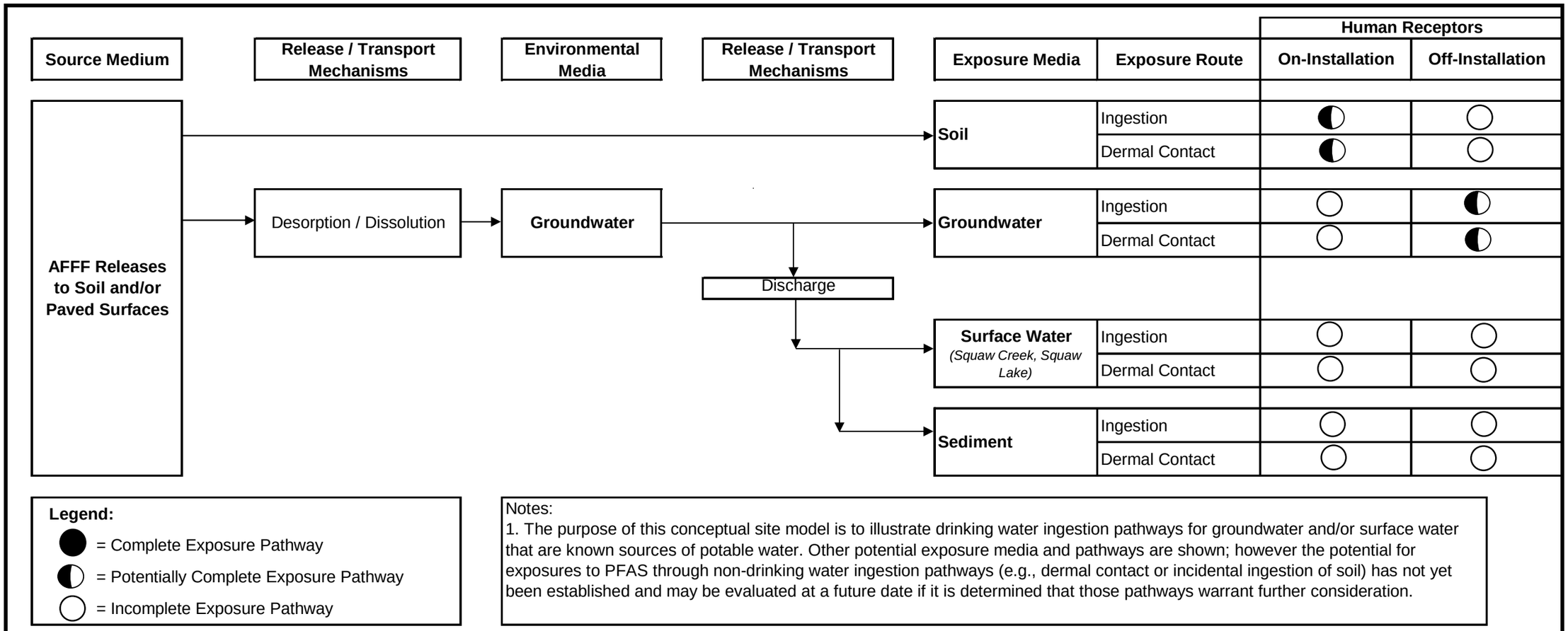
ARCADIS

Conceptual Site Model for Drinking Water Pathway - AOPI Former Landfill #5
USAEC PFAS Preliminary Assessment / Site Inspection
Fort McCoy, Wisconsin

Figure 6



Conceptual Site Model for Drinking Water Pathway - AOPI Fire Training Burn Pit #1
USAEC PFAS Preliminary Assessment / Site Inspection
Fort McCoy, Wisconsin

Figure 7

Attachment 1

Sampling Location Coordinates

Sample Location Type	Sample Location ID	Latitude	Longitude
Sediment/Surface Water	FTMC-FL5-1-SE/SW	44.0437839	-90.68727866
	FTMC-FL5-2-SE/SW	44.04272023	-90.688784
	FTMC-FL5-3-SE/SW	44.04043863	-90.69046009
	FTMC-FTBP1-1-SE/SW	44.03782139	-90.69347181
Groundwater	FTMC-FTBP1-1-GW	44.03776059	-90.69203681
	FTMC-FTBP1-2-GW	44.03836522	-90.6914225
	FTMC-FL5-1-GW	44.0400851	-90.68933624
	FTMC-FL5-2-GW	44.04222982	-90.68749789
	FTMC-FL5-3-GW	44.0412755	-90.68843453
	FTMC-FTBP2-1-GW	43.9544255	-90.73842436
	FTMC-FTBP2-2-GW	43.95433603	-90.73806661
	FTMC-FTBP2-3-GW	43.95698649	-90.73886575
Soil	FTMC-FTBP1-1-SO	44.03774121	-90.68605001
	FTMC-FTBP1-2-SO	44.03770611	-90.68620129
	FTMB-FTBP3-1-SO	43.95291899	-90.73720742
	FTMB-FTBP3-3-SO	43.95292722	-90.73672945
	FTMB-FTBP3-4-SO	43.95261705	-90.73670449
	FTMB-FTBP3-2-SO	43.95261028	-90.73725588
Soil/Groundwater	FTMC-2017R-1-SO	43.95551026	-90.73491664
	FTMC-2017R-2-SO	43.95491707	-90.73534336
	FTMC-2017R-3-SO	43.95524988	-90.73517149
	FTMC-FFS2-1-SO	43.95709177	-90.73524848
	FTMC-FFS2-2-SO	43.95707935	-90.73373015
	FTMC-FFS2-3-SO	43.95713098	-90.73454883
	FTMC-DLG-1-SO	43.95491985	-90.73280793
	FTMC-DLG-2-SO	43.95473112	-90.73221497
	FTMC-DLG-3-SO	43.95484329	-90.7325169
	FTMC-1990R-1-SO	43.95445024	-90.73411182
	FTMC-1990R-2-SO	43.95406609	-90.73437138
	FTMC-1990R-3-SO	43.95427463	-90.73417974
Potable Water	SW-5020	43.95632793	-90.7351196
	6082W	43.95843886	-90.74149902
	6081W	43.95843441	-90.74083702

Notes and Acronyms:
1990R - 1990s AFFF Release
2017R - 2017 AFFF Release
DLG - Deluge System
FFS2 - Former Fire Station #2
FL5 - Former Landfill #5
FTBP - Fire Training Burn Pit
FTMC - Fort McCoy
GW - Groundwater
ID - Identification
SE - Sediment
SO - Soil
SW - Surface Water

Attachment 2

Monitoring Well Construction Details

Site No.	Well No.	Installation Date	Boring Depth (ft bgs)	Screened Interval (ft bgs)	TOC Elevation (ft NGVD)
FTMC	6082W or 6081W[1]	3/18/1976	67	NA	NA
	6082W or 6081W[1]	12/3/1987	41	37-41	NA
	SW-5020	3/20/1981	110	NA	NA

Notes and Acronyms:
[1]Available records are not clear on the name of the well. Attempts will be made in the field to distinguish the wells.

bgs - below ground surface
ft - feet
FTMC - Fort McCoy
NA - not available
NGVD - National Geodetic Vertical Datum
TOC - top of casing

Attachment 3

TGI – PFAS Potable Water Sampling Guidance

ARCADIS Design & Consultancy for natural and built assets

POLY- AND PERFLUORINATED ALKYL SUBSTANCES (PFAS) POTABLE WATER SAMPLING GUIDANCE

Rev: 0

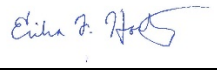
Rev Date: November 16, 2017

VERSION CONTROL

Revision No	Revision Date	Page No(s)	Description	Reviewed by
0	November 16, 2017	All	Initial Release	Erica Kalve Erika Houtz

APPROVAL SIGNATURES

Prepared by:



11/16/2017

Erika F. Houtz, PhD
Environmental Engineer and PFAS Analytical Lead

Date

Reviewed by:

11/16/2017

Erica Kalve, PG-CA
Emerging Contaminants Focus Group Leader

Date:

1 INTRODUCTION

This document describes general and/or specific procedures, methods, actions, steps, and considerations to be used and observed by Arcadis staff when performing work, tasks, or actions under the scope and relevancy of this document. This document may describe expectations, requirements, guidance, recommendations, and/or instructions pertinent to the service, work task, or activity it covers.

It is the responsibility of the Arcadis Certified Project Manager (CPM) to provide this document to the persons conducting services that fall under the scope and purpose of this procedure, instruction, and/or guidance. The Arcadis CPM will also ensure that the persons conducting the work falling under this document are appropriately trained and familiar with its content. The persons conducting the work under this document are required to meet the minimum competency requirements outlined herein, and inquire to the CPM regarding any questions, misunderstanding, or discrepancy related to the work under this document.

This document is not considered to be all inclusive nor does it apply to any and all projects. It is the CPM's responsibility to determine the proper scope and personnel required for each project. There may be project- and/or client- and/or state-specific requirements that may be more or less stringent than what is described herein. The CPM is responsible for informing Arcadis and/or Subcontractor personnel of omissions and/or deviations from this document that may be required for the project. In turn, project staff are required to inform the CPM if or when there is a deviation or omission from work performed as compared to what is described herein.

In following this document to execute the scope of work for a project, it may be necessary for staff to make professional judgment decisions to meet the project's scope of work based upon site conditions, staffing expertise, state-specific requirements, health and safety concerns, etc. Staff are required to consult with the CPM when or if a deviation or omission from this document is required that has not already been previously approved by the CPM. Upon approval by the CPM, the staff can perform the deviation or omission as confirmed by the CPM.

2 SCOPE AND APPLICATION

The purpose of this document is to provide guidance on sampling for poly-and perfluorinated alkyl substances (PFASs) from potable water supplies. This protocol was adapted from various sources including the United States (US) Department of Defense, US Army Corp of Engineers (USACE) Omaha, Transport Canada, and US Environmental Protection Agency (US EPA).

Given the extremely low detection limits associated with PFAS analysis and the many potential sources of trace levels of PFAS, field personnel are advised to err on the side of caution by strictly following these protocols to mitigate the potential for false detections of PFASs. Specific items related to field sampling for PFASs are discussed in the sections below.

3 PERSONNEL QUALIFICATIONS

3.1 Sampling Personnel

Field personnel must have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, and site-specific training, as needed. In addition, field personnel must possess the

skills and experience necessary to successfully complete the desired field work. The site Health and Safety Plan (HASP) and other documents will identify any other training requirements such as site-specific safety training or access control requirements.

3.2 Laboratories

These laboratories may be used to analyze potable water for PFASs:

- TestAmerica
- SGS
- Vista
- Eurofins

Other laboratories may be used if they are accredited for PFAS analysis.

4 EQUIPMENT LIST

The following equipment and materials must be available for sampling:

- Site plan of sampling locations, relevant work plan (or equivalent), and this guidance document;
- Appropriate health and safety equipment, as specified in the site HASP;
- Pens, pencils, and/or Sharpies® for writing;
- Clipboards, field binders, and field note pages that are not waterproof;
- Labeled sample bottles:
    - Water: High-density polyethylene (HDPE) bottles fitted with polypropylene or HDPE screw cap only;
- Ziploc® bags to hold ice and samples;
- Appropriate blanks (field reagent blanks supplied by the laboratory);
- Appropriate transport bottles (coolers) with ice and appropriate labeling, no blue ice;
- Methanol for cleaning reusable sampling equipment (if available);
- “PFAS-free” water provided by the laboratory for field blanks;
- Packing and shipping materials; and
- Chain-of-Custody (COC) Forms.

5 CAUTIONS

5.1 Food Packaging

Some food packaging may be treated with PFAS-containing chemicals to prevent permeation of oil and water in the food outside of the packaging. To avoid potential food packaging-related PFAS contact:

- Do not bring any food outside of the field vehicles on site, and eat snacks and meals off site.
- Wash hands after eating.
- Remove any field garments or outer layers prior to eating. Do not put them back on until done eating and hands are washed.

5.2 Field Gear

5.2.1 Clothing

Many types of clothing are treated with PFASs for stain and water resistance, in particular outdoor performance wear under brand names such as Gore-Tex® or eVent™. To avoid potential clothing-related PFAS contact:

- Do not wear any outdoor performance wear that is water or stain resistant, or appears to be. Err on the side of caution.
- Wear pre-laundered (multiple washings, i.e. 6+) clothing that is not stain resistant or water proof.
- Natural fabrics such as cotton are preferred. Synthetic fabrics may also be acceptable if there is no indication on the label that the fabric is water and/or stain resistant.
- Most importantly, avoid contacting your clothing with sampling equipment, bottles, and samples.

5.2.2 Personal Protective Equipment

Safety Footwear

Some safety footwear has been treated to provide a degree of waterproofing and increase durability, and may represent a source of trace PFAS. For the health and safety of field personnel, protective footwear must be worn at all times. To avoid potential PFAS contamination:

- Do not touch your safety footwear in the immediate vicinity of the sampling port (i.e., within 2 feet).
- Do not allow gloves used for sampling to come in contact with safety footwear.

Nitrile Gloves

Wear disposable nitrile gloves at all times. Don a new pair of nitrile gloves **before** the following activities at each sample location:

- Contact with sample bottles or “PFAS-free” water bottles;
- Handling of any quality assurance/quality control (QA/QC) samples including field blanks and equipment blanks.

Don a new pair of nitrile gloves **after** the following activities:

- Contacting contaminated surfaces; or
- When judged necessary by field personnel.

5.3 Personal Hygiene

Some personal care products may contain PFASs. To minimize potential for cross-contamination from personal care products:

- Shower at night.
- Do not use personal care products after showering such as lotions, makeup, and perfumes, UNLESS medically necessary.
- Use sunscreen and insect repellent ONLY if necessary for health and safety. If they are necessary, apply sunscreen and repellant prior to initiating field sampling. If sunscreen and/or repellant need to

be reapplied, ensure a safe distance away from the sampling locations and equipment (i.e., more than 30 feet away). Wash hands after application.

5.4 Visitors

If possible, visitors to the site are to remain at least 30 feet from sampling areas.

6 HEALTH AND SAFETY CONSIDERATIONS

- Field activities must be performed in accordance with the site HASP, a copy of which will be present on site during such activities.
- Use caution when removing well caps as well may be under pressure, cap can dislodge forcefully and cause injury.

7 PROCEDURE

7.1 Sample Collection

Different laboratories may supply sample collection bottles of varying sizes. The laboratory should specify the amount of sample required for the analysis given the anticipated detection levels.

7.1.1 Sample Containers

- Collect samples in HDPE bottles fitted with an unlined (no Teflon™), polypropylene or HDPE screw cap.
- Sample bottles must contain Trizma® preservative if samples are being collected from a chlorinated water source. The laboratory should specify the amount added to the sample container.
- Complete bottle labels after sample collection, once the caps have been placed back on each bottle.
- Do not use glass bottles due to potential loss of analyte through adsorption to glass.

7.1.2 Potable Water Sampling

Before Sample Collection

- Don a new set of nitrile gloves. Do not use gloved hands to subsequently handle papers, pens, clothes, etc., before collecting samples.
- Use the HDPE bottles that are supplied by the laboratory. Samples bottle caps must remain on the bottle until immediately prior to sample collection, and the bottle must be sealed immediately after sample collection. This will minimize the potential for contamination of the sample. The bottle cap must remain in the other hand of the sampler, until replaced on the bottle. Sample bottles will not be rinsed during sampling.

During Sample Collection

- Potable water outfalls and taps are likely to vary. Avoid sampling from any taps fitted with Teflon tape or other PFAS-containing materials. Stainless steel and polyvinyl chloride materials are acceptable.
- If a port or tap is not available to collect the water sample, use a stainless steel or HDPE bailer that has been pre-rinsed with methanol (if available) and PFAS-free water. A pump may be used if

needed, but new silicon and/or HDPE outflow tubing should be used for each sample and any wetted pump parts should be decontaminated with methanol (if available) and PFAS-free water.
- If sampling from a tap or port, in accordance with US EPA Method 537 sample collection procedures, begin flow from the water source and allow the system to flush for at least 3 minutes.
- Collect the sample into the HDPE bottle until the sample bottle is full (leaving slight headspace in the bottle is acceptable). Tightly screw on the polypropylene or HDPE cap. Do not filter samples.

After Sample Collection
- Place sample bottles in a sealed Ziploc® bag.
- Record the sample name and time of sampling on the sample bottle label, in the field notes, and on the COC form.
- Place samples in coolers that are durable in transportation and keep the temperature between 0 and 4ºC until transported to the laboratory. **Do not use blue ice.**
- Treat all disposable sampling materials as single use and dispose of them appropriately after sampling at each location.

7.2 Shipping

- If samples cannot be shipped the same day as collected, arrange an appropriate means of keeping the samples cool overnight and maintain the temperature between 0 and 4°C.
- Store samples in appropriate transport bottles (coolers) with ice (Ziploc® bags for use as ice containers) with appropriate labeling. **Do not use blue ice.**
- Complete the appropriate procedures for COC handling, packing, and shipping.
- Fill out and check COC forms against the labels on the sample bottles progressively after each sample is collected.
- Ship samples via FedEx using priority overnight delivery. Tracking numbers for all shipments should be provided and recorded to ensure their timely delivery.

8 DATA RECORDING AND MANAGEMENT

8.1 Field Notes

Waterproof field books must not be used for field notes. Instead, field notes should be on loose paper on Masonite, plastic, or aluminum clip boards. Other requirements for field notes include:

- Pens, pencils, and Sharpies® may be used.
- Keep field notes and writing implements away from samples and sampling materials.
- Do not write on sampling bottle labels unless the sample bottle covers are tightly closed.
- Complete sampling logs in their entirety.
- Make sure COC forms are properly completed. Verify that the analysis method requested is US EPA 537 for potable water and includes the appropriate analytes desired for analysis.

8.2 Quality Control

Refer to quality control requirements for the project to ensure that appropriate QA/QC samples are collected. When collecting QA/QC samples, the same guidelines apply as when collecting regular samples – specifically that:

- Samples should be collected in laboratory-supplied HDPE bottles;
- Bottle caps must remain in the hand of the sampler until replaced on the bottle;
- Labels must be completed after the caps have been placed back on each bottle; and
- Samples must be stored in appropriate transport bottles (coolers) with ice (Ziploc® bags for use as ice containers) with appropriate labeling. **Do not use blue ice.**

8.3 Field Duplicates

QA/QC sampling typically includes the collection of one field duplicate for every 20 samples collected or one per day, whichever is more frequent. Each duplicate sample will be collected immediately after the initial sample of which it is a duplicate into a separate laboratory-provided sample bottle. Do not indicate to the laboratory which sample the duplicate replicates (i.e. it should be given a blind reference on the COC form and given a sample name such as “duplicate”).

8.4 Field Blanks

QA/QC sampling for PFASs typically includes the submission of one laboratory supplied reagent field blank per day or per site. The PFAS-free water used for the reagent field blank sample is brought to the site in a laboratory-supplied bottle. Field staff should transfer the laboratory-supplied PFAS-free water into an empty sample bottle. This reagent field blank should be placed in the same cooler as other PFAS samples.

8.5 Laboratory Analytical QA/QC

- Internal laboratory QA/QC should consist of one laboratory blank and one laboratory control sample (or blank spike) per batch of samples, and additional QA/QCs as indicated by the laboratory QA/QC procedures. For potable water, the laboratory should follow the methodology of US EPA Method 537. Updated potable water analytical procedures may become available and may be considered at that time.
- As part of the internal QA/QC, relative percent difference (RPD) should be calculated between samples and corresponding field or laboratory duplicates. The laboratory quality assurance portion of the laboratory certificates should be reviewed to verify that all calculations/recoveries were within acceptable limits as established by the laboratory method, typically 20% RPD.
- The laboratory may require additional sample volume (and, therefore, extra sample bottles to be filled) for analysis of matrix spike (MS) and/or matrix spike duplicate (MSD) samples. Be sure to coordinate these requirements with the laboratory prior to mobilizing to the field for the sampling event.

9 REFERENCES

U.S. Army Corps of Engineers – Omaha District. 2016. Chemistry Requirements – PFAS.

U.S. Environmental Protection Agency. 2009. USEPA Method 537: Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), version 1.1, September. National Exposure Research Laboratory, Office of Research and Development.

Transport Canada. February 2016, Per-and Polyfluorinated Alkyl Substances (PFAS) Field Sampling Guidance.

Attachment 4

Site Safety and Health Plan (provided under separate cover)