AREA 3 FIELD SAMPLING PLAN

ADDENDUM TO REMEDIAL INVESTIGATION WORK PLAN FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MA

JULY 2020

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Area 3 Field Sampling Plan

Addendum to the Remedial Investigation Work Plan

for Per- and Polyfluoroalkyl Substances (PFAS)

Former Fort Devens Army Installation

Devens, Massachusetts

July 2020

CERTIFICATION:

I hereby certify that the enclosed Report, shown and marked in this submittal, is that proposed to be incorporated with Contract Number W912WJ-18-C-0011. This document was prepared in accordance with the U.S. Army Corps of Engineers (USACE) Scope of Work and is hereby submitted for Government approval.

Reviewed By:

07/30/2020

KGS Project Manager **Date**

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USACE Project Manager **Date**

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ACRONYMS AND ABBREVIATIONS

AFFF	aqueous film-forming foam
AOC	Area of Contamination
bgs	below ground surface
CSM	conceptual site model
Devens	former Fort Devens Army Installation
DOC	dissolved organic carbon
DPT	direct push technology
DQO	data quality objective
FSP	Field Sampling Plan
ft	feet/foot
FTA	fire training area
HERA	Draft Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment
IDW	investigation derived waste
KGS	KOMAN Government Solutions, LLC
LHA	lifetime health advisory
LTM	long-term monitoring
MAAF	Moore Army Airfield
MassDEP	Massachusetts Department of Environmental Protection
ng/L	nanograms per liter
PA	Preliminary Assessment
PCE	tetrachloroethene
PFAS	per-and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
RI	Remedial Investigation
SI	Site Inspection
SOP	standard operating procedure
SSL	site-specific screening level
TOC	total organic carbon
TOP	total oxidizable precursor
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
USACE	United States Army Corps of Engineers, New England District
USEPA	United States Environmental Protection Agency
WWTP	wastewater treatment plant

1.0 INTRODUCTION AND BACKGROUND

This Field Sampling Plan (FSP) for Area 3 at Former Fort Devens Army Installation (Devens) located in Devens, Massachusetts has been prepared by KOMAN Government Solutions, LLC (KGS) on behalf of the United States Army Corps of Engineers, New England District (USACE) and has been generated as an addendum to the *Draft Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS)* (KGS, 2018a). Area 3 consists of Areas of Contamination (AOC) 20, 21, 30, 31, and 50 (Figure 1). The other AOCs and areas of investigation for the Remedial Investigation (RI) will be addressed as part of Area 1 and Area 2 FSPs. Areas 1, 2, and 3 were designated for sequencing of field activities and do not represent prioritization.

A base-wide Preliminary Assessment (PA) for per- and polyfluoroalkyl substances (PFAS) was completed in 2017 (KGS, 2017) that identified several AOCs at Devens where aqueous film-forming foam (AFFF), which is a source of PFAS, was stored, used, or released. A Site Inspection (SI) (BERS-Weston, 2018) and a one-time sampling of existing long-term monitoring (LTM) wells (KGS, 2018b) concluded that PFAS are present in groundwater, surface water, sediment, and soil at several AOCs in Area 3. Therefore, the Army is conducting an RI under the Comprehensive Environmental Response, Compensation, and Liability Act to determine the nature and extent of PFAS in groundwater, soil, surface water, and sediment at AOCs 20, 21, 30, 31, and 50 at Devens to determine whether sources at Devens are impacting public water supply wells, and to evaluate whether PFAS are present in environmental media at Devens at concentrations that pose an unacceptable risk to human health or the environment.

2.0 OBJECTIVES

The purpose of this FSP is to provide the sampling design and rationale associated with each AOC for Area 3 and is intended to be used in conjunction with the RI Work Plan (KGS, 2018a) and the project Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) [Appendix A of the RI Work Plan (KGS, 2018a)]. This FSP has been developed to support the study goals, questions and decision statements summarized in Worksheet #11 (Data Quality Objectives) of the UFP-QAPP. The PFAS UFP-QAPP worksheets referenced in this FSP are provided in Appendix A. A conceptual site model (CSM) for the presence of PFAS in the environment at Devens and potential exposure pathways are provided in Section 3 of the RI Work Plan. AOC-specific CSM details are provided in Section 5.0 of this FSP.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The organizational structure for the PFAS RI at Devens is provided in combined Worksheet #3 and #5 (Project Organization and UFP-QAPP Distribution) of the UFP-QAPP. Personnel qualifications for key project personnel are summarized on combined Worksheet #4, #7, and #8 (Personnel Qualifications). Communication pathways are provided in Worksheet #6 (Communication Pathways).

4.0 GENERAL REMEDIAL INVESTIGATION APPROACH

This section provides a general overview of the RI approach at Area 3. A discussion of the CSM and data quality objectives (DQO) for PFAS at each AOC as well as figures and tables that provide the sampling plan for each AOC, are provided in Section 5.0 of this FSP. Requirements for collection of field quality control samples are discussed in Section 6.0. A listing of field standard operating procedures (SOP) applicable to the Area 3 investigation is provided in Section 7.0. Sample packaging and shipping requirements are summarized in Section 8.0. Management of

investigation-derived waste (IDW) is summarized in Section 9.0 and processes for field assessment and corrective actions are presented in Section 10.0.

Field work in RI Area 3 will be conducted using an approach that will allow for timely collection, receipt, and review of data that will be incorporated into the CSM for each AOC and that will help guide additional field activities, if needed. The investigation program is intended to be dynamic such that the proposed activities will be completed, and the results provided and discussed with the U.S. Environmental Protection Agency (USEPA) and Massachusetts Department of Environmental Protection (MassDEP) to expedite selection and implementation of additional activities needed to achieve the study goals and DQOs specified in UFP-QAPP Worksheet #11 (Data Quality Objectives) at Area 3 (Appendix A). A scoping meeting was conducted on October 11, 2018 to discuss sampling locations with the stakeholders for Area 3.

4.1 Evaluation of Previous PFAS Results

The PFAS groundwater and soil data obtained during the SI (BERS-Weston, 2018) and a one-time sampling of existing LTM wells (KGS, 2018b), were used to develop the sampling plan for Area 3. Environmental media sampled for PFAS analysis within Area 3 during the SI and LTM sampling events consisted of groundwater samples that were collected from either existing monitoring wells or temporary well points installed at the water table and removed after sampling. Soil samples were collected from potential source areas associated with AOCs 20, 21, 30, 31, and 50. Two surface water and sediment samples were collected in Area 3. These samples were collected from a drainage swale located near AOC 50.

Historic PFAS groundwater results at Area 3 AOCs are compared to the USEPA Lifetime Health Advisory (LHA) of 70 nanograms per liter (ng/L) for perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) individually or combined.

4.2 Groundwater Investigation

Groundwater monitoring wells from previous investigations are present at AOCs 20, 21, and 50. Whenever possible, existing monitoring wells will be utilized to provide data regarding the extent of PFAS in groundwater. The existing groundwater monitoring well network will be augmented with groundwater vertical profile sampling ("profiling") involving direct push technology (DPT) and/or possibly sonic drilling technology, both of which are proven to provide representative groundwater samples that will support the objectives of this RI, as outlined in Section 2.0 of the RI Workplan (KGS, 2018a). The groundwater vertical profiling will be conducted in conjunction with sampling of existing monitoring wells to delineate PFAS groundwater contamination vertically and laterally in the aquifer.

During the RI, piezometers will be installed at the water table and will be used to provide depth to water measurements to calculate local groundwater flow direction in portions of Area 3 that have little to no existing groundwater monitoring well coverage. As discussed in Section 4.6 of this Area 3 FSP, new monitoring wells will be installed within Area 3 to supplement the existing monitoring well network to provide for chemical and hydraulic monitoring of the aquifer across areas of PFAS contamination that are delineated during the RI at Area 3.

A detailed discussion of groundwater sampling activities planned within Area 3 is provided in Section 5.0 of this FSP.

4.3 Soil Investigation

Surface and subsurface soil samples will be collected for PFAS analysis from the unsaturated zone to identify and/or confirm the location of potential PFAS source areas that have been tentatively identified at AOCs 20, 21, 30, 31, and 50. The additional soil data collected during this RI will be reviewed to confirm the presence of soil contamination at potential Area 3 source areas. A detailed discussion of soil sampling activities planned in Area 3 is provided in Section 5.0 of this FSP.

4.4 Surface Water and Sediment Investigation

A network of collocated surface water and sediment samples has been developed for Area 3 aquatic settings. The locations and number of samples within each aquatic system were selected to determine if PFAS are present in areas most likely to be impacted by PFAS originating (either through groundwater discharge or overland flow of contaminated surface soils and/or AFFF) from the Area 3 AOCs.

If PFAS are detected in surface water and/or sediment at concentrations that represent a potential risk to human health and the environment (i.e., concentrations greater than the USEPA SSLs [USEPA, 2018] or ecological screening levels presented in the Draft Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment (HERA) Work Plan [KGS, 2018d]), then additional sampling of surface water and sediment may be conducted near areas of potential risk that were identified. A detailed discussion of surface water and sediment samples to be collected within Area 3, as well as at background pond and river locations is provided in Section 5.0.

4.5 Initial Data Review

The results from groundwater vertical profiling, soil sampling, sampling of existing monitoring wells, and surface water and sediment sampling at Area 3 will be evaluated in coordination with USEPA and MassDEP to determine if the vertical and lateral extent of PFAS in environmental media have been adequately delineated. If significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps. If additional potential point sources or secondary sources, such as sewer lines and storm water drainage systems are identified through review of the results, then additional groundwater vertical profiling and/or soil sampling will be completed to further delineate the nature and extent of PFAS related to these potential sources.

4.6 Monitoring Well Installation

The Army plans to install overburden monitoring wells in Area 3 following a review of the PFAS data obtained from new piezometers, groundwater vertical profiling, soil sampling, and existing monitoring wells, which will aid in determining the location and screen settings of the permanent monitoring wells. Potential well locations are identified on figures; however, final locations will be determined based on profiling data review and discussion with the regulatory agencies. The PFAS groundwater monitoring network will be designed to monitor PFAS concentrations within and bounding potential plumes identified through the groundwater vertical profiling and existing monitoring well sampling effort associated with this RI. The wells will be installed through drive and wash drilling.

During advancement of borings for permanent monitoring well installations, continuous soil cores from the water table to the bottom of the boring will be logged for field lithologic classification at select locations and select soil samples will be collected from the saturated zone. This

logging/sampling will provide for further evaluation of hydrogeology and PFAS fate and transport. In addition to field descriptions of soil characteristics, a select subset of soil samples will be collected for grain size, total organic carbon (TOC), and total oxidizable precursor (TOP) assay analysis. These borings and well installations will be advanced using DPT, sonic, and/or drive and wash with split spoons drilling technology. These technologies provide for continuous soil logging and sampling, as needed during borehole advancement. A detailed discussion of soil samples to be collected during monitoring well installation is provided in Section 5.0 of this FSP.

4.7 Baseline Sampling of New Monitoring Wells

After new monitoring wells are installed, developed and surveyed, a synoptic water level measurement event will be conducted to evaluate groundwater flow in the vicinity of each Area 3 AOC. The synoptic water level event will involve measurements at a combination of new and existing monitoring wells. The specific wells for the synoptic water level event will be identified in consultation with the MassDevelopment, MassDEP, and EPA, after the locations and screen settings of the new monitoring wells and piezometers, if present, are determined. In addition, one round of groundwater samples will be collected from the new monitoring wells and analyzed for PFAS. A subset of samples from select wells will also be sampled for dissolved organic carbon (DOC) and TOP assay analysis to assess the potential for total PFAS mass in each sample to biotransform into fully fluorinated PFAS compounds including PFOS and PFOA. These data will be used to assess the potential for continuing sources.

4.8 Sampling of Water Supply Wells

Sampling of public or private water supply wells may be completed in support of the RI, if during completion of the above RI activities, potential migration pathway to public or private water supply wells located beyond Devens is suspected.

5.0 FIELD ACTIVITIES BY AREAS OF CONCERN

5.1 AOC 20/21

5.1.1 Introduction/ Conceptual Site Model Discussion

The Devens Wastewater Treatment Plant (WWTP) is situated in the former North Post area southwest of the Nashua River and former Moore Army Airfield (MAAF) (Figures 1 and 2). Municipal and industrial wastewater undergoes pretreatment in the WWTP before it is pumped to three Imhoff tanks, a dosing tank, and then applied to rapid infiltration beds (AOC 20). There is no evidence that storm drains at the former MAAF were connected to the sanitary sewer system based on information reviewed on the subject (ADL, 1994; KGS, 2018a). Based on 2018 billing records provided by MassDevelopment, the Devens WWTP influent is comprised of the following categories:

- 26.03% from the towns of Ayer and Shirley (unknown origins),
- 25.48% from the prison facility at Devens (MCI Shirley),
- 18.74% from Industrial,
- 14.30% from Institutional,
- 11.37% from Commercial,
- 2.58% from Residential,
- 0.81% from Military,
- 0.27% from Municipal,

- 0.21% from Small Business,
- 0.17% from Non-Profit
- 0.04% from National Guard.

A detailed discussion of site history and operations for the Devens WWTP is provided in the RI Work Plan (KGS, 2018a). In general, treated water is returned to the glacial overburden aquifer through discharge to the plant infiltration beds, which are used on a rotational basis. Plant operations and maintenance did not consider PFAS in the past, therefore treatment plant effluent discharged to the infiltration beds may have contained dissolved phase PFAS (either as a steady state or in intermittent periods), which then migrated down through the vadose zone and entered the groundwater beneath the infiltration beds. Infiltration rates at the WWTP beds are reportedly 25-28 meters/year (ANL, 1992). Infiltrated water likely creates a hydraulic mound, resulting in localized radial groundwater flow beneath the infiltration beds. However, infiltrated water ultimately migrates in the direction of regional groundwater flow, which is to the east/northeast, toward the Nashua River.

Sludge from the Imhoff tanks is drained to four uncovered drying beds (AOC 21) two to three times annually (KGS, 2018a). These drying beds were equipped with clay pipe underdrains that collected supernatant, which prior to 1982 was discharged to the east bank of the Nashua River. After 1985, supernatant was collected and pumped back to an infiltration basin (KGS, 2018a). However, the clay pipe underdrains have reportedly collapsed over the years and supernatant from the sludge drying beds currently infiltrates into the permeable subsurface beneath AOC 21 (KGS, 2018a), migrates downward through the vadose zone and enters the overburden aquifer to migrate to the east, toward the Nashua River.

No specific information related to the disposal of AFFF or cleaning of firefighting equipment to the sanitary sewer system was identified during the PA (KGS, 2017) and storm water sewers at the former MAAF are not connected to the sanitary sewer system (ADL, 1994). However, the Devens WWTP was identified as a potential source of Army PFAS due to the potential for past disposal of AFFF compounds via the municipal sewer system and the WWTP was not designed or operated to remove PFAS (KGS, 2017). Therefore, AOCs 20 and 21 were included in the SI (BERS-Weston, 2018).

5.1.2 Previous PFAS Sampling

Three soil samples collected from 0-5 feet (ft) below ground surface (bgs), six groundwater samples collected at the water table, and WWTP influent and effluent samples were collected for PFAS analysis during the SI (BERS-Weston, 2018). Groundwater samples were collected from the water table from three existing monitoring wells and from three temporary well points that were located downgradient and to the east of AOCs 20 and 21, between the WWTP infiltration beds and the Nashua River (Figure 2). The sum of PFAS in groundwater exceeded the USEPA LHA of 70 ng/L at all six locations. Influent and effluent water samples from the WWTP did not exceed the LHA.

No surface water or sediment samples were collected from surface water body features near AOCs 20 and 21 during the SI.

5.1.3 Remedial Investigation Approach/Sampling Plan

The remedial investigation for PFAS at AOCs 20 and 21 entails sampling existing monitoring wells located downgradient, upgradient and cross gradient to the Devens WWTP infiltration beds

and sludge drying bed to delineate the extent of PFAS in groundwater. The existing monitoring well network will be augmented with groundwater vertical profile borings that will be advanced to better define the vertical and lateral extent of PFAS in groundwater at these AOCs. Soil borings will also be advanced to collect soil samples throughout the vadose zone (including within 2 ft of the water table) to determine if PFAS are present in vadose zone soils at concentrations that represent a risk to human health and the environment or a significant source for groundwater contamination. Piezometers will be installed and used in conjunction with the existing monitoring well network to verify groundwater flow directions. Surface water and sediment samples will be collected from the Nashua River and nearby wetland water bodies. Additional samples will be collected from the Devens WWTP influent/effluent and analyzed for TOP assay. Details on the sampling plan for AOCs 20 and 21 are provided below.

5.1.3.1 Groundwater Sample Collection

A network of existing monitoring wells, in addition to the WWTP influent/effluent, will be sampled for PFAS analysis to further define the vertical and lateral distribution of PFAS in groundwater. The locations of monitoring wells and WWTP influent/effluent to be sampled for PFAS analysis are identified on Figure 2. A listing of existing wells at AOCs 20/21 to be sampled during the RI, including well construction information, is provided in Table 1. The sampling nomenclature and analytical scope for existing monitoring wells is provided in Table 2. The influent and effluent samples will also be analyzed for TOP assay to determine whether it remains an ongoing source.

Groundwater samples will be collected from existing monitoring wells for PFAS analysis using standard operating procedures specified in Section 6.0 of this FSP and Worksheet #21 of the UFP QAPP (Appendix A). Field quality control samples, such as field duplicate and field blanks will be collected at a frequency as specified in Worksheet #20 of the UFP-QAPP (Appendix A).

5.1.3.2 Groundwater Vertical Profiling

Monitoring well data collection will be followed by groundwater vertical profiling. 13 vertical profiles, and two piezometers are planned at AOCs 20/21. The proposed locations are shown in Figure 2 and the rationale for each groundwater vertical profile boring is provided in Table 3.

Groundwater vertical profile samples will be collected in 10-ft intervals from water table to refusal or the bedrock surface. The depth to water will be measured in accordance with field procedure SOP-F002 (Worksheet # 21 of the UFP-QAPP, Appendix A) at nearby monitoring wells and depth to bedrock will be estimated based on the results of previous investigations at Devens. If refusal is encountered significantly shallower than the anticipated depth to bedrock, one 10-ft step out boring will be advanced. The sampling nomenclature, anticipated depths, and analytical scope for each groundwater vertical profile are summarized in Table 4.

Groundwater samples will be collected during advancement of the vertical profiling borings using field procedure SOP-F014 (Direct Push Technology) and SOP-F003 (Groundwater Sampling) and SOP-F009 (PFAS Sampling) as listed in Section 6.0 of this FSP and Worksheet #21 of the UFP QAPP. Field quality control samples, such as field duplicate and field blanks will be collected at a frequency as specified in Worksheet #20 of the UFP-QAPP (Appendix A).

5.1.3.3 Soil Sample Collection

11 soil borings will be advanced at AOCs 20/21 (Figure 2). Three soil borings will be advanced in the sludge drying beds (AOC 21) and eight soil borings will be advanced within the sand

infiltration beds (AOC 20). Soil borings will be advanced to characterize the vertical and lateral extent of PFAS contamination in unsaturated soil within the footprint of each AOC (Figure 2).

Vadose zone soil samples will be collected from the following depth intervals and submitted for PFAS analysis by isotope dilution (analyte list in QAPP Worksheet #15).

- 0-0.5 ft bgs
- 0.5-3 ft bgs
- 3-7 ft bgs
- 7-15 ft bgs

Soil samples will also be collected within 2 ft of the water table at three borings within AOC 20 and one boring within AOC 21 to provide additional data for evaluating a potential leaching threat to groundwater. The WWTP sludge was uniformly applied across the relatively small footprint of AOC 21 and likely resulted in a similar loading rate of PFAS to the vadose zone at this AOC. Additionally, PFAS from WWTP effluent are expected to have been uniformly distributed across the infiltration beds over time. Therefore, collection of a soil sample within 2 ft of water table sample at one location at AOC 21 and three locations at AOC 20 will provide PFAS data that is representative of conditions near the water table at each AOC.

If the water table is encountered at a depth less than 17 ft bgs in any of the soil borings, then the final soil sampling interval at the boring will be shortened by the appropriate amount to collect a separate 2-ft sample just above the water table to assess leaching threat to groundwater. The final depth of a soil sampling intervals will end at the water table at borings where the water table is less than 15 ft bgs. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring planned at AOCS 20/21 are provided in Table 5.

Additional soil borings may be advanced after review of the groundwater and soil data to further delineate the nature and extent of PFAS contamination in the soil. Additional soil borings may also be advanced after review of the soil data in areas of high PFAS concentrations in soil to assist in the assessment of a potential continuing source of PFAS to groundwater. The location of additional soil borings, if needed, and the target depth of sample collection will be determined after review of the soil data.

5.1.3.4 Surface Water and Sediment Sampling

Surface water and sediment samples will be collected at AOCs 20 and 21. The surface water and sediment sampling plan for all of Area 3 is provided in Section 5.3 of this document.

5.1.3.5 Monitoring Well Installation

An overburden monitoring well network for PFAS will be developed for AOCs 20 and 21. The PFAS groundwater monitoring network at AOCs 20 and 21 will entail the use of existing monitoring wells that will be augmented with installation of new monitoring wells. For planning purposes, up to four new overburden monitoring wells will be installed at AOCs 20 and 21. The rationale for installing new monitoring wells at AOCs 20 and 21 is provided in Table 6. Tentative locations for the new monitoring wells are shown on Figure 2. However, monitoring well installation will be completed following a review of the PFAS data obtained from new piezometers, groundwater vertical profiling, soil sampling, and existing monitoring wells; the final location and screen settings of the permanent monitoring wells will be reviewed with the USEPA and MassDEP and will be based on that data. The monitoring well network will be designed to

monitor PFAS contamination in groundwater at AOCs 20 and 21 as well as provide bounding locations to demonstrate the limits of PFAS contamination in groundwater.

During advancement of the monitoring well borings, soil cores will be collected from the water table to the bottom of the boring for field lithologic classification at select locations and a subset of samples collected from potential screen setting elevations at new monitoring wells placed within the plume will be collected for grain size, TOC, and total oxidizable precursor (TOP) assay analysis (Table 7). Confirmation of the depth to the top of bedrock will also be conducted, where it is an identified data gap after review of the vertical profiling data and previous bedrock elevation data from other investigations.

5.1.3.6 Baseline Sampling of New Monitoring Wells

New monitoring wells will be sampled after installation. The samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15). Samples from selected wells (approximately two to four per AOC) will be analyzed for PFAS via the TOP assay and for DOC. The new monitoring wells to be sampled along with the sampling nomenclature and analytical scope are provided in Table 8.

As discussed in Section 4.7, after new monitoring wells are installed, developed and surveyed, a synoptic water level measurement event will be conducted to evaluate groundwater flow in the vicinity of AOCs 20 and 21. The synoptic water level event will consist of measuring depth to water at a combination of new and existing monitoring wells. The specific wells for the synoptic water level event will be identified in consultation with the MassDevelopment, MassDEP, and USEPA, after the locations and screen settings of the new monitoring wells and piezometers, if present, are determined.

5.2 AOCS 30, 31, AND 50

5.2.1 Introduction/Conceptual Site Model Discussion/Previous PFS Sampling

There are several areas where AFFF may have been stored, applied, or released to the environment that have been identified at the former MAAF or where PFAS has been detected in soil, sediment, surface water and groundwater (BERS-Weston, 2018). Therefore, the RI will entail evaluating the nature and extent of PFAS in soil, groundwater, sediment, and surface water at the following areas shown on Figures 3 through 7. Figure 5 provides an overview of the entire former MAAF.

- AOC 30 – Former Drum Storage Areas
- AOC 31 – Former Fire Training Area
- AOC 50 tetrachloroethene (PCE) plume and associated source area
- Former airfield hangars (Buildings 3813 and 3818)
- Former Devens Fire Station
- Former sludge application areas
- Downgradient of areas listed above

A discussion of the history is provided in the RI Workplan (KGS, 2018a). A brief description of AFFF usage, the CSM and previous PFAS sampling results associated with the former MAAF is provided below. The remedial approach and sampling plan is provided in Section 5.2.2 of this document.

AOC 30 – Former Drum Storage Areas

The former Drum Storage Area located in the former North Post area at the former MAAF is comprised of two locations north of the main airfield runway (Figure 3). Interviews conducted with people associated with previous site activities indicated that AFFF may have potentially been stored in 55-gallon drums and used for firefighting training at AOC 31 (KGS 2017).

PFAS originating from spills or leakage from drums may have entered the vadose zone soils and migrated to groundwater. Due to a lack of monitoring wells at this AOC, groundwater direction has not been measured, but based on a review of site topography and proximity to the Nashua River, is assumed to the north/northwest, toward the Nashua River.

Six groundwater samples were collected from the water table at temporary points advanced at AOC 30 during the SI (BERS-Weston, 2018). The sum of PFOS and PFOA exceeded the USEPA LHA at five of the six locations (Figure 3). Soil samples were collected from 0-5 ft bgs at each of the temporary points advanced during the SI (Figure 3). No surface water or sediment samples were collected from the Nashua River during the SI.

AOC 31 – Fire Training Area

AFFF was historically used during firefighting training exercises conducted between 1975 and 1986 within a bermed area at the end of an abandoned runway (KGS, 2018a). The fire training area (FTA) consists of a 50 x 50-ft asphalt covered concrete pad that is approximately 8-inches thick. The pad is surrounded by a 12-inch high by 24-inch wide earthen containment berm (Figure 4).

AFFF that was released to the ground during fire training exercises may have migrated through the vadose zone to groundwater. Due to the lack of monitoring wells at this AOC, groundwater direction at AOC 31 has not been measured, but based on a review of the site topography and proximity to the Nashua River, is assumed to be to the west/southwest, toward the Nashua River.

Groundwater samples were collected during the SI and during LTM sampling (KGS, 2018b) at one temporary well point installed within the FTA, at five locations potentially downgradient of the FTA, and at four monitoring wells (associated with the AOC 50 LTM program) crossgradient and potentially downgradient of the FTA (Figure 4). The sum of PFOS and PFOA exceeded the LHA at nine locations with a maximum sum of PFOS and PFOA reported within the footprint of the former FTA. Soil samples were collected from 0-5 ft bgs at five locations within the former FTA. No surface water or sediment samples were collected from the Nashua River during the SI.

AOC 50 PCE Plume Area, Former MAAF, Former Devens Fire Station and Hanger Buildings

In addition to AOCs 30 and 31, other areas within the former MAAF were identified during the PA (KGS, 2017) that may have had storage, use, or releases of AFFF. These other areas at the former MAAF include the former Devens Fire Station, Hangar Buildings 3818 and 3813, and historic airfield operations as described below. Also, sludge from the Devens WWTP was applied to portions of the former MAAF (Figure 5).

- Although there were no documented airplane crashes (or associated responses with AFFF) on the main runway, it is noted that the main airfield runway may have been foamed during firefighting and crash training exercises (KGS, 2018a).

- There is no documentation of AFFF being used in the fire suppression systems at the former hangar buildings (Buildings 3813 and 3818). However, AFFF may have been stored in the former hangar area during the operational period of the airfield (KGS, 2018a).
- AFFF concentrate was also reportedly stored in 5-gallon pails and within firefighting equipment stored at the former MAAF Fire Station.
- Dried sludge from the Devens WWTP (AOC 21) was periodically spread on the ground surface at AOC 50. The area of historic sludge disposal to the ground surface at former MAAF was reportedly along the southwestern side of the main runway and in a triangular area of grass located in the center of the airfield.
- While there was no documented usage or storage of AFFF at the AOC 50 PCE plume source area identified during the PA (KGS, 2017) or SI (BERS-Weston, 2018), a one-time sampling of select existing monitoring wells for PFAS was conducted (KGS, 2018b).

Groundwater flow direction under the former MAAF is generally toward the Nashua River, which is the main surface water body that occupies the topographic low in the region (i.e., Nashua River drainage basin). In the vicinity of the AOC 50 PCE plume and the former hangar buildings, groundwater flow has been routinely measured to be to the southwest between State Route 2A and the Nashua River (ARCADIS, 2004 and KGS, 2018c) (Figure 5). Groundwater flow direction has not been measured in the other areas of the former MAAF due to a lack of monitoring wells in those areas. However, based on a review of site topography and proximity to the Nashua River, groundwater flow in the southeastern portion of the former MAAF is assumed to be to the southwest while groundwater flow direction to the west of AOC 50 plume and former hangar buildings is assumed to be to the west/northwest toward the Nashua River.

Groundwater and soil samples were collected near the former hangers, former Fort Devens Fire Station, as well as locations around the flight line during the SI (BERS-Weston, 2018) and the one-time sampling of existing LTM wells (KGS, 2018b) located in the same areas and near AOC 31. Of the 28 locations sampled for groundwater, 16 locations had a sum of PFOS and PFOA that exceeded that USEPA LHA. A maximum sum of PFOS and PFOA was detected in groundwater near the former airfield hanger Building 3818 (Figure 7). Soil samples were collected from 0-5 ft bgs at seventeen locations, including five of the flight line storm water outfalls. Collocated surface water and sediment samples were collected from two locations at an unnamed stream that drains the wetland located to the west of the former MAAF (Figure 4).

5.2.2 Remedial Investigation Approach/Sampling Plan

Due to the close proximity of potential sources of AFFF it is likely that PFAS groundwater contamination from one or more of these potential source areas resulted in a single, commingled area of PFAS groundwater contamination. Therefore, the remedial investigation approach at the former MAAF is to define the extent of PFAS contaminated groundwater around the edge of the airfield with some groundwater and soil sampling to be completed near the potential source areas to confirm the presence of potential sources within the former MAAF. Surface water and sediment sampling will also be completed to assess if PFAS are present in the wetland located to the west of the former MAAF and along the Nashua River that is adjacent to the former MAAF. A PFAS groundwater monitoring network will be developed based on the results of the RI sampling. Details on the sampling plan for AOCs 30, 31, and 50 at the former MAAF are provided below.

5.2.2.1 Groundwater Sample Collection

A network of monitoring wells has been selected within the AOC 50 PCE plume and associated source area for sampling for PFAS. The locations of monitoring wells to be sampled at AOC 50 are shown on Figures 4 through 7. A listing of monitoring wells to be sampled at AOC 50 along with the sampling nomenclature and analytical scope are summarized in Table 2 and well construction information is provided in Table 9.

Groundwater samples will be collected from existing monitoring wells for PFAS analysis using standard operating procedures specified in Section 6.0 of this FSP and Worksheet #21 of the UFP QAPP. Field quality control samples, such as field duplicate and field blanks will be collected at a frequency as specified in Worksheet #20 of the UFP-QAPP (Appendix A). Groundwater samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15). The sampling nomenclature and analytical scope for existing monitoring wells is provided in Table 2.

5.2.2.2 Groundwater Vertical Profiling

Monitoring well data collection will be augmented by groundwater vertical profiling at new locations. Fifty-one groundwater vertical profiles are planned for the former MAAF. The locations of the groundwater vertical profiles are shown on Figures 3 through 7. Due to the close proximity (i.e., former hangar and fire department buildings) and/or overlapping nature of potential source areas (i.e., sludge disposal over portions of the airfield) at the former MAAF it is likely that a single commingled area of PFAS groundwater contamination is present beneath the former MAAF. Therefore, locations of groundwater vertical profile borings were selected to primarily provide data on the vertical and lateral extent of PFAS in groundwater along and downgradient of the edge of the former MAAF. Locations were also selected to provide PFAS data in groundwater at and downgradient of one or more potential source areas identified within the former MAAF in an effort to determine if these areas are potential sources of PFAS groundwater contamination observed at the former MAAF.

Figures 3 through 7 show proposed vertical profile locations at the former MAAF. The rationale for each groundwater vertical profile boring is provided in Table 3. A generalized rational for boring placement is provided below.

- Eight vertical profiles are planned in the vicinity of AOC 30 (Figure 3). The locations of these groundwater vertical profile borings at AOC 30 were selected to provide PFAS data in groundwater within, downgradient and cross gradient of the former drum storage areas. Groundwater samples will be collected in 10-ft intervals from the water table to bedrock.
- Eleven vertical profiles are planned near AOC 31 (Figures 4 and 5). One profile will be advanced within the FTA, three profiles will be advanced along a transect that is generally perpendicular to groundwater flow downgradient of the FTA at the edge of the airfield and one will be advanced on the west side of the Nashua River to determine if PFAS are present in groundwater on the west side of the river. One location will be to the southwest of vertical profile G6M-19-02. Three groundwater vertical profiles will also be advanced east of the Nashua River in the flood plain[1]. One location will be located southwest of the FTA

[1] Due to steep topography and presence of sensitive wetland habitats, access to the floodplain area between airfield and the Nashua River with a drill rig may be difficult. An attempt to conduct the drilling with the rig will occur. If access is limited, the three groundwater vertical profile borings located on the eastern side the Nashua River in the flood plain will then be advanced using hand-held tooling, such as an air-percussion hammer drill or similar. Vertical

in the vicinity of XSA-00-88X and one location will be south of the FTA in the vicinity of XSA-00-90X. Groundwater vertical profiling will be completed in 10-ft intervals from the water table to refusal.

- Two vertical profiles are planned east of AOC 31 and west of the AOC 50 PCE plume (G6M-18-01 and -02) (Figures 4 and 5). These two profiles were conducted as part of the AOC 50 LTM program in October 2018 and samples were split for PFAS analysis. Groundwater vertical profiling at these two locations were completed in 10-ft intervals from the water table to bedrock.
- Thirty groundwater vertical profile borings are planned for other areas of the former MAAF (Figures 5 through 7).
  - Four groundwater vertical profiles (50VP-19-01 through -03 and 50VP-19-14) will be advanced to the north of the AOC 50 PCE plume source area to determine the vertical extent of PFAS in groundwater north of the PCE plume source area. One location (50VP-19-14) will be located east of the former PCE drum storage area, southeast of vertical profile location 50VP-19-03. Samples will be collected in 10-ft intervals from the water table to bedrock (Figure 6).
  - Twelve vertical profiles (50VP-19-04 through -06, and 50VP-19-17 through -24, and 50VP-19-30) will be advanced along an anticipated groundwater flow path at locations that are upgradient of, within and downgradient of the former hangar buildings and fire station. Groundwater samples will be collected in 10-ft intervals from the water table to bedrock (Figure 7). Several locations will also have co-located piezometers to refine groundwater flow directions. Refer to Figure 7 and Table 3.
  - Three vertical profiles will be advanced in the downgradient area of AOC 50 (50VP-19-07, -08, -15). Vertical profile 50VP-19-07 will be advanced to refusal. Vertical profile 50VP-19-08 is located near an existing monitoring well with a screen located at the bottom of the overburden aquifer. Therefore, vertical profiling at 50VP-19-08 will be in 10-ft intervals from the water table to the top of existing monitoring well screens (Figure 4). An additional vertical profile (50VP-19-15) will be co-located near 50VP-19-08 and will begin collecting groundwater samples from 90 ft bgs to refusal.
  - Nine vertical profiles (50VP-19-09 through -12, 50VP-19-16, and 50VP-19-26 through -29) are planned for the southeastern portion of the former MAAF. One of the locations is within the former sludge application area (50VP-19-10) and three are located along the eastern perimeter of the former MAAF and are expected to serve as potential bounding locations for PFAS groundwater contamination at the former MAAF (Figure 5). One location (50VP-19-16) will be located downgradient to the southwest of SI sample location AOC50-17-08. One location (50VP-19-26)

profiling of groundwater to bedrock will not likely be achieved using hand-held drilling technology, however it is anticipated that this technology can achieve adequate depth to determine if PFAS are present in shallow groundwater adjacent to the Nashua River. This data, in conjunction with the groundwater vertical profiling completed on the airfield and on the west side of the river, will provide sufficient data to characterize PFAS in groundwater that is downgradient of AOC 31 in the vicinity of the Nashua River. The rods will be left in place at the maximum depth achieved for use as a groundwater monitoring point in the future if needed.

will be located in the vicinity of SI sample location AOC50-17-14 to provide vertical delineation. One location (50VP-19-27) will be associated with soil boring 50SB-19-08. One location (50VP-19-28) will be located in the vicinity of SI sample location AOC50-17-15 to provide vertical delineation. One location (50VP-19-29) will be placed halfway between G6M-01-01X and 50VP-19-16 to define the extent of PFAS south of G6M-01-01X.

- Two vertical profiles are planned for the western portion of the former MAAF (50VP-19-13 and -25), generally between AOCs 30 and 31 (Figure 5 and 7).

During groundwater vertical profiling, the depth to water will be measured in accordance with field procedure SOP-F002 (Worksheet # 21 of the UFP-QAPP, Appendix A) at nearby monitoring wells and depth to bedrock will be estimated based on the results of previous remedial investigations completed at AOC 50. If rig refusal is encountered significantly shallower than the anticipated depth to bedrock, then one 10-ft step-out will be conducted. The sampling nomenclature, anticipated depths, and analytical scope are summarized in Table 4.

Groundwater samples will be collected during advancement of the vertical profiling using field procedure SOP-F014 (Direct Push Technology) and SOP-F003 (Groundwater Sampling) and SOP-F009 (PFAS Sampling) as listed in Section 6.0 of this FSP and Worksheet #21 of the UFP QAPP. Field quality control samples, such as field duplicate and field blanks will be collected at a frequency as specified in Worksheet #20 of the UFP-QAPP (Appendix A).

A total of 28 piezometers will be installed between AOC 30, 31, and 50. At 26 of the vertical profiling locations (Table 3), piezometers will be set at the water table. A nested (shallow/deep) piezometer will be co-located with vertical profile location 31VP-19-07. The locations of the piezometers are shown on Figures 3, 4, 5 and 7 and were selected to provide depth to water measurements in areas of the former MAAF with limited coverage with existing monitoring wells (i.e., west and east of the AOC 50 PCE plume). The depth to water measurements collected at the new piezometers, along with depth to water measurements obtained at existing monitoring wells at AOC 50, will provide data to confirm groundwater flow direction beneath the areas of the former MAAF located to the west and east of the AOC 50 PCE plume. A staff gauge will be installed in the Nashua River adjacent to the piezometers at 31VP-19-07. The piezometers and staff gauge will be surveyed, and a synoptic water level survey along with select existing monitoring wells at AOC 50 will be performed. The synoptic water level survey will be used to assist in placement of monitoring wells and additional vertical profiling locations if they are needed.

5.2.2.3 Soil Sampling

Soil sampling will be conducted at locations within and near suspected AFFF discharge/storage areas at the former MAAF, including the former drum storage areas (AOC 30), former FTA (AOC 31), former Devens Fire Station/Hangar Buildings, and historic sludge disposal areas adjacent to the flight line (Figures 3 through 7). The rationale for soil borings placement at the former MAAF is included in Table 3. The sampling nomenclature, anticipated depths, and analytical scope are summarized in Table 5.

The soil sampling locations were selected in consideration of reported AFFF use and storage at the former MAAF as well as the PFAS soil and groundwater sampling results obtained during the SI (BERS-Weston, 2018). A discussion of the soil sampling approach at each area is provided below.

AOC 30 – Former Drum Storage Areas

During the SI, PFAS were reported in shallow soil (0-5 ft bgs) at AOC 30. The RI soil sampling program at AOC 30 is designed to identify/confirm the location of soil source area at AOC 30. Six soil borings will be advanced (three at each drum storage area) at locations near or upgradient of groundwater contamination reported during the SI (Figure 3). Soil samples from all six borings will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation. In addition, a sample will be collected from within 2 ft of the water table at two borings (one within each drum storage area) (30SB-19-01 and 30SB-19-04) to provide data to assess leaching potential to groundwater. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring at AOC 30 are summarized in Table 5.

AOC 31 – Former Fire Training Area

During the SI, PFAS were reported in shallow soil (0-5 ft bgs) at AOC 31. The RI soil sampling program at AOC 31 is designed to delineate the extent of PFAS contaminated soil within and immediately downgradient of the FTA. Five soil borings will be advanced within the former FTA (Figure 4). The ground surface within the former FTA is reportedly covered by asphalt and 8-inch thick concrete associated with the former runway. During a site walk conducted in October 2018, the asphalt and concrete within the FTA appears to be cracked and fragmented with small trees growing within the FTA footprint. At borings advanced within the FTA, soil sampling will begin below the concrete (31SB-19-01 through -05). Soil samples from all five borings will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation. A soil sample will also be collected within 2 ft of the water table at one of the borings (31SB-19-01) to assess leaching potential to groundwater. A concrete sample will also be collected at one of the borings to determine if PFAS from the AFFF have sorbed to the concrete.

Three soil borings will also be advanced outside the bermed area to evaluate if overspray of AFFF occurred during training exercises (31SB-19-06, -07, and -08). Soil samples for 31SB-19-06 and -07 will be collected for PFAS analysis from 0 to 1 ft bgs and 3-7 ft bgs to provide data needed to evaluate if PFAS are present in soils outside the FTA. Soil samples from 31SB-19-08 will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation, and within 2 ft of the water table to assess leaching potential to groundwater. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring at AOC 31 are summarized in Table 5.

Former Fort Devens Fire Station and Hangar Buildings

During the SI, PFAS were reported in shallow soil (0-5 ft bgs) at both the former Fort Devens Fire Station and Hangar Buildings. The RI soil sampling program at the former Devens Fire Station and Hangar Building is designed to assess if soils are present in this area at concentrations that represent a risk to human health and the environment. Eleven soil borings will be advanced in this area (50SB-19-01 through -05 and 50SB-19-13 through 18) (Figure 7). The locations were selected in consideration of groundwater results reported during the SI (BERS-Weston, 2018) and a review of historic as-builts to identify the location of potential receiving structures, such as the former dry well and oil water separator located to the north of Hangar Building 3818 and former flammable storage building and fuel oil tank located to the south of Hangar Building 3818 (USACE, 1942, 1958, and 1960).

Soil samples from all 11 borings will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation. In addition, at locations 50SB-19-01, -05, and 50SB-19-13 through -18) samples will be collected from within 2 ft of the water table to provide data to assess leaching potential to groundwater surrounding the fire station and hangar buildings. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring are summarized in Table 5.

Sludge Disposal Areas at the Former MAAF

Sludge from the Devens WWTP (AOC 20) was reportedly spread on grassed areas along the southern side of the flight line (Figure 5). Five soil borings will be advanced in the areas that formerly received sludge from the Devens WWTP (50SB-19-06 through -08, and 50SB-19-11 and -12 (Figure 5). Soil samples from all five borings will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation. In addition, a sample will be collected from within 2 ft of the water table at one boring to provide data to assess leaching potential to groundwater. Depth to groundwater beneath the former MAAF is greater than 17 ft. However, if the water table is encountered at a depth less than 17 ft bgs in any of the soil borings then the final soil sampling interval at the boring will be shortened by the appropriate amount to collect a separate sample just above the water table to assess leaching threat to groundwater. The final depth of a soil sampling intervals will end at the water table at borings where the water table is less than 15 ft bgs. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring are summarized in Table 5.

North of Route 2A

Two soil borings (50SB-19-09 and -10) will be advanced north of the fire pond, north of Route 2A. One location (50SB-19-09) will be co-located with vertical profile 50VP-19-01, and the second location (50SB-19-10) will be located west of 50VP-19-01. Soil samples from the two borings will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation. If the water table is encountered at a depth less than 17 ft bgs in any of the soil borings then the final soil sampling interval at the boring will be shortened by the appropriate amount to collect a separate sample just above the water table to assess leaching threat to groundwater. The final depth of a soil sampling intervals will end at the water table at borings where the water table is less than 15 ft bgs. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring are summarized in Table 5.

Soil borings will be advanced at the former MAAF using DPT and the samples will be analyzed for PFAS by isotopic dilution analyte list in QAPP Worksheet #15 (Appendix A). If PFAS contamination is confirmed in soils at the former MAAF source areas, additional soil sampling may be needed to determine the nature and extent of PFAS contamination in soil, to support a human health and ecological risk assessment, and to collect data for the assessment of the source as a continuing source of PFAS to groundwater. The location of additional soil borings, if needed, and the target depth of sample collection will be determined after review of the soil data.

5.2.2.4 Surface Water and Sediment Sampling

Surface water and sediment samples will be collected at the former MAAF. The surface water and sediment sampling plan for all of Area 3 is provided in Section 5.3 of this document.

5.2.2.5 Monitoring Well Installation

An overburden monitoring well network for PFAS will be developed for the former MAAF. The PFAS groundwater monitoring network at the former MAAF will entail the use of existing monitoring wells that will be augmented with installation of new monitoring wells. For planning purposes up to ten new monitoring wells will be installed at the former MAAF. The rationale for installing new monitoring wells is provided in Table 6. Tentative locations for the new monitoring wells are shown on Figures 3 through 7. Monitoring well installation will be completed following a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells and piezometers; the final location and screen settings of the permanent monitoring wells will be reviewed with the USEPA and MassDEP and will be based on that data. The monitoring well network will be designed to monitor PFAS contamination in groundwater as well as provide bounding locations to demonstrate the limits of PFAS contamination in groundwater.

During advancement of the monitoring well borings, soil cores may be collected from the water table to the bottom of the boring for field lithologic classification at select locations and a subset of samples collected from potential screen setting elevations at new monitoring wells placed within the plume will be collected for grain size, TOC, and TOP assay analysis (Table 7). Confirmation of the depth to the top of bedrock may also be conducted, where it is an identified data gap after review of the vertical profiling data and previous bedrock elevation data from AOC 50. After the new wells are installed, an Area 3 synoptic water level survey will be conducted.

5.2.2.6 Baseline Sampling of New Monitoring Wells

New monitoring wells will be sampled after installation. The samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15). Samples from selected wells (approximately two to four per AOC) will be analyzed for PFAS via the TOP assay and for DOC. The new monitoring wells to be sampled along with the sampling nomenclature and analytical scope are provided in Table 8.

As discussed in Section 4.7, after new monitoring wells are installed, developed and surveyed, a synoptic water level measurement event will be conducted to evaluate groundwater flow across the former MAAF. The synoptic water level event will consist of monitoring water levels at a combination of new and existing monitoring wells. The specific wells for the synoptic water level event will be identified after the locations and screen settings of the new monitoring wells are determined.

5.3 SURFACE WATER AND SEDIMENT SAMPLING – AREA 3

The Nashua River and associated wetland areas are the primary surface water settings within Area 3. The Nashua River and associated floodplain bisect all of Area 3 with AOCs 20 and 21 abutting the Nashua River to the west and the former MAAF abutting the Nashua River to the east. Surface water and sediment samples were collected for PFAS analysis at only two locations within Area 3 during the SI (BERS-Weston, 2018). Two locations were sampled at the outlet stream from the unnamed wetland that is adjacent to the former MAAF. PFAS were detected in surface water and sediment collected at this stream. The results are presented in Section 5.2.1 of this document. Additional surface water and sediment sampling is needed to determine if PFAS have impacted surface water bodies at Area 3, beyond the small stream that was sampled during the SI.

Surface water and shallow sediment samples, involving cores (0-6 inches), will be collected from 26 locations at Area 3 (Table 10). Locations were selected to determine if PFAS are present in surface water and sediment in surface water bodies that likely receive groundwater discharge and/or sediment transport from overland flow originating from Area 3. Depositional areas along the major bends in the Nashua River adjacent to Area 3 will also be investigated. The surface water/sediment sample locations are shown on Figures 1 through 5.

- A total of 22 collocated surface water/sediment sampling locations have been selected for the Nashua River. One location (NR-19-01) is situated upstream of any potential inputs from Area 3. Seven locations (adjacent to AOCs 20 and 21) are located on the west bank of the river channel, four locations (adjacent to the former MAAF) are located on the east bank of the river channel, and two locations are downstream of potential inputs from Devens (north of State Route 2A). Five locations are located along depositional areas along the west banks of the Nashua River. Three locations are located along depositional areas along the east banks of the Nashua River. These depositional samples are located adjacent to AOCs 20/21, 30, 31/50. Refer to Table 10 for sampling rationale and to Figures 1 through 5 for specific locations.
- Two locations have been identified on the eastern bank of the unnamed airfield wetland that is adjacent to the former MAAF.
- One location has been identified in the unnamed pond located to the north of AOC 20.
- One location has been identified in an unnamed stream to the east of AOC 20.

If a potential for human health and/or ecological risks are identified (i.e., PFAS are present at concentrations greater than USEPA SSLs [USEPA, 2018] or ecological screening values presented in the HERA Work Plan [KGS, 2018d]), additional surface water and sediment sampling may be needed to identify which area is contributing the greatest potential risk.

In addition, surface water and sediment samples will be collected from the shores of surface water bodies that are located topographically and hydrologically upgradient of known AOCs on the former Main Post and North Post in support of the RI. Refer to Table 11 for sample details and Figure 8 for locations. The land use around these upstream sampling locations is primarily residential or light industrial and they are expected to have similar physical characteristics and habitat to surface water bodies downgradient of or adjacent to the AOCs. The PFAS results from these locations will be used to evaluate if detections of PFAS in surface waters and sediment potentially impacted by known AOCs on the former Main Post are elevated compared to upstream conditions.

Surface water and sediment samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15), TOC, and grain size. The sampling nomenclature for each surface water and sediment location and the quality control samples are provided in Table 10 and Table 11. Sample collection procedures are provided in Worksheet #21. Field quality control samples will be collected at a frequency specified by Worksheet #20 of the UFP-QAPP (Appendix A).

6.0 FIELD QUALITY CONTROL SAMPLES

Collection of field quality control samples, including field duplicates, equipment blanks, field reagent blanks, matrix spikes, and matrix spike duplicates, associated with groundwater, soil, surface water, and sediment sampling efforts are required. A summary of the types and frequency

of field quality control samples to be collected is provided in Worksheet #20 (Field Quality Control Sample Summary) of the UFP-QAPP (Appendix A).

7.0 FIELD PROCEDURES

The field SOP associated with the project are listed in Worksheet #21 of the UFP-QAPP and the field equipment calibration, maintenance, testing and inspection requirements are listed in Worksheet #22 of the UFP-QAPP, which are both provided in Attachment A of the UFP-QAPP (Appendix A). The field SOPs are summarized below.

- Groundwater vertical profile borings will be conducted in accordance with the procedure specified in Worksheet #17 and #17a of the UFP-QAPP, SOP-F014 (Direct Push Technology), and the SP16 SOP.
- Soil samples will be collected in accordance with SOP-F015 (Soil Sampling – Surface and Shallow Depth) and SOP-F009 (PFAS Sampling).
- Surface water and sediment samples will be collected in accordance with SOP-F004 (Sediment-Surface Water Sampling) and SOP-F009 (PFAS Sampling).
- Groundwater samples will be collected in accordance with SOP-F003 (Groundwater Sampling) and SOP-F009 (PFAS Sampling).
- Water quality parameters: dissolved oxygen, oxidation reduction potential, specific conductance, temperature, and pH will be collected in accordance with SOP-F003 (Groundwater Sampling).
- Static depth to groundwater measurements will be measured in accordance with SOP-F002 (Evaluation of Existing Monitoring Wells and Water Level Measurements).
- New groundwater monitoring wells will be constructed and developed in accordance with SOP-F017 (Monitoring Well Construction and Development).
- Soil samples and soil cores will be described in the field in accordance with SOP-F018 (Soil Description).
- Private water supply wells will be purged and samples in accordance with SOP-F016 (Private and Water Supply Well Sampling).

8.0 SAMPLING PACKAGING AND SHIPPING REQUIREMENTS

Sample volume, containers, preservation, and holding time requirements are provided in combined Worksheet #19 and #30 (Sample Containers, Preservation and Hold Times) of the UFP-QAPP (Appendix A). Procedures for field sample handling, packing and shipment are detailed in SOP-F008 (Sample Handling), which is listed in Worksheet #21 of the UFP-QAPP (Appendix A). Sampling handling, custody and disposal requirements are provided in Worksheet #26 and 27 of the UFP-QAPP and provided in Attachment A of the UFP-QAPP (Appendix A).

9.0 INVESTIGATION-DERIVED WASTE

IDW management procedures are presented in Worksheet #17 of the UFP-QAPP and will be managed in accordance with SOP-F011 (IDW Management), which is listed in Worksheet #21 of the UFP-QAPP and provided in Attachment A of the UFP-QAPP (Appendix A).

10.0 FIELD ASSESSMENT PROCEDURES AND CORRECTIVE ACTIONS

Periodic assessments will be performed during the course of the project so that the planned project activities are implemented in accordance with the UFP-QAPP. The type, frequency, and responsible parties of planned assessment activities to be performed for the project as well as any corrective action measures, are provided in Combined Worksheet #31, 32, and 33 (Assessment and Corrective Actions) of the UFP-QAPP (Appendix A).

11.0 REFERENCES

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FIGURES

AOC 30 Extents
AOC 50 Source Extents
AOC 50 Central Figure
AOC 31 Extents
AOC 50,30, 31 Extents
AOC 20 and 21 Extents
Nashua River
Squannacook River
James Brook
Great Rd
Fitchburg Rd
Mulpus Brook
Walker Brook
Morse Brook
SHIRLEY
AYER
Willow Branch
Nonacoicus Brook
Main St
NR-19-01
N
W
E
S

Legend

- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Surface Water and Sediment Sampling Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Staff Gauge
- Stream/River
- Lake/Pond
- Swamp/Marsh
- MassDEP Zone II Wellhead Protection Area
- City/Town Boundary
- Former Fort Devens Boundary

Area 3 Figure Extents
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

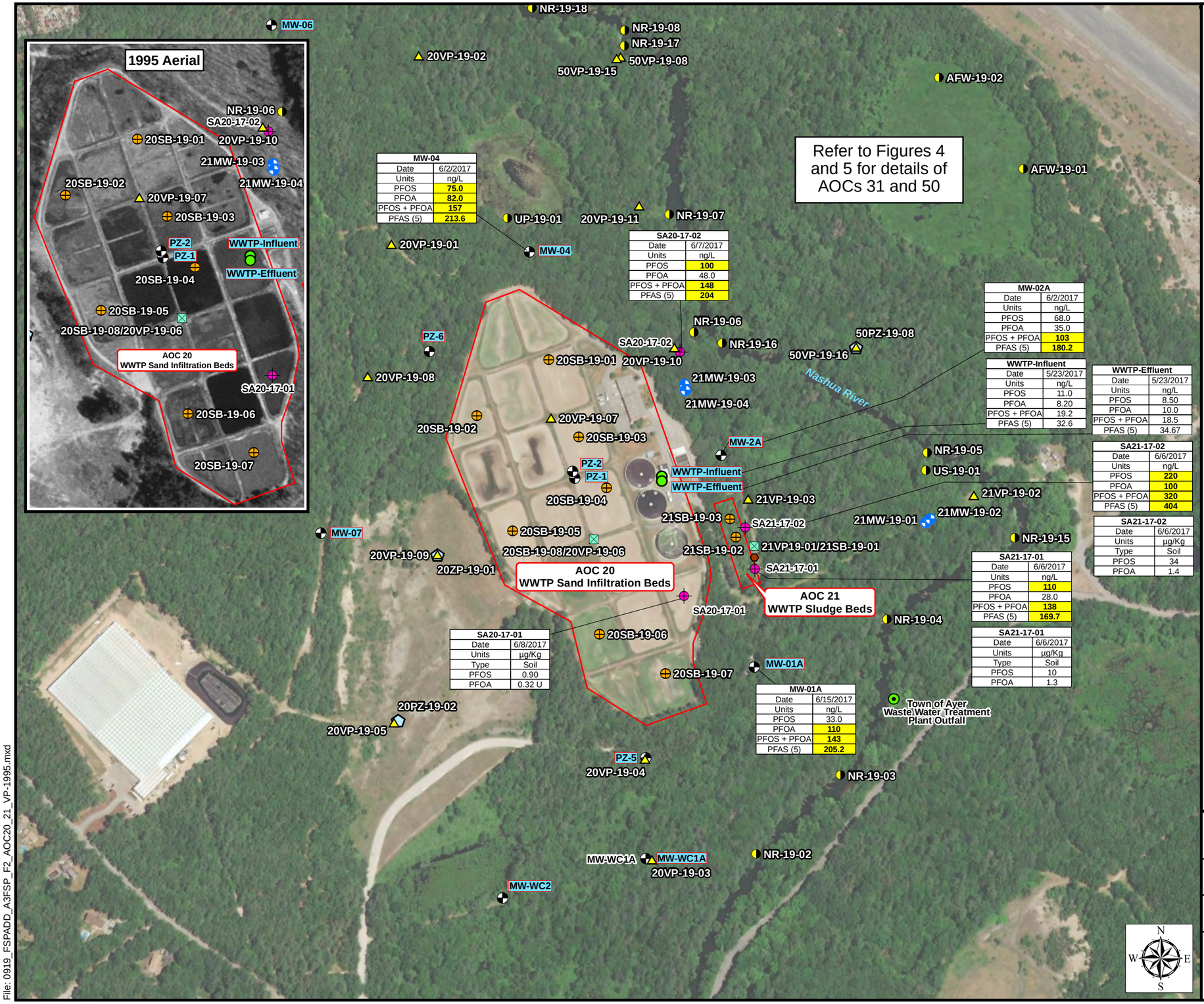
0 400 800
Feet

Date: 01/02/2020

Figure 1

File: 0919_FSPADD_A3FSP_F1_Extents_VPL.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

- MW-04 — Proposed Wells to be Sampled
- Proposed Surface Water and Sediment Sampling Location
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Temporary Well Location from SI
- Monitoring Well Location
- Sample Location
- Approximate Pre-1985 Discharge Location
- Area of Contamination

Notes:

Proposed locations shown on current and 1995 Aerial Imagery.

ng/L = nanograms per Liter
µg/Kg = micrograms per Kilogram

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

J = estimated result
U = non-detect

AOCs 20 and 21 Sampling Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

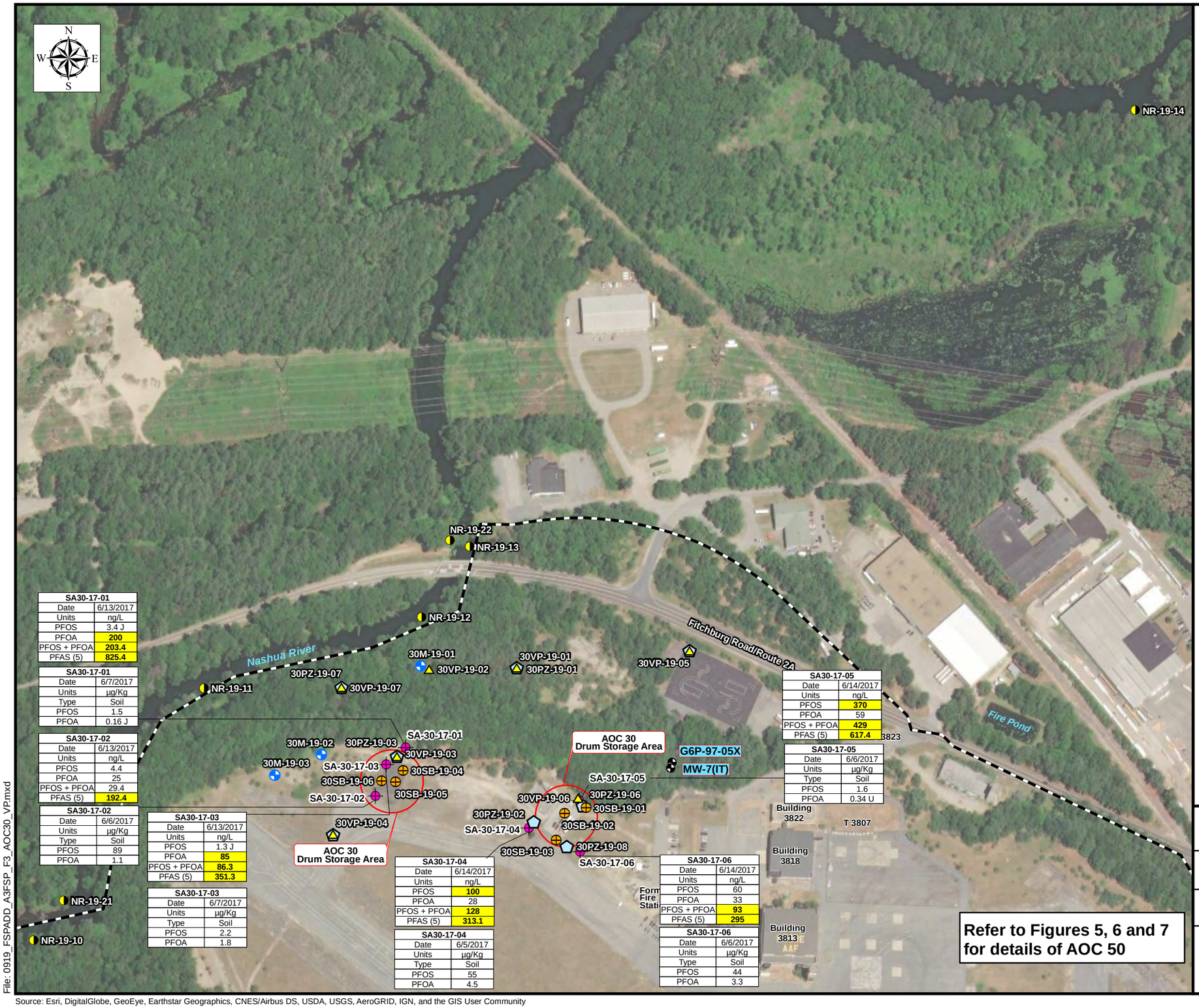
0 200 400
Feet

Date: 01/02/2020

Figure 2

File: 0919_FSPADD_A3FSP_F2_AOC20_21_VP-1995.mxd

Aerial 1995: MassGIS
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



SA30-17-01	
Date	6/13/2017
Units	ng/L
PFOS	3.4 J
PFOA	**200**
PFOS + PFOA	**203.4**
PFAS (5)	**825.4**

SA30-17-01	
Date	6/7/2017
Units	µg/Kg
Type	Soil
PFOS	1.5
PFOA	0.16 J

SA30-17-02	
Date	6/13/2017
Units	ng/L
PFOS	4.4
PFOA	25
PFOS + PFOA	29.4
PFAS (5)	**192.4**

SA30-17-02	
Date	6/6/2017
Units	µg/Kg
Type	Soil
PFOS	89
PFOA	1.1

SA30-17-03	
Date	6/13/2017
Units	ng/L
PFOS	1.3 J
PFOA	**85**
PFOS + PFOA	**86.3**
PFAS (5)	**351.3**

SA30-17-03	
Date	6/7/2017
Units	µg/Kg
Type	Soil
PFOS	2.2
PFOA	1.8

SA30-17-04	
Date	6/14/2017
Units	ng/L
PFOS	**100**
PFOA	28
PFOS + PFOA	**128**
PFAS (5)	**313.1**

SA30-17-04	
Date	6/5/2017
Units	µg/Kg
Type	Soil
PFOS	55
PFOA	4.5

SA30-17-06	
Date	6/14/2017
Units	ng/L
PFOS	60
PFOA	33
PFOS + PFOA	**93**
PFAS (5)	**295**

SA30-17-06	
Date	6/6/2017
Units	µg/Kg
Type	Soil
PFOS	44
PFOA	3.3

SA30-17-05	
Date	6/14/2017
Units	ng/L
PFOS	**370**
PFOA	59
PFOS + PFOA	**429**
PFAS (5)	**617.4**

SA30-17-05	
Date	6/6/2017
Units	µg/Kg
Type	Soil
PFOS	1.6
PFOA	0.34 U

Refer to Figures 5, 6 and 7 for details of AOC 50

Legend

- MW-7(IT)
- G6P-97-05X — Proposed Wells to be Sampled
- MonitoringPoints
- Proposed Surface Water and Sediment Sampling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Temporary Well Location from SI
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect

µg/Kg = micrograms per Kilogram
There is no established criteria for PFOS or PFOA in soil.

AOC 30 Vertical Profiling and Soil Boring Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

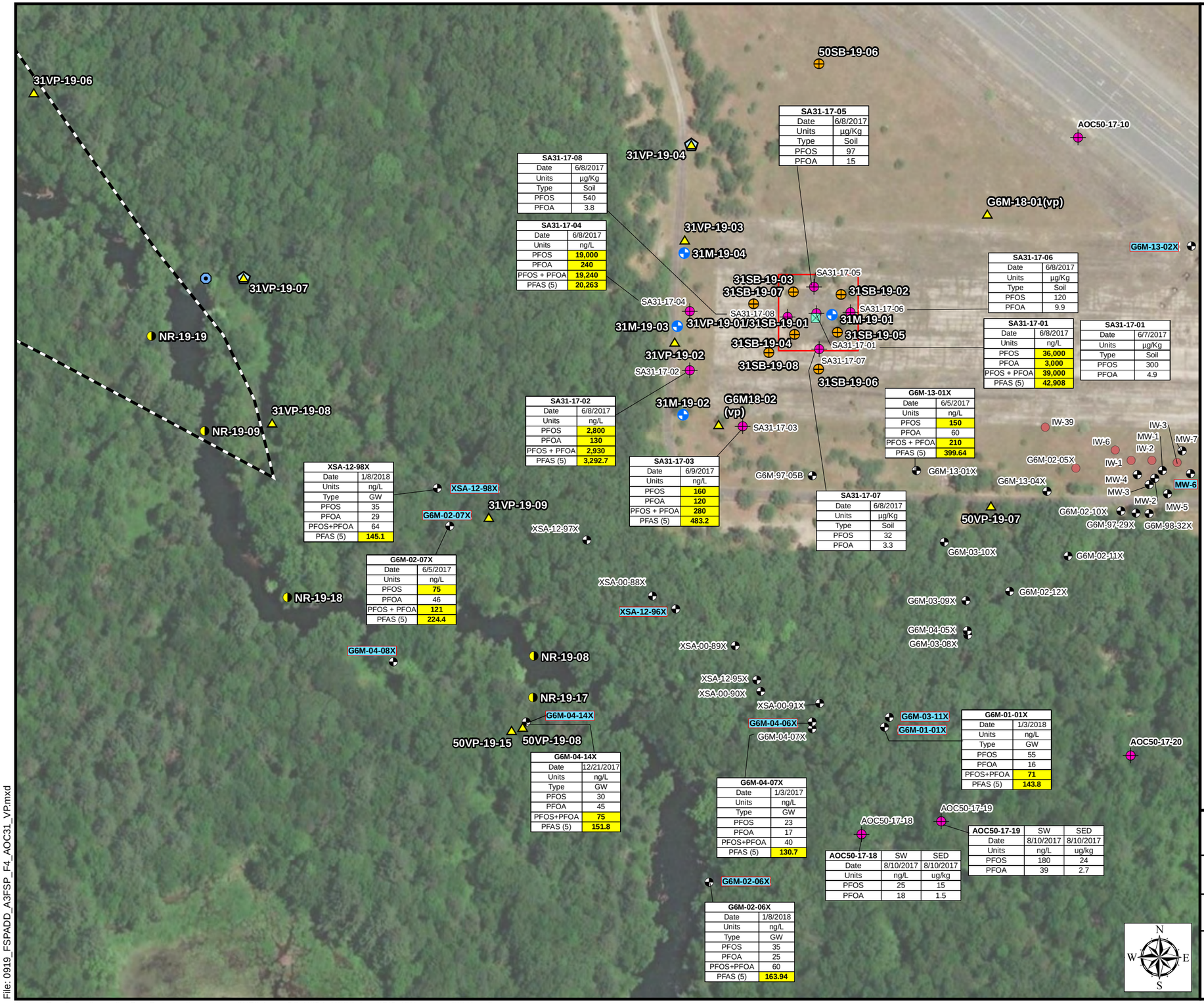
0 150 300
Feet

Date: 01/02/2020

Figure 3

File: 0919_FSPADD_A3FSP_F3_AOC30_VP.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

G6M-04-06X	Proposed Wells to be Sampled
	Proposed Surface Water and Sediment Sampling Location
	Proposed Piezometer
	Tentative Overburden Monitoring Well
	Proposed Soil Boring and Vertical Profiling Location
	Proposed Vertical Profiling Location
	Proposed Soil Boring Location
(vp)	Vertical profile to be advanced for AOC 50 LTM, splits will be collected for PFAS
	Temporary Well Location from SI
	Monitoring Well
	Injection Well
	Staff Gauge
	Area of Contamination (AOC)
	Former Fort Devens Boundary

Notes:

Piezometers at 31VP-19-07 will be nested (shallow/deep) pairs.

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect

µg/Kg = micrograms per Kilogram
There is no established criteria for PFOS or PFOA in soil.

AOC 31 and AOC 50 Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

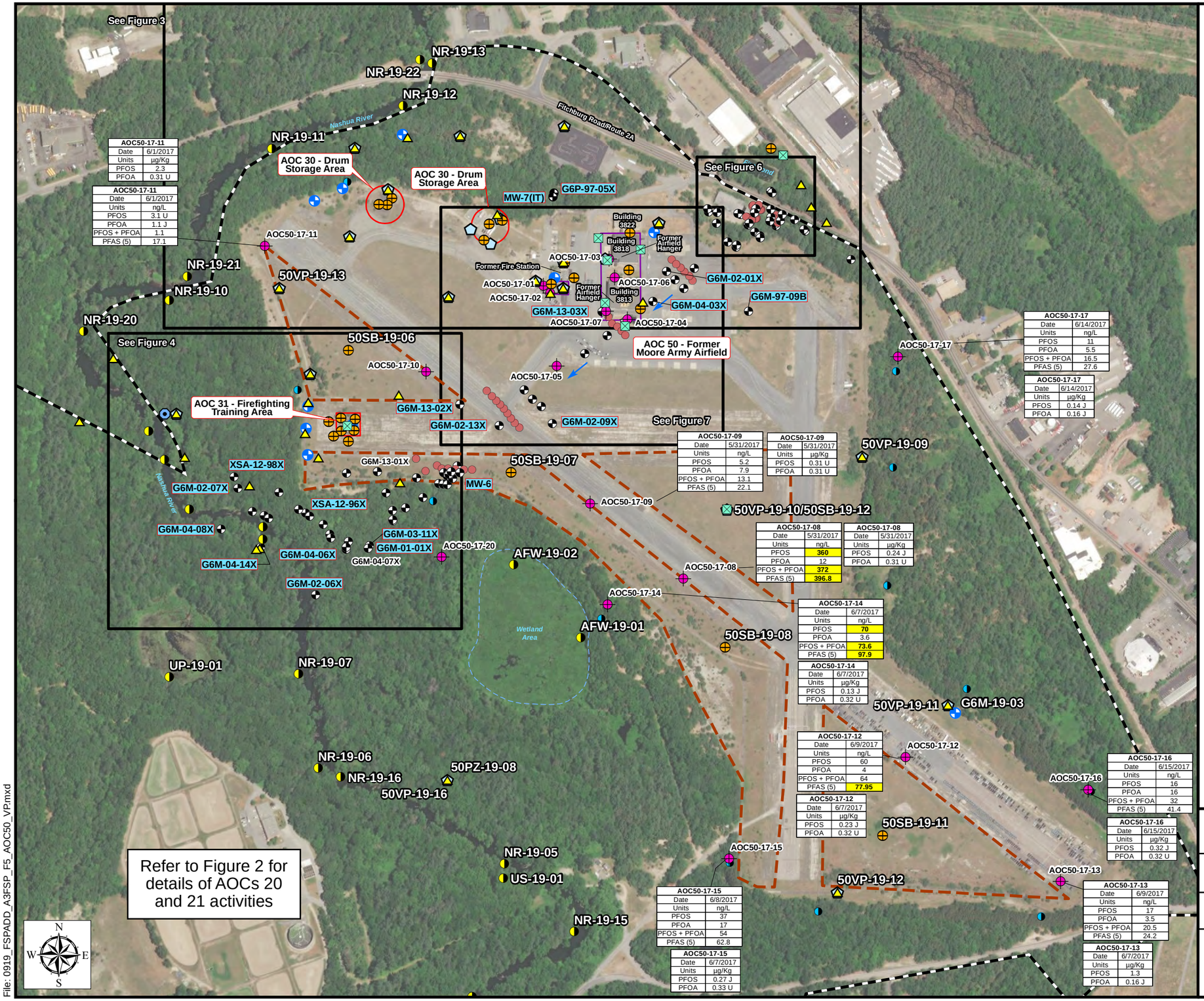
0 75 150
Feet

Date: 01/02/2020

Figure 4

File: 0919_FSPADD_A3FSP_F4_AOC31_VP.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



AOC50-17-11	
Date	6/1/2017
Units	µg/Kg
PFOS	2.3
PFOA	0.31 U

AOC50-17-11	
Date	6/1/2017
Units	ng/L
PFOS	3.1 U
PFOA	1.1 J
PFOS + PFOA	1.1
PFAS (5)	17.1

AOC50-17-17	
Date	6/14/2017
Units	ng/L
PFOS	11
PFOA	5.5
PFOS + PFOA	16.5
PFAS (5)	27.6

AOC50-17-17	
Date	6/14/2017
Units	µg/Kg
PFOS	0.14 J
PFOA	0.16 J

AOC50-17-09	
Date	5/31/2017
Units	ng/L
PFOS	5.2
PFOA	7.9
PFOS + PFOA	13.1
PFAS (5)	22.1

AOC50-17-09	
Date	5/31/2017
Units	µg/Kg
PFOS	0.31 U
PFOA	0.31 U

AOC50-17-08	
Date	5/31/2017
Units	ng/L
PFOS	**360**
PFOA	12
PFOS + PFOA	**372**
PFAS (5)	**396.8**

AOC50-17-08	
Date	5/31/2017
Units	µg/Kg
PFOS	0.24 J
PFOA	0.31 U

AOC50-17-14	
Date	6/7/2017
Units	ng/L
PFOS	**70**
PFOA	3.6
PFOS + PFOA	**73.6**
PFAS (5)	**97.9**

AOC50-17-14	
Date	6/7/2017
Units	µg/Kg
PFOS	0.13 J
PFOA	0.32 U

AOC50-17-12	
Date	6/9/2017
Units	ng/L
PFOS	60
PFOA	4
PFOS + PFOA	64
PFAS (5)	**77.95**

AOC50-17-12	
Date	6/7/2017
Units	µg/Kg
PFOS	0.23 J
PFOA	0.32 U

AOC50-17-16	
Date	6/15/2017
Units	ng/L
PFOS	16
PFOA	16
PFOS + PFOA	32
PFAS (5)	41.4

AOC50-17-16	
Date	6/15/2017
Units	µg/Kg
PFOS	0.32 J
PFOA	0.32 U

AOC50-17-15	
Date	6/8/2017
Units	ng/L
PFOS	37
PFOA	17
PFOS + PFOA	54
PFAS (5)	62.8

AOC50-17-15	
Date	6/7/2017
Units	µg/Kg
PFOS	0.27 J
PFOA	0.33 U

AOC50-17-13	
Date	6/9/2017
Units	ng/L
PFOS	17
PFOA	3.5
PFOS + PFOA	20.5
PFAS (5)	24.2

AOC50-17-13	
Date	6/7/2017
Units	µg/Kg
PFOS	1.3
PFOA	0.16 J

Legend

- G6M-04-06X — Proposed Wells to be Sampled
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Proposed Surface Water and Sediment Sampling Location
- Temporary Well Location from SI
- Monitoring Well
- Injection Well
- Runway Stormwater Drain Outlet
- Groundwater Flow Direction
- Area of Contamination (AOC)
- Site Inspection Study Area Boundary
- Approximate Areas of Sludge Disposal
- Former Fort Devens Boundary

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

µg/Kg = micrograms per Kilogram
ng/L = nanograms per liter
J = estimated result
U = non-detect

There is no established criteria for PFOS or PFOA in Soil.

AOCs 50, 30 and 31 Sampling Location Overview
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

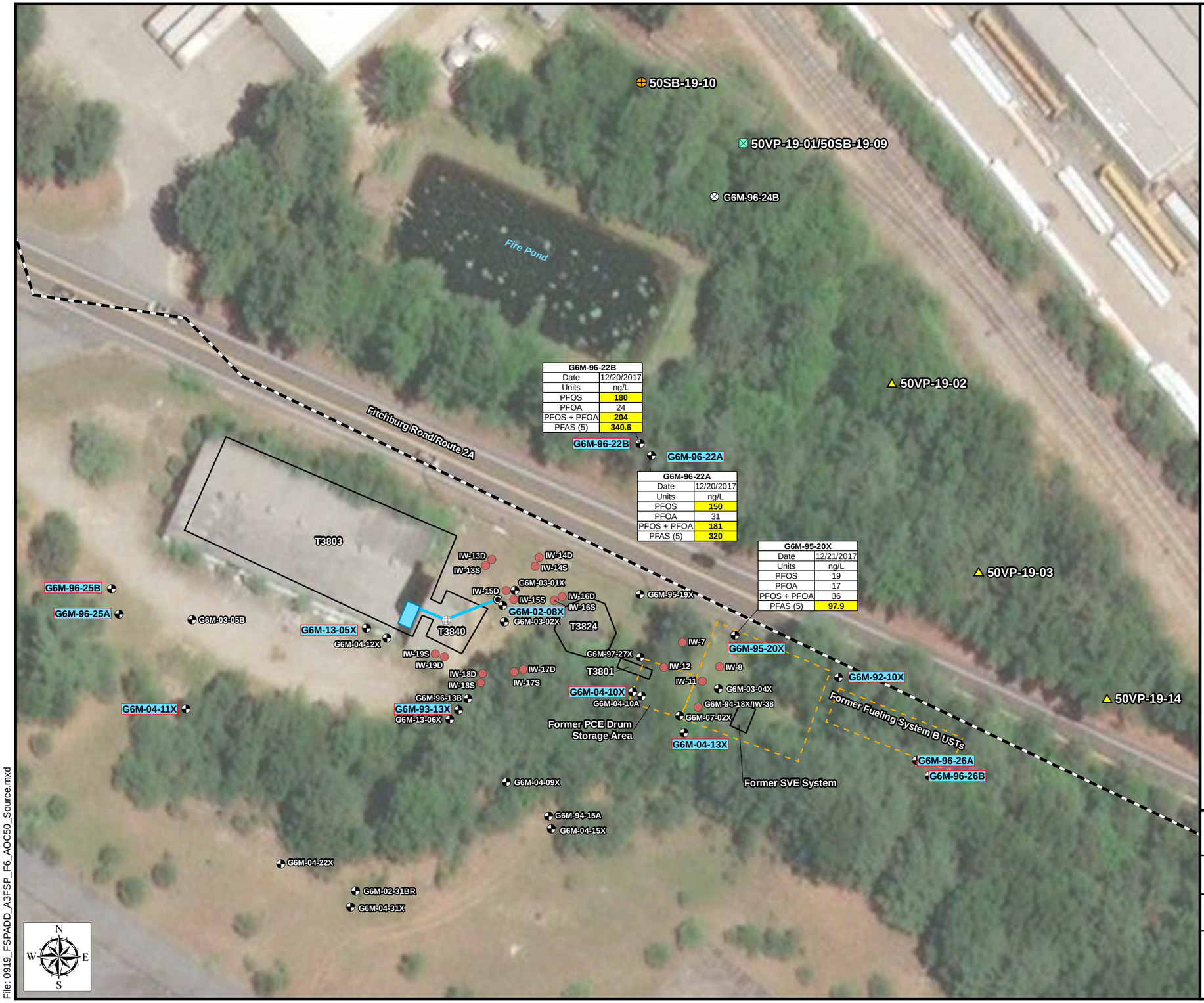
0 250 500
Feet

Date: 01/02/2020

Figure 5

File: 0919_FSPADD_A3FSP_F5_AOC50_VP.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



G6M-96-22B	
Date	12/20/2017
Units	ng/L
PFOS	**180**
PFOA	24
PFOS + PFOA	**204**
PFAS (5)	**340.6**

G6M-96-22A	
Date	12/20/2017
Units	ng/L
PFOS	**150**
PFOA	31
PFOS + PFOA	**181**
PFAS (5)	**320**

G6M-95-20X	
Date	12/21/2017
Units	ng/L
PFOS	19
PFOA	17
PFOS + PFOA	36
PFAS (5)	**97.9**

Legend

- G6M-02-08X — Proposed Wells to be Sampled
- Proposed Vertical Profiling Location
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Soil Boring Location
- Monitoring Well
- Injection Well
- Destroyed Well
- Former Dry Well
- Floor Drain
- Janitor Sink
- Floor Drain Piping
- Former Feature
- Building Footprint
- Former Fort Devens Boundary

Notes:
Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect

Aerial Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

AOC 50 Locations Near Route 2A
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

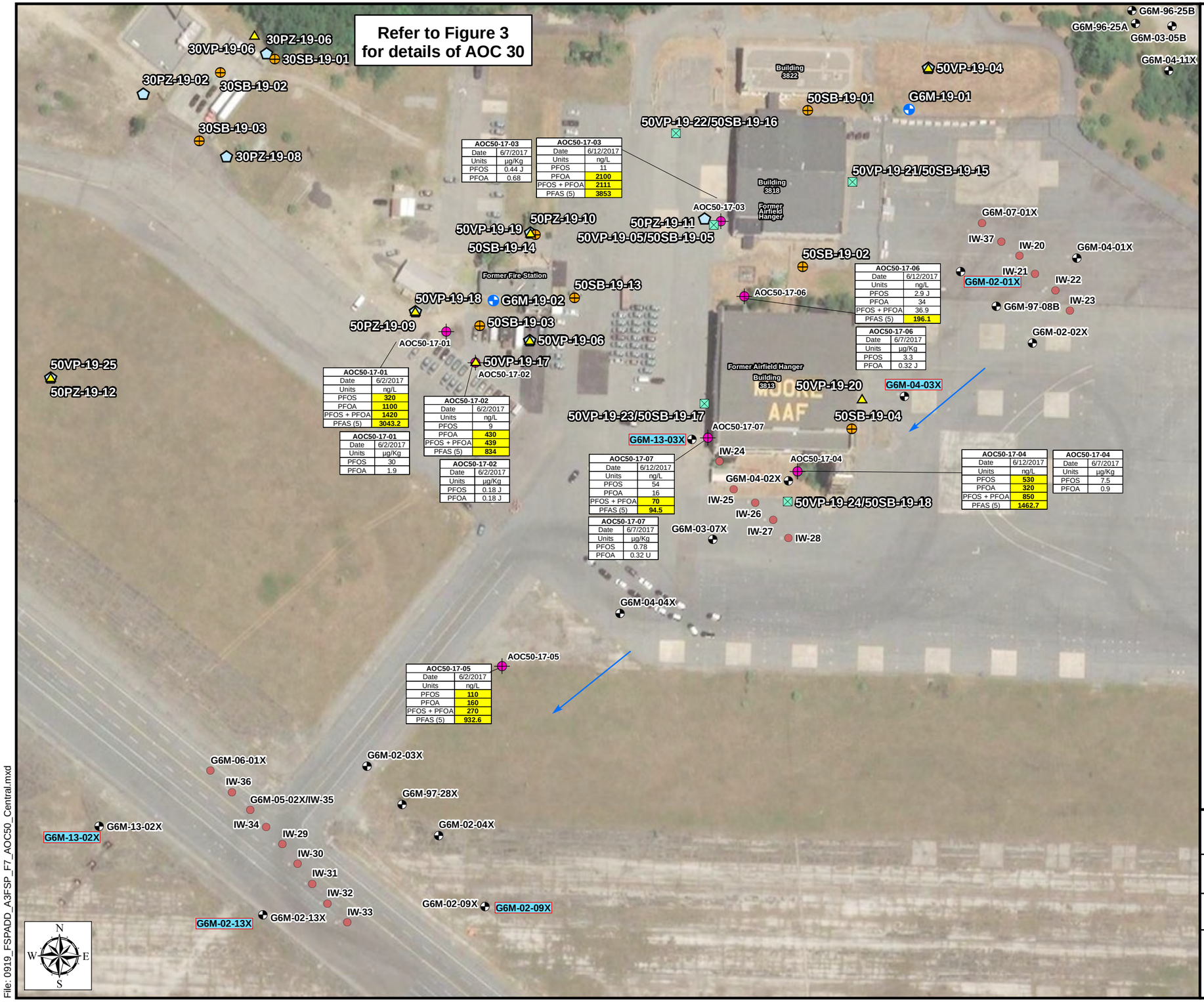
KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 30 60
Feet

Date: 01/02/2020

Figure 6

File: 0919_FSPADD_A3FSP_F6_AOC50_Source.mxd



AOC50-17-03	
Date	6/7/2017
Units	µg/Kg
PFOS	0.44 J
PFOA	0.68

AOC50-17-03	
Date	6/12/2017
Units	ng/L
PFOS	11
PFOA	**2100**
PFOS + PFOA	**2111**
PFAS (5)	**3853**

AOC50-17-06	
Date	6/12/2017
Units	ng/L
PFOS	2.9 J
PFOA	34
PFOS + PFOA	36.9
PFAS (5)	**196.1**

AOC50-17-06	
Date	6/7/2017
Units	µg/Kg
PFOS	3.3
PFOA	0.32 J

AOC50-17-01	
Date	6/2/2017
Units	ng/L
PFOS	**320**
PFOA	**1100**
PFOS + PFOA	**1420**
PFAS (5)	**3043.2**

AOC50-17-01	
Date	6/2/2017
Units	µg/Kg
PFOS	30
PFOA	1.9

AOC50-17-02	
Date	6/2/2017
Units	ng/L
PFOS	9
PFOA	**430**
PFOS + PFOA	**439**
PFAS (5)	**834**

AOC50-17-02	
Date	6/2/2017
Units	µg/Kg
PFOS	0.18 J
PFOA	0.18 J

AOC50-17-07	
Date	6/12/2017
Units	ng/L
PFOS	54
PFOA	16
PFOS + PFOA	**70**
PFAS (5)	**94.5**

AOC50-17-07	
Date	6/7/2017
Units	µg/Kg
PFOS	0.78
PFOA	0.32 U

AOC50-17-04	
Date	6/12/2017
Units	ng/L
PFOS	**530**
PFOA	**320**
PFOS + PFOA	**850**
PFAS (5)	**1462.7**

AOC50-17-04	
Date	6/7/2017
Units	µg/Kg
PFOS	7.5
PFOA	0.9

AOC50-17-05	
Date	6/2/2017
Units	ng/L
PFOS	**110**
PFOA	**160**
PFOS + PFOA	**270**
PFAS (5)	**932.6**

Legend

- G6M-04-06X — Proposed Wells to be Sampled
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Temporary Well Location from SI
- Monitoring Well
- Injection Well
- Groundwater Flow Direction

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

µg/Kg = micrograms per Kilogram
ng/L = nanograms per liter
J = estimated result
U = non-detect

There is no established criteria for PFOS or PFOA in Soil.

AOC 50 Central Area Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

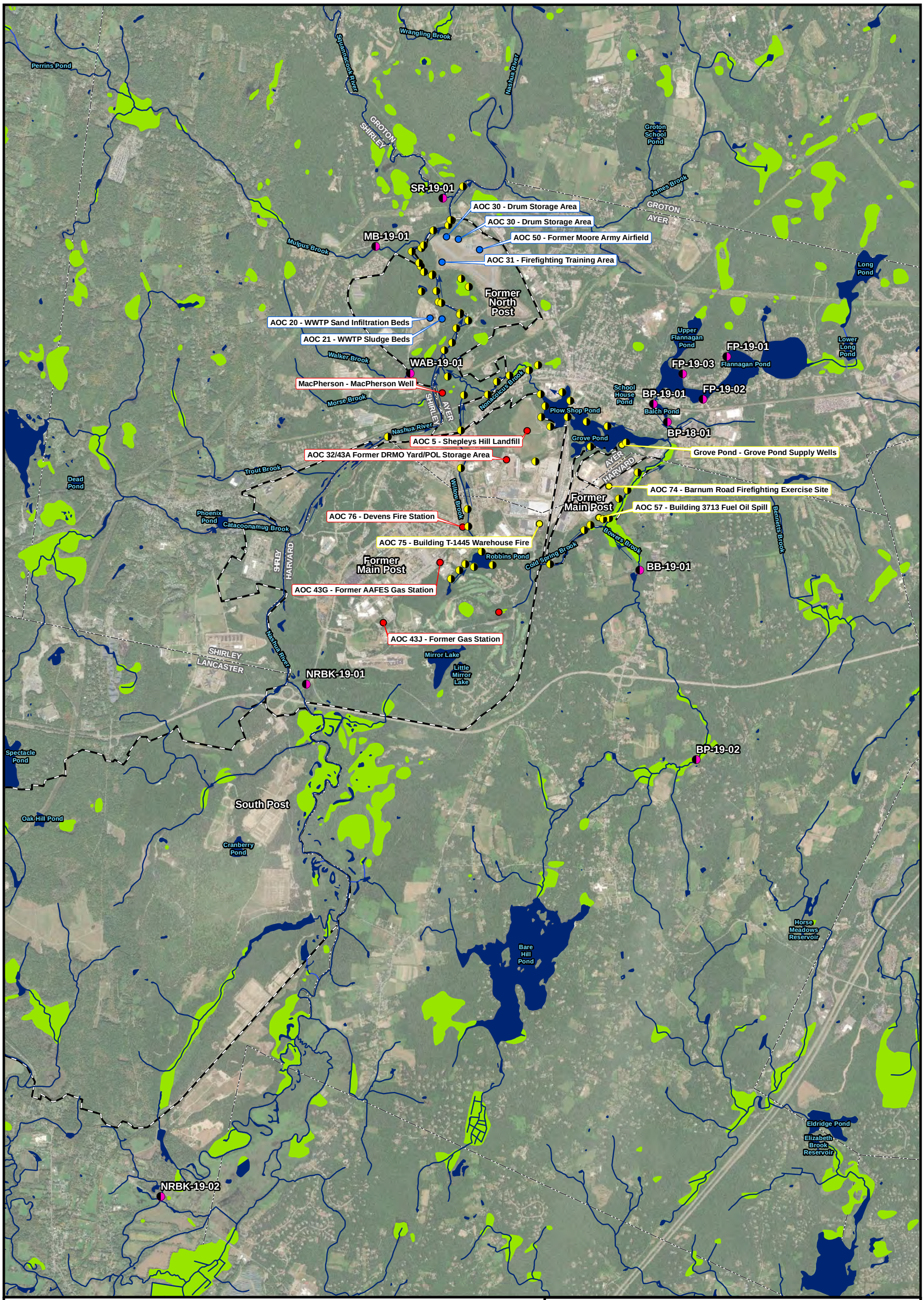
0 60 120
Feet

Date: 12/23/2019

Figure 7

File: 0919_FSPADD_A3FSP_F7_AOC50_Central.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

- Proposed Background Surface Water and Sediment Sampling Location
- Proposed Surface Water and Sediment Sampling Location
- Area 1 - Grove Pond Supply Wells, AOCs 57, 74, and 75
- Area 2 - MacPherson Water Supply Well, SHL, AOCs 32/43A, 76, 43G and 43J
- Area 3 - AOCs 20, 21, 30, 31, and 50
- Surface Water Flow Direction
- City/Town Boundary
- Former Fort Devens Boundary

National Hydrography Dataset

- Stream/River
- Connector
- Lake/Pond
- Swamp/Marsh

N W E S

Background Surface Water Body Sample Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Army Installation Devens
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 2,000 4,000 Feet

Date: 01/16/2020

Figure 8

File: 0919_FSPADD_A3FSP_F8_BkgrndPond.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

TABLES

Table 1
Area 3 Existing Monitoring Well Construction Information - AOCs 20 and 21
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Well ID	Screen Interval (ft bgs)	Ground Surface Elevation (NGVD88)	Top of Casing Elevation (NGVD88)
PZ-1	70.00 - 75.00	272.10	274.6
PZ-2	95.00 - 100.00	272.10	275.1
PZ-5	25.00 - 30.00	224.30	227.2
PZ-6	15.00 - 20.00	218.90	221.8
WWTMW-01A	18 - 33	218.71	221.4
WC-1A	6.45 - 17.95	209.69	212.5
WWTMW-02A	18 - 33	223.65	225.3
WC-2	5.4-19.9	210.4	217.1
WWTMW-04	7 - 22	214.72	217.3
MW-6	14 - 29	231.71	233.9
WWTMW-07	20.5 - 35.5	241.2	242.5
WWTP-Influent	N/A	N/A	N/A
WWTP-Effluent	N/A	N/A	N/A

* denotes estimated based on GoogleEarth.
bgs = below ground surface.
ft = feet.
NA = denotes not applicable.
NGVD88 = National Geodetic Vertical Datum 88.
UKN = unknown.
Wells designated to be sampled in RI.

Table 2
Area 3 Existing Monitoring Well Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Sample Type**
AOC 20/21	MW-01A	MW-01A-MONYY	Native Sample
	MW-2A	MW-2A-MONYY	Native Sample
	MW-04	MW-04-MONYY	Native Sample
	MW-06	MW-06-MONYY	Native Sample
	MW-07	MW-07-MONYY	Native Sample
	MW-WC1A	MW-WC1A-MONYY	Native Sample
	MW-WC2	MW-WC2-MONYY	Native Sample
	PZ-1	PZ-1-MONYY	Native Sample
	PZ-2	PZ-2-MONYY	Native Sample
	PZ-5	PZ-5-MONYY	Native Sample
	PZ-6	PZ-6-MONYY	Native Sample
	WWTP-influent	WWTP-Influent-MONYY	Native Sample
	WWTP-effluent	WWTP-Effluent-MONYY	Native Sample
AOC 50 (Source Area)	G6M-02-08X	G6M-02-08X-MONYY	Native Sample
	G6M-13-05X	G6M-13-05X-MONYY	Native Sample
	G6M-04-10X	G6M-04-10X-MONYY	Native Sample
	G6M-04-11X	G6M-04-11X-MONYY	Native Sample
	G6M-04-13X	G6M-04-13X-MONYY	Native Sample
	66M-92-10X	66M-92-10X-MONYY	Native Sample
	G6M-93-13X	G6M-93-13X-MONYY	Native Sample
	G6M-95-20X	G6M-95-20X-MONYY	Native Sample
	G6M-96-22A	G6M-96-22A-MONYY	Native Sample
	G6M-96-22B	G6M-96-22B-MONYY	Native Sample
	G6M-96-25A	G6M-96-25A-MONYY	Native Sample
	G6M-96-25B	G6M-96-25B-MONYY	Native Sample
	G6M-96-26A	G6M-96-26A-MONYY	Native Sample
	G6M-96-26B	G6M-96-26B-MONYY	Native Sample
	G6M-97-09B	G6M-97-09B-MONYY	Native Sample
AOC 50 (Plume Area)	G6M-01-01X	G6M-01-01X-MONYY	Native Sample
	G6M-02-01X	G6M-02-01X-MONYY	Native Sample
	G6M-02-06X	G6M-02-06X-MONYY	Native Sample
	G6M-02-07X	G6M-02-07X-MONYY	Native Sample
	G6M-02-09X	G6M-02-09X-MONYY	Native Sample
	G6M-02-13X	G6M-02-13X-MONYY	Native Sample
	G6M-03-11X	G6M-03-11X-MONYY	Native Sample
	G6M-04-03X	G6M-04-03X-MONYY	Native Sample
	G6M-04-06X	G6M-04-06X-MONYY	Native Sample
	G6M-04-08X	G6M-04-08X-MONYY	Native Sample
	G6M-04-14X	G6M-04-14X-MONYY	Native Sample
	G6M-13-02X	G6M-13-02X-MONYY	Native Sample
	G6M-13-03X	G6M-13-03X-MONYY	Native Sample
	G6P-97-05X	G6P-97-05X-MONYY	Native Sample
	MW-6	MW-6-MONYY	Native Sample
	MW-7(IT)	MW-7(IT)-MONYY	Native Sample
	XSA-12-96X	XSA-12-96X-MONYY	Native Sample
	XSA-12-98X	XSA-12-98X-MONYY	Native Sample

Table 2
Area 3 Existing Monitoring Well Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Sample Type**
QC Samples**	MW-2A	A3-MW-DUP-MMDDYY	Field Duplicate
	G6M-04-10X	A3-MW-DUP-MMDDYY	Field Duplicate
	G6M-96-25A	A3-MW-DUP-MMDDYY	Field Duplicate
	G6M-03-11X	A3-MW-DUP-MMDDYY	Field Duplicate
	MW-2A	MW-2A-MONYY	MS/MSD
	G6M-96-25A	G6M-96-25A-MONYY	MS/MSD
	XSA-00-88X	XSA-00-88X-MONYY	MS/MSD
	NA	A3-MW-EB-MMDDYY	Equipment Blank
	NA	A3-MW-FRB-MDDYY	Field Blank

Notes:

All samples will be analyzed for PFAS via isotope dilution. Analyte list is specified in UFP-QAPP Worksheet #15.

* = The sample name will consist of the well identifier followed by the month and the year the sample was collected. The month will be represented by three letters and the year by two numbers.

** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during each sampling event. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used. Only one EB and FRB sample IDs are shown, but the appropriate number will be collected.

AOC = area of contamination
EB = equipment rinsate blank
FRB = field reagant blank
FD = field duplicate
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control

Table 3
Area 3 Groundwater Vertical Profiling/Piezometer/Soil Boring Locations and Rationale
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Proposed Location	Rationale	Sampling intervals
Area of Concern 20		
20VP-19-01	Determine if PFAS contamination is present in groundwater to the north of AOC 20.	Water table to refusal
20VP-19-02	Define extent of PFAS contamination in groundwater to the northwest and cross-gradient of MW-04.	Water table to refusal
20VP-19-03	Define extent of PFAS contamination in groundwater cross-gradient of PZ-5.	Water table to refusal
20VP-19-04	Determine if PFAS contamination in groundwater to the south of AOC 20, between the sand infiltration beds and the Nashua River.	Water table to refusal
20VP-19-05/20PZ-19-02	Determine if PFAS contamination is present in groundwater to the west of AOC 20 and upgradient (northwest) of PZ-5.	Water table to refusal
20VP-19-06/20SB19-08	Determine if PFAS contamination is present in groundwater and soil within a sand infiltration bed.	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
20VP-19-07	Determine if PFAS contamination is present in groundwater beneath the sand infiltration beds.	Water table to refusal
20VP-19-08	Determine if PFAS contamination is present in groundwater to the west of AOC 20.	Water table to refusal
20VP-19-09/20PZ-19-01	Determine if PFAS contamination is present in groundwater to the west of AOC 20.	Water table to refusal
20VP-19-10	Determine if PFAS contamination is present in groundwater to the east of AOC 20.	Water table to refusal
20VP-19-11	Define extent of PFAS contamination in groundwater to the northeast of AOC 20.	Water table to refusal
20SB-19-01 through 19-07	Determine if PFAS contamination is present in soil associated with sand infiltration beds.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and 2 samples two feet above the water table
Area of Concern 21		
21VP-19-01/ 21SB-19-01	Define extent of PFAS contamination in groundwater and soil within AOC 21.	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
21VP-19-02	Define extent of PFAS in groundwater to the east of AOCs 20 and 21	Water table to refusal
21VP-19-03	Define extent of PFAS in groundwater to the east of AOCs 20 and 21	Water table to refusal
21SB-19-02	Define extent of PFAS in soil at sludge drying beds.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
21SB-19-03	Define extent of PFAS in soil at sludge drying beds.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
Area of Concern 30		
30VP-19-01/30PZ-19-01	Determine if PFAS contamination is present in groundwater to the north of AOC 30.	Water table to refusal
30VP-19-02	Determine if PFAS contamination is present in groundwater to the north of AOC 30.	Water table to refusal
30PZ-19-02	Provide hydraulic measurement point southwest of eastern former drum storage area.	NA
30VP-19-03/30PZ-19-03	Define the extent of PFAS contamination in groundwater within an area of known groundwater contamination at former drum storage areas.	Water table to refusal
30VP-19-04/30PZ-19-04	Determine if PFAS contamination is present in groundwater to the southwest of AOC 30.	Water table to refusal
30VP-19-05/30PZ-19-05	Determine if PFAS contamination is present in groundwater to the north of the fromer eastern drum storage area.	Water table to refusal
30VP-19-06	Determine if PFAS contamination is present in groundwater within the former eastern drum storage area.	Water table to refusal
30PZ-19-06	Provide hydraulic measurement point northeast of eastern former drum storage area.	NA
30VP-19-07/30PZ-19-07	Determine if PFAS contamination is present in groundwater west of the former eastern drum storage area.	Water table to refusal
30PZ-19-08	Provide hydraulic measurement point southeast of eastern former drum storage area.	NA
30SB-19-01	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
30SB-19-02	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
30SB-19-03	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
30SB-19-04	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table

Table 3
Area 3 Groundwater Vertical Profiling/Piezometer/Soil Boring Locations and Rationale
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Proposed Location	Rationale	Sampling intervals
30SB-19-05	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
30SB-19-06	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
Area of Concern 31		
31VP-19-01/ 31SB-19-01	Define the extent of PFAS contamination in groundwater and soil within former fire training area.	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
31VP-19-02	Define extent of PFAS in groundwater within an area of known PFAS contamination downgradient of former fire training area.	Water table to refusal
31VP-19-03	Define extent of PFAS in groundwater within an area of known PFAS contamination downgradient of former fire training area.	Water table to refusal
31VP-19-04/31PZ-19-01	Determine if PFAS contamination is present in groundwater to the north of former fire training area.	Water table to refusal
31VP-19-05	Determine if PFAS contamination is present in groundwater to the west of former fire training area, on west side of Nashua River.	Water table to refusal
31VP-19-06	Determine if PFAS contamination is present in groundwater to the west of former fire training area, on east side of the Nashua River.	Water table to refusal
31VP-19-07/31PZ-19-02S and -02D	Determine if PFAS contamination is present in groundwater to the west of former fire training area, on east side of the Nashua River.	Water table to refusal
31VP-19-08	Determine if PFAS contamination is present in groundwater to the west of former fire training area, on east side of the Nashua River.	Water table to refusal
31VP-19-09	Determine if PFAS contamination is present in groundwater to the west of former fire training area, on east side of the Nashua River.	Water table to refusal
G6M-18-01	Define extent of PFAS contamination in groundwater to the northeast of former fire training area. Vertical profile to be installed under AOC 50 LTM program. Splits will be collected and submitted for PFAS analysis. To be performed in October 2018.	Water table to refusal
G6M-18-02	Define extent of PFAS contamination in groundwater to the southwest of fire training area. Vertical profile to be installed under AOC 50 LTM program. Splits will be collected and submitted for PFAS analysis. To be perfomred in October 2018.	Water table to refusal
31SB-19-02	Define the extent of PFAS soil contamination within former fire training area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
31SB-19-03	Define the extent of PFAS soil contamination within former fire training area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
31SB-19-04	Define the extent of PFAS soil contamination within former fire training area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
31SB-19-05	Define the extent of PFAS soil contamination within former fire training area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
31SB-19-06	Determine if PFAS contamination is present in soil downgradient of former fire training area.	0-1, 3-7 ft bgs
31SB-19-07	Determine if PFAS contamination is present in soil downgradient of former fire training area.	0-1, 3-7 ft bgs
31SB-19-08	Determine if PFAS contamination is present in soil downgradient of former fire training area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
Area of Concern 50		
50VP-19-01/50SB-19-09	Determine if PFAS are present in groundwater to the north of Route 2A.	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50VP-19-02	Determine if PFAS are present in groundwater to the north of Route 2A.	Water table to refusal
50VP-19-03	Determine if PFAS are present in groundwater to the north of Route 2A.	Water table to refusal
50VP-19-04/50PZ-19-01	Determine if PFAS are present in groundwater to the northeast of former hangar buildings.	Water table to refusal
50VP-19-05/50PZ-19-11	Define extent of PFAS within an area of known PFAS groundwater contamination at former airfield hanger.	Water table to refusal
50VP-19-06/50PZ-19-02	Define extent of PFAS within an area of known PFAS groundwater contamination south of the former Fire Station.	Water table to refusal
50VP-19-07	Define the extent of PFAS in groundwater within area of known PFAS groundwater contamination.	Water table to refusal
50VP-19-08	Define the extent of PFAS in groundwater on the west side of the Nashua River.	VP to top of nearby monitoring well screen
50VP-19-09/50PZ-19-03	Determine if PFAS are present in groundwater to the east of the airfield.	Water table to refusal
50VP-19-10 / 50SB-19-12/50PZ-19-04	Determine if PFAS are present in soil and groundwater in an area of the airfield that historically received sludge from the Devens WWTP.	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50VP-19-11/50PZ-19-05	Determine if PFAS are present in groundwater to the east of the airfield.	Water table to refusal
50VP-19-12/50PZ-19-06	Determine if PFAS are present in groundwater to the east of the airfield.	Water table to refusal
50VP-19-13/50PZ-19-07	Determine if PFAS are present in groundwater to the west of the airfield.	Water table to refusal
50VP-19-14	Determine if PFAS are present in groundwater east of AOC 50 source area.	Water table to refusal
50VP-19-15	Determine if PFAS are below existing well G6M-04-14X.	90 ft bgs to refusal

Table 3
Area 3 Groundwater Vertical Profiling/Piezometer/Soil Boring Locations and Rationale
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Proposed Location	Rationale	Sampling intervals
50VP-19-16/50PZ-19-08	Determine if PFAS are present in groundwater and soil southwest of AOC50-17-08	Water table to refusal
50VP-19-17	Determine if PFAS are present in groundwater southwest of the former fire station	Water table to refusal
50VP-19-18/50PZ-19-09	Determine if PFAS are present in groundwater and soil southwest of the former fire station	Water table to refusal
50VP-19-19/50PZ-19-10/ 50SB-19-14	Determine if PFAS are present in groundwater and soil north of the former fire station	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
50VP-19-20	Determine if PFAS are present in groundwater east of Building 3813	Water table to refusal
50VP-19-21/50SB-19-15	Determine if PFAS are present in groundwater and soil east of Building 3818	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
50VP-19-22/50SB-19-16	Determine if PFAS are present in groundwater and soil west of Building 3818	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and at two feet above the water table
50VP-19-23/50SB-19-17	Determine if PFAS are present in groundwater and soil west of Building 3813	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50VP-19-24/50SB-19-18	Determine if PFAS are present in groundwater and soil south of Building 3813	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
50VP-19-25/50PZ-19-12	Determine if PFAS are present in groundwater southwest of the former fire station	Water table to refusal
50SB-19-01 through 50SB-19-05	Determine if PFAS are present in soil at potential source area (Former Airfield Hanger and Fire Station).	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and at 2 locations two feet above the water table
50SB-19-06	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
50SB-19-07	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50SB-19-08	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50SB-19-10	Determine if PFAS are present in soil in area west of vertical profile 50VP-19-01.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50SB-19-11	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50SB-19-12	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50SB-19-13	Determine if PFAS are present in soil east of the former fire station.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table

Notes:
AOC = Area of Contamination
LTM = Long-Term Monitoring
ft bgs = feet below ground surface
WWTP = Water Water Treatment Plant

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 20	20VP-19-01	20VP-19-01-XX-XX	156	35	35-39	Native Sample
		20VP-19-01-XX-XX	156	35	45-49	Native Sample
		20VP-19-01-XX-XX	156	35	55-59	Native Sample
		20VP-19-01-XX-XX	156	35	65-69	Native Sample
		20VP-19-01-XX-XX	156	35	75-79	Native Sample
		20VP-19-01-XX-XX	156	35	85-89	Native Sample
		20VP-19-01-XX-XX	156	35	95-99	Native Sample
		20VP-19-01-XX-XX	156	35	105-109	Native Sample
		20VP-19-01-XX-XX	156	35	115-119	Native Sample
		20VP-19-01-XX-XX	156	35	125-129	Native Sample
		20VP-19-01-XX-XX	156	35	135-139	Native Sample
		20VP-19-01-XX-XX	156	35	145-149	Native Sample
	20VP-19-02	20VP-19-02-XX-XX	135	15	15-19	Native Sample
		20VP-19-02-XX-XX	135	15	25-29	Native Sample
		20VP-19-02-XX-XX	135	15	35-39	Native Sample
		20VP-19-02-XX-XX	135	15	45-49	Native Sample
		20VP-19-02-XX-XX	135	15	55-59	Native Sample
		20VP-19-02-XX-XX	135	15	65-69	Native Sample
		20VP-19-02-XX-XX	135	15	75-79	Native Sample
		20VP-19-02-XX-XX	135	15	85-89	Native Sample
		20VP-19-02-XX-XX	135	15	95-99	Native Sample
		20VP-19-02-XX-XX	135	15	105-109	Native Sample
		20VP-19-02-XX-XX	135	15	115-119	Native Sample
		20VP-19-02-XX-XX	135	15	125-129	Native Sample
	20VP-19-03	20VP-19-03-XX-XX	135	15	15-19	Native Sample
		20VP-19-03-XX-XX	135	15	25-29	Native Sample
		20VP-19-03-XX-XX	135	15	35-39	Native Sample
		20VP-19-03-XX-XX	135	15	45-49	Native Sample
		20VP-19-03-XX-XX	135	15	55-59	Native Sample
		20VP-19-03-XX-XX	135	15	65-69	Native Sample
		20VP-19-03-XX-XX	135	15	75-79	Native Sample
		20VP-19-03-XX-XX	135	15	85-89	Native Sample
		20VP-19-03-XX-XX	135	15	95-99	Native Sample
		20VP-19-03-XX-XX	135	15	105-109	Native Sample
		20VP-19-03-XX-XX	135	15	115-119	Native Sample
		20VP-19-03-XX-XX	135	15	125-129	Native Sample
	20VP-19-04	20VP-19-04-XX-XX	135	15	15-19	Native Sample
		20VP-19-04-XX-XX	135	15	25-29	Native Sample
		20VP-19-04-XX-XX	135	15	35-39	Native Sample
		20VP-19-04-XX-XX	135	15	45-49	Native Sample
		20VP-19-04-XX-XX	135	15	55-59	Native Sample
		20VP-19-04-XX-XX	135	15	65-69	Native Sample
		20VP-19-04-XX-XX	135	15	75-79	Native Sample
		20VP-19-04-XX-XX	135	15	85-89	Native Sample
		20VP-19-04-XX-XX	135	15	95-99	Native Sample
		20VP-19-04-XX-XX	135	15	105-109	Native Sample
		20VP-19-04-XX-XX	135	15	115-119	Native Sample
		20VP-19-04-XX-XX	135	15	125-129	Native Sample
	20VP-19-05	20VP-19-05-XX-XX	145	25	25-29	Native Sample
		20VP-19-05-XX-XX	145	25	35-39	Native Sample
		20VP-19-05-XX-XX	145	25	45-39	Native Sample
		20VP-19-05-XX-XX	145	25	55-59	Native Sample
		20VP-19-05-XX-XX	145	25	65-69	Native Sample
		20VP-19-05-XX-XX	145	25	75-79	Native Sample
		20VP-19-05-XX-XX	145	25	85-89	Native Sample
		20VP-19-05-XX-XX	145	25	95-99	Native Sample
		20VP-19-05-XX-XX	145	25	95-99	Native Sample
		20VP-19-05-XX-XX	145	25	105-109	Native Sample
		20VP-19-05-XX-XX	145	25	115-119	Native Sample
	20VP-19-06	20VP-19-06-XX-XX	190	60	60-64	Native Sample
		20VP-19-06-XX-XX	190	60	70-74	Native Sample
		20VP-19-06-XX-XX	190	60	80-84	Native Sample
		20VP-19-06-XX-XX	190	60	90-94	Native Sample
		20VP-19-06-XX-XX	190	60	100-104	Native Sample
		20VP-19-06-XX-XX	190	60	110-114	Native Sample
		20VP-19-06-XX-XX	190	60	120-124	Native Sample
		20VP-19-06-XX-XX	190	60	130-134	Native Sample
		20VP-19-06-XX-XX	190	60	140-144	Native Sample
		20VP-19-06-XX-XX	190	60	150-154	Native Sample
		20VP-19-06-XX-XX	190	60	160-164	Native Sample
		20VP-19-06-XX-XX	190	60	170-174	Native Sample
		20VP-19-06-XX-XX	190	60	180-184	Native Sample

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 20	20VP-19-07	20VP-19-07-XX-XX	190	60	60-64	Native Sample
		20VP-19-07-XX-XX	190	60	70-74	Native Sample
		20VP-19-07-XX-XX	190	60	80-84	Native Sample
		20VP-19-07-XX-XX	190	60	90-94	Native Sample
		20VP-19-07-XX-XX	190	60	100-104	Native Sample
		20VP-19-07-XX-XX	190	60	110-114	Native Sample
		20VP-19-07-XX-XX	190	60	120-124	Native Sample
		20VP-19-07-XX-XX	190	60	130-134	Native Sample
		20VP-19-07-XX-XX	190	60	140-144	Native Sample
		20VP-19-07-XX-XX	190	60	150-154	Native Sample
		20VP-19-07-XX-XX	190	60	160-164	Native Sample
		20VP-19-07-XX-XX	190	60	170-174	Native Sample
		20VP-19-07-XX-XX	190	60	180-184	Native Sample
	20VP-19-08	20VP-19-08-XX-XX	30	25	25-29	Native Sample
	20VP-19-09	20VP-19-09-XX-XX	25	16	18-22	Native Sample
	20VP-19-10	20VP-19-10-XX-XX	88	21	23-27	Native Sample
		20VP-19-10-XX-XX	88	21	33-37	Native Sample
		20VP-19-10-XX-XX	88	21	43-47	Native Sample
		20VP-19-10-XX-XX	88	21	53-57	Native Sample
		20VP-19-10-XX-XX	88	21	63-67	Native Sample
		20VP-19-10-XX-XX	88	21	73-77	Native Sample
		20VP-19-10-XX-XX	88	21	83-87	Native Sample
	20VP-19-11	20VP-19-11-XX-XX	65	9	11-15	Native Sample
		20VP-19-11-XX-XX	65	9	21-25	Native Sample
		20VP-19-11-XX-XX	65	9	31-35	Native Sample
		20VP-19-11-XX-XX	65	9	41-45	Native Sample
		20VP-19-11-XX-XX	65	9	51-55	Native Sample
		20VP-19-11-XX-XX	65	9	61-65	Native Sample
AOC 21	21VP-19-01	21VP-19-01-XX-XX	150	30	30-34	Native Sample
		21VP-19-01-XX-XX	150	30	40-44	Native Sample
		21VP-19-01-XX-XX	150	30	50-54	Native Sample
		21VP-19-01-XX-XX	150	30	60-64	Native Sample
		21VP-19-01-XX-XX	150	30	70-74	Native Sample
		21VP-19-01-XX-XX	150	30	80-84	Native Sample
		21VP-19-01-XX-XX	150	30	90-94	Native Sample
		21VP-19-01-XX-XX	150	30	100-104	Native Sample
		21VP-19-01-XX-XX	150	30	110-114	Native Sample
		21VP-19-01-XX-XX	150	30	120-124	Native Sample
		21VP-19-01-XX-XX	150	30	130-134	Native Sample
		21VP-19-01-XX-XX	150	30	140-144	Native Sample
	21VP-19-02	21VP-19-02-XX-XX	135	15	15-19	Native Sample
		21VP-19-02-XX-XX	135	15	25-29	Native Sample
		21VP-19-02-XX-XX	135	15	35-39	Native Sample
		21VP-19-02-XX-XX	135	15	45-49	Native Sample
		21VP-19-02-XX-XX	135	15	55-59	Native Sample
		21VP-19-02-XX-XX	135	15	65-69	Native Sample
		21VP-19-02-XX-XX	135	15	75-79	Native Sample
		21VP-19-02-XX-XX	135	15	85-89	Native Sample
		21VP-19-02-XX-XX	135	15	95-99	Native Sample
		21VP-19-02-XX-XX	135	15	105-109	Native Sample
		21VP-19-02-XX-XX	135	15	115-119	Native Sample
		21VP-19-02-XX-XX	135	15	125-129	Native Sample
	21VP-19-03	21VP-19-03-XX-XX	95	21	23-27	Native Sample
		21VP-19-03-XX-XX	95	21	33-37	Native Sample
		21VP-19-03-XX-XX	95	21	43-47	Native Sample
		21VP-19-03-XX-XX	95	21	53-57	Native Sample
		21VP-19-03-XX-XX	95	21	63-67	Native Sample
		21VP-19-03-XX-XX	95	21	73-77	Native Sample
		21VP-19-03-XX-XX	95	21	83-87	Native Sample
		21VP-19-03-XX-XX	95	21	91-95	Native Sample
AOC 30	30VP-19-01	30VP-19-01-XX-XX	70	20	20-24	Native Sample
		30VP-19-01-XX-XX	70	20	30-34	Native Sample
		30VP-19-01-XX-XX	70	20	40-44	Native Sample
		30VP-19-01-XX-XX	70	20	50-54	Native Sample
		30VP-19-01-XX-XX	70	20	60-64	Native Sample
	30VP-19-02	30VP-19-02-XX-XX	70	20	20-24	Native Sample
		30VP-19-02-XX-XX	70	20	30-34	Native Sample
		30VP-19-02-XX-XX	70	20	40-44	Native Sample
		30VP-19-02-XX-XX	70	20	50-54	Native Sample
		30VP-19-02-XX-XX	70	20	60-64	Native Sample
	30VP-19-03	30VP-19-03-XX-XX	115	65	65-69	Native Sample
		30VP-19-03-XX-XX	115	65	75-79	Native Sample
		30VP-19-03-XX-XX	115	65	85-89	Native Sample
		30VP-19-03-XX-XX	115	65	95-99	Native Sample
		30VP-19-03-XX-XX	115	65	105-109	Native Sample
		30VP-19-03-XX-XX	115	65	110-114	Native Sample

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 30	30VP-19-04	30VP-19-04-XX-XX	115	65	65-69	Native Sample
		30VP-19-04-XX-XX	115	65	75-79	Native Sample
		30VP-19-04-XX-XX	115	65	85-89	Native Sample
		30VP-19-04-XX-XX	115	65	95-99	Native Sample
		30VP-19-04-XX-XX	115	65	105-109	Native Sample
		30VP-19-04-XX-XX	115	65	110-114	Native Sample
	30VP-19-05	30VP-19-05-XX-XX	70	20	20-24	Native Sample
		30VP-19-05-XX-XX	70	20	30-34	Native Sample
		30VP-19-05-XX-XX	70	20	40-44	Native Sample
		30VP-19-05-XX-XX	70	20	50-54	Native Sample
		30VP-19-05-XX-XX	70	20	60-64	Native Sample
	30VP-19-06	30VP-19-06-XX-XX	115	65	65-69	Native Sample
		30VP-19-06-XX-XX	115	65	75-79	Native Sample
		30VP-19-06-XX-XX	115	65	85-89	Native Sample
		30VP-19-06-XX-XX	115	65	95-99	Native Sample
		30VP-19-06-XX-XX	115	65	105-109	Native Sample
		30VP-19-06-XX-XX	115	65	110-114	Native Sample
	30VP-19-07	30VP-19-07-XX-XX	45	17	18-22	Native Sample
		30VP-19-07-XX-XX	45	17	28-32	Native Sample
		30VP-19-07-XX-XX	45	17	38-42	Native Sample
AOC 31	31VP-19-01	31VP-19-01-XX-XX	185	65	65-69	Native Sample
		31VP-19-01-XX-XX	185	65	75-79	Native Sample
		31VP-19-01-XX-XX	185	65	85-89	Native Sample
		31VP-19-01-XX-XX	185	65	95-99	Native Sample
		31VP-19-01-XX-XX	185	65	105-109	Native Sample
		31VP-19-01-XX-XX	185	65	115-119	Native Sample
		31VP-19-01-XX-XX	185	65	125-129	Native Sample
		31VP-19-01-XX-XX	185	65	135-139	Native Sample
		31VP-19-01-XX-XX	185	65	145-149	Native Sample
		31VP-19-01-XX-XX	185	65	155-159	Native Sample
		31VP-19-01-XX-XX	185	65	165-169	Native Sample
		31VP-19-01-XX-XX	185	65	175-179	Native Sample
	31VP-19-02	31VP-19-02-XX-XX	185	65	65-69	Native Sample
		31VP-19-02-XX-XX	185	65	75-79	Native Sample
		31VP-19-02-XX-XX	185	65	85-89	Native Sample
		31VP-19-02-XX-XX	185	65	95-99	Native Sample
		31VP-19-02-XX-XX	185	65	105-109	Native Sample
		31VP-19-02-XX-XX	185	65	115-119	Native Sample
		31VP-19-02-XX-XX	185	65	125-129	Native Sample
		31VP-19-02-XX-XX	185	65	135-139	Native Sample
		31VP-19-02-XX-XX	185	65	145-149	Native Sample
		31VP-19-02-XX-XX	185	65	155-159	Native Sample
		31VP-19-02-XX-XX	185	65	165-169	Native Sample
		31VP-19-02-XX-XX	185	65	175-179	Native Sample
	31VP-19-03	31VP-19-03-XX-XX	185	65	65-69	Native Sample
		31VP-19-03-XX-XX	185	65	75-79	Native Sample
		31VP-19-03-XX-XX	185	65	85-89	Native Sample
		31VP-19-03-XX-XX	185	65	95-99	Native Sample
		31VP-19-03-XX-XX	185	65	105-109	Native Sample
		31VP-19-03-XX-XX	185	65	115-119	Native Sample
		31VP-19-03-XX-XX	185	65	125-129	Native Sample
		31VP-19-03-XX-XX	185	65	135-139	Native Sample
		31VP-19-03-XX-XX	185	65	145-149	Native Sample
		31VP-19-03-XX-XX	185	65	155-159	Native Sample
		31VP-19-03-XX-XX	185	65	165-169	Native Sample
		31VP-19-03-XX-XX	185	65	175-179	Native Sample
	31VP-19-04	31VP-19-04-XX-XX	185	65	65-69	Native Sample
		31VP-19-04-XX-XX	185	65	75-79	Native Sample
		31VP-19-04-XX-XX	185	65	85-89	Native Sample
		31VP-19-04-XX-XX	185	65	95-99	Native Sample
		31VP-19-04-XX-XX	185	65	105-109	Native Sample
		31VP-19-04-XX-XX	185	65	115-119	Native Sample
		31VP-19-04-XX-XX	185	65	125-129	Native Sample
		31VP-19-04-XX-XX	185	65	135-139	Native Sample
		31VP-19-04-XX-XX	185	65	145-149	Native Sample
		31VP-19-04-XX-XX	185	65	155-159	Native Sample
		31VP-19-04-XX-XX	185	65	165-169	Native Sample
		31VP-19-04-XX-XX	185	65	175-179	Native Sample

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 31	31VP-19-05	31VP-19-05-XX-XX	125	5	5-9	Native Sample
		31VP-19-05-XX-XX	125	5	15-19	Native Sample
		31VP-19-05-XX-XX	125	5	25-29	Native Sample
		31VP-19-05-XX-XX	125	5	35-39	Native Sample
		31VP-19-05-XX-XX	125	5	45-49	Native Sample
		31VP-19-05-XX-XX	125	5	55-59	Native Sample
		31VP-19-05-XX-XX	125	5	65-69	Native Sample
		31VP-19-05-XX-XX	125	5	75-79	Native Sample
		31VP-19-05-XX-XX	125	5	85-89	Native Sample
		31VP-19-05-XX-XX	125	5	95-99	Native Sample
		31VP-19-05-XX-XX	125	5	105-109	Native Sample
		31VP-19-05-XX-XX	125	5	115-119	Native Sample
	31VP-19-06 ****	31VP-19-06-XX-XX	80	5	5-9	Native Sample
		31VP-19-06-XX-XX	80	5	15-19	Native Sample
		31VP-19-06-XX-XX	80	5	25-29	Native Sample
		31VP-19-06-XX-XX	80	5	35-39	Native Sample
		31VP-19-06-XX-XX	80	5	45-49	Native Sample
		31VP-19-06-XX-XX	80	5	55-59	Native Sample
		31VP-19-06-XX-XX	80	5	65-69	Native Sample
		31VP-19-06-XX-XX	80	5	75-79	Native Sample
	31VP-19-07 ****	31VP-19-07-XX-XX	80	5	5-9	Native Sample
		31VP-19-07-XX-XX	80	5	15-19	Native Sample
		31VP-19-07-XX-XX	80	5	25-29	Native Sample
		31VP-19-07-XX-XX	80	5	35-39	Native Sample
		31VP-19-07-XX-XX	80	5	45-49	Native Sample
		31VP-19-07-XX-XX	80	5	55-59	Native Sample
		31VP-19-07-XX-XX	80	5	65-69	Native Sample
		31VP-19-07-XX-XX	80	5	75-79	Native Sample
	31VP-19-08 ****	31VP-19-08-XX-XX	80	5	5-9	Native Sample
		31VP-19-08-XX-XX	80	5	15-19	Native Sample
		31VP-19-08-XX-XX	80	5	25-29	Native Sample
		31VP-19-08-XX-XX	80	5	35-39	Native Sample
		31VP-19-08-XX-XX	80	5	45-49	Native Sample
		31VP-19-08-XX-XX	80	5	55-59	Native Sample
		31VP-19-08-XX-XX	80	5	65-69	Native Sample
		31VP-19-08-XX-XX	80	5	75-79	Native Sample
	31VP-19-09 ****	31VP-19-09-XX-XX	80	5	5-9	Native Sample
		31VP-19-09-XX-XX	80	5	15-19	Native Sample
		31VP-19-09-XX-XX	80	5	25-29	Native Sample
		31VP-19-09-XX-XX	80	5	35-39	Native Sample
		31VP-19-09-XX-XX	80	5	45-49	Native Sample
		31VP-19-09-XX-XX	80	5	55-59	Native Sample
		31VP-19-09-XX-XX	80	5	65-69	Native Sample
		31VP-19-09-XX-XX	80	5	75-79	Native Sample
AOC 50	50VP-19-01	50VP-19-01-XX-XX	65	5	5-9	Native Sample
		50VP-19-01-XX-XX	65	5	15-19	Native Sample
		50VP-19-01-XX-XX	65	5	25-29	Native Sample
		50VP-19-01-XX-XX	65	5	35-39	Native Sample
		50VP-19-01-XX-XX	65	5	45-49	Native Sample
		50VP-19-01-XX-XX	65	5	55-59	Native Sample
	50VP-19-02	50VP-19-02-XX-XX	65	5	5-9	Native Sample
		50VP-19-02-XX-XX	65	5	15-19	Native Sample
		50VP-19-02-XX-XX	65	5	25-29	Native Sample
		50VP-19-02-XX-XX	65	5	35-39	Native Sample
		50VP-19-02-XX-XX	65	5	45-49	Native Sample
		50VP-19-02-XX-XX	65	5	55-59	Native Sample
	50VP-19-03	50VP-19-03-XX-XX	65	5	5-9	Native Sample
		50VP-19-03-XX-XX	65	5	15-19	Native Sample
		50VP-19-03-XX-XX	65	5	25-29	Native Sample
		50VP-19-03-XX-XX	65	5	35-39	Native Sample
		50VP-19-03-XX-XX	65	5	45-49	Native Sample
		50VP-19-03-XX-XX	65	5	55-59	Native Sample
	50VP-19-04	50VP-19-04-XX-XX	115	55	55-59	Native Sample
		50VP-19-04-XX-XX	115	55	65-69	Native Sample
		50VP-19-04-XX-XX	115	55	75-79	Native Sample
		50VP-19-04-XX-XX	115	55	85-89	Native Sample
		50VP-19-04-XX-XX	115	55	95-99	Native Sample
		50VP-19-04-XX-XX	115	55	105-109	Native Sample
	50VP-19-05	50VP-19-05-XX-XX	115	55	55-59	Native Sample
		50VP-19-05-XX-XX	115	55	65-69	Native Sample
		50VP-19-05-XX-XX	115	55	75-79	Native Sample
		50VP-19-05-XX-XX	115	55	85-89	Native Sample
		50VP-19-05-XX-XX	115	55	95-99	Native Sample
		50VP-19-05-XX-XX	115	55	105-109	Native Sample

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 50	50VP-19-06	50VP-19-06-XX-XX	115	55	55-59	Native Sample
		50VP-19-06-XX-XX	115	55	65-69	Native Sample
		50VP-19-06-XX-XX	115	55	75-79	Native Sample
		50VP-19-06-XX-XX	115	55	85-89	Native Sample
		50VP-19-06-XX-XX	115	55	95-99	Native Sample
		50VP-19-06-XX-XX	115	55	105-109	Native Sample
	50VP-19-07	50VP-19-07-XX-XX	165	65	65-69	Native Sample
		50VP-19-07-XX-XX	165	65	75-79	Native Sample
		50VP-19-07-XX-XX	165	65	85-89	Native Sample
		50VP-19-07-XX-XX	165	65	95-99	Native Sample
		50VP-19-07-XX-XX	165	65	105-109	Native Sample
		50VP-19-07-XX-XX	165	65	115-119	Native Sample
		50VP-19-07-XX-XX	165	65	125-129	Native Sample
		50VP-19-07-XX-XX	165	65	135-139	Native Sample
		50VP-19-07-XX-XX	165	65	145-149	Native Sample
		50VP-19-07-XX-XX	165	65	155-159	Native Sample
	50VP-19-08*****	50VP-19-08-XX-XX	80	5	5-9	Native Sample
		50VP-19-08-XX-XX	80	5	15-19	Native Sample
		50VP-19-08-XX-XX	80	5	25-29	Native Sample
		50VP-19-08-XX-XX	80	5	35-39	Native Sample
		50VP-19-08-XX-XX	80	5	45-49	Native Sample
		50VP-19-08-XX-XX	80	5	55-59	Native Sample
		50VP-19-08-XX-XX	80	5	65-69	Native Sample
		50VP-19-08-XX-XX	80	5	75-79	Native Sample
	50VP-19-09	50VP-19-09-XX-XX	100	50	50-54	Native Sample
		50VP-19-09-XX-XX	100	50	60-64	Native Sample
		50VP-19-09-XX-XX	100	50	70-74	Native Sample
		50VP-19-09-XX-XX	100	50	80-84	Native Sample
		50VP-19-09-XX-XX	100	50	90-94	Native Sample
	50VP-19-10	50VP-19-10-XX-XX	105	50	50-54	Native Sample
		50VP-19-10-XX-XX	105	50	60-64	Native Sample
		50VP-19-10-XX-XX	105	50	70-74	Native Sample
		50VP-19-10-XX-XX	105	50	80-84	Native Sample
		50VP-19-10-XX-XX	105	50	90-94	Native Sample
		50VP-19-10-XX-XX	105	50	100-104	Native Sample
	50VP-19-11	50VP-19-11-XX-XX	105	50	50-54	Native Sample
		50VP-19-11-XX-XX	105	50	60-64	Native Sample
		50VP-19-11-XX-XX	105	50	70-74	Native Sample
		50VP-19-11-XX-XX	105	50	80-84	Native Sample
		50VP-19-11-XX-XX	105	50	90-94	Native Sample
		50VP-19-11-XX-XX	105	50	100-104	Native Sample
	50VP-19-12	50VP-19-12-XX-XX	105	50	50-54	Native Sample
		50VP-19-12-XX-XX	105	50	60-64	Native Sample
		50VP-19-12-XX-XX	105	50	70-74	Native Sample
		50VP-19-12-XX-XX	105	50	80-84	Native Sample
		50VP-19-12-XX-XX	105	50	90-94	Native Sample
		50VP-19-12-XX-XX	105	50	100-104	Native Sample
	50VP-19-13	50VP-19-13-XX-XX	115	65	65-69	Native Sample
		50VP-19-13-XX-XX	115	65	75-79	Native Sample
		50VP-19-13-XX-XX	115	65	85-89	Native Sample
		50VP-19-13-XX-XX	115	65	95-99	Native Sample
		50VP-19-13-XX-XX	115	65	105-109	Native Sample
	50VP-19-14	50VP-19-14-XX-XX	65	5	5-9	Native Sample
		50VP-19-14-XX-XX	65	5	15-19	Native Sample
		50VP-19-14-XX-XX	65	5	25-29	Native Sample
		50VP-19-14-XX-XX	65	5	35-39	Native Sample
		50VP-19-14-XX-XX	65	5	45-49	Native Sample
		50VP-19-14-XX-XX	65	5	55-59	Native Sample
	50VP-19-15	50VP-19-15-XX-XX	135	5	90-94	Native Sample
		50VP-19-15-XX-XX	135	5	100-104	Native Sample
		50VP-19-15-XX-XX	135	5	110-114	Native Sample
		50VP-19-15-XX-XX	135	5	120-124	Native Sample
		50VP-19-15-XX-XX	135	5	130-134	Native Sample
	50VP-19-16	50VP-19-16-XX-XX	108	61	63-67	Native Sample
		50VP-19-16-XX-XX	108	61	73-77	Native Sample
		50VP-19-16-XX-XX	108	61	83-87	Native Sample
		50VP-19-16-XX-XX	108	61	93-97	Native Sample
		50VP-19-16-XX-XX	108	61	103-107	Native Sample

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 50	50VP-19-17	50VP-19-17-XX-XX	96	57	63-67	Native Sample
		50VP-19-17-XX-XX	96	57	73-77	Native Sample
		50VP-19-17-XX-XX	96	57	83-87	Native Sample
		50VP-19-17-XX-XX	96	57	92-96	Native Sample
	50VP-19-18	50VP-19-18-XX-XX	96	57	63-67	Native Sample
		50VP-19-18-XX-XX	96	57	73-77	Native Sample
		50VP-19-18-XX-XX	96	57	83-87	Native Sample
		50VP-19-18-XX-XX	96	57	92-96	Native Sample
	50VP-19-19	50VP-19-19-XX-XX	96	57	63-67	Native Sample
		50VP-19-19-XX-XX	96	57	73-77	Native Sample
		50VP-19-19-XX-XX	96	57	83-87	Native Sample
		50VP-19-19-XX-XX	96	57	92-96	Native Sample
	50VP-19-20	50VP-19-20-XX-XX	96	57	63-67	Native Sample
		50VP-19-20-XX-XX	96	57	73-77	Native Sample
		50VP-19-20-XX-XX	96	57	83-87	Native Sample
		50VP-19-20-XX-XX	96	57	92-96	Native Sample
	50VP-19-21	50VP-19-21-XX-XX	108	61	63-67	Native Sample
		50VP-19-21-XX-XX	108	61	73-77	Native Sample
		50VP-19-21-XX-XX	108	61	83-87	Native Sample
		50VP-19-21-XX-XX	108	61	93-97	Native Sample
		50VP-19-21-XX-XX	108	61	103-107	Native Sample
	50VP-19-22	50VP-19-22-XX-XX	108	61	63-67	Native Sample
		50VP-19-22-XX-XX	108	61	73-77	Native Sample
		50VP-19-22-XX-XX	108	61	83-87	Native Sample
		50VP-19-22-XX-XX	108	61	93-97	Native Sample
		50VP-19-22-XX-XX	108	61	103-107	Native Sample
	50VP-19-23	50VP-19-23-XX-XX	96	57	63-67	Native Sample
		50VP-19-23-XX-XX	96	57	73-77	Native Sample
		50VP-19-23-XX-XX	96	57	83-87	Native Sample
		50VP-19-23-XX-XX	96	57	92-96	Native Sample
	50VP-19-24	50VP-19-24-XX-XX	96	57	63-67	Native Sample
		50VP-19-24-XX-XX	96	57	73-77	Native Sample
		50VP-19-24-XX-XX	96	57	83-87	Native Sample
		50VP-19-24-XX-XX	96	57	92-96	Native Sample
	50VP-19-25	50VP-19-25-XX-XX	115	65	65-69	Native Sample
		50VP-19-25-XX-XX	115	65	75-79	Native Sample
		50VP-19-25-XX-XX	115	65	85-89	Native Sample
		50VP-19-25-XX-XX	115	65	95-99	Native Sample
		50VP-19-25-XX-XX	115	65	105-109	Native Sample
QC Samples ***	20VP-19-XX	A3-VP-DUP-MMDDYY	NA	NA	NA	Field Duplicate
	20VP-19-XX	20VP-19-XX-XX	NA	NA	NA	MS/MSD
	NA	A3-VP-DUP-MMDDYY	NA	NA	NA	Equipment Blank
	NA	A3-VP-FRB-MMDDYY	NA	NA	NA	Field Blank

Notes:

All samples analyzed for PFAS via isotope dilution. Select samples will be analyzed for total oxidizable precussor assay and total organic carbon.

If additional groundwater vertical profiles are advanced at an AOC, the location identifiers, sample identifiers and QC sample identifiers will be sequential to the locations provided in the table above.

Vertical profiling at G6M-18-01 and G6M-18-02 is not included as it was conducted in October 2018 in support of the AOC 50 LTM program.

* Groundwater samples will be collected from the water table to refusal, except at 50VP-19-07 and -08 as indicated in Table 3 . Maximum target depth is anticipated depth to bedrock/glacial till based on depth to bedrock reported at AOC 50 (KGS, 2018d). The actual depths and number of sampling intervals at a given location may be more or less than anticipated, depending on field conditions observed during profiling.

** Approximate depth to groundwater and proposed sample depths are for planning purposes and are estimated from depth to water measurements at nearby temporary wells or long-term monitoring wells sampled during the SI (BERS-Weston, 2018a) or LTM monitoring (KGS, 2018b). Actual depth to water will be measured during advancement of the groundwater vertical profile borings and sample depths and sample nomenclature will be adjusted to reflect actual conditions measured at the time of groundwater vertical profiling.

*** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during the event. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used.

**** An attempt will be made to drill these locations with the drill rig, however, vertical profiling may be advanced to the maximum depth possible using a hand-held air percussion hammer to advance sampling rods. Final depth will be dependent on subsurface conditions encountered in the field.

***** 50VP-19-08 will be advance adjacent to existing monitoring well G6M-04-14X. Vertical profiling at this boring will be completed to 80 ft bgs, which is the depth to the top of the monitoring well screen at G6M-04-14X.

XX = Final sample name to be determined in the field. For the native samples XX-XX will represent the depth relative to ground surface of the sample interval. For the QC samples XX respresents the sample number and will be incremented as each sample is collected. MS/MSD samples will be identified in the notes of the chain of custody (i.e., a unique field sample identifier will not be used to denote a MS/MSD sample).

AOC = area of contamination
EB = equipment rinsate blank
FRB = field reagent blank
FD = field duplicate
ft bgs = feet below ground surface
LTM = long-term monitoring program
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
QC = quality control
SI = site inspection

Table 5
Area 3 Soil Boring Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs)**	Sample Type
AOC 20	20SB-19-01	20SB-19-01-0-0.5	0-0.5	60	Native Sample
		20SB-19-01-0.5-3	0.5-3	60	Native Sample
		20SB-19-01-3-7	3-7	60	Native Sample
		20SB-19-01-7-15	7-15	60	Native Sample
	20SB-19-02	20SB-19-02-0-0.5	0-0.5	60	Native Sample
		20SB-19-02-0.5-3	0.5-3	60	Native Sample
		20SB-19-02-3-7	3-7	60	Native Sample
		20SB-19-02-7-15	7-15	60	Native Sample
		20SB-18-02-58-60	58-60	60	Native Sample
	20SB-19-03	20SB-19-03-0-0.5	0-0.5	60	Native Sample
		20SB-19-03-0.5-3	0.5-3	60	Native Sample
		20SB-19-03-3-7	3-7	60	Native Sample
		20SB-19-03-7-15	7-15	60	Native Sample
	20SB-19-04	20SB-19-04-0-0.5	0-0.5	60	Native Sample
		20SB-19-04-0.5-3	0.5-3	60	Native Sample
		20SB-19-04-3-7	3-7	60	Native Sample
		20SB-19-04-7-15	7-15	60	Native Sample
		20SB-18-04-58-60	58-60	60	Native Sample
	20SB-19-05	20SB-19-05-0-0.5	0-0.5	60	Native Sample
		20SB-19-05-0.5-3	0.5-3	60	Native Sample
		20SB-19-05-3-7	3-7	60	Native Sample
		20SB-19-05-7-15	7-15	60	Native Sample
	20SB-19-06	20SB-19-06-0-0.5	0-0.5	60	Native Sample
		20SB-19-06-0.5-3	0.5-3	60	Native Sample
		20SB-19-06-3-7	3-7	60	Native Sample
		20SB-19-06-7-15	7-15	60	Native Sample
	20SB-19-07	20SB-19-07-0-0.5	0-0.5	60	Native Sample
		20SB-19-07-0.5-3	0.5-3	60	Native Sample
		20SB-19-07-3-7	3-7	60	Native Sample
		20SB-19-07-7-15	7-15	60	Native Sample
	20SB-19-08	20SB-19-08-0-0.5	0-0.5	60	Native Sample
		20SB-19-08-0.5-3	0.5-3	60	Native Sample
		20SB-19-08-3-7	3-7	60	Native Sample
		20SB-19-08-7-15	7-15	60	Native Sample
		20SB-18-08-58-60	58-60	60	Native Sample
AOC 21	21SB-19-01	21SB-19-01-0-0.5	0-0.5	30	Native Sample
		21SB-19-01-0.5-3	0.5-3	30	Native Sample
		21SB-19-01-3-7	3-7	30	Native Sample
		21SB-19-01-7-15	7-15	30	Native Sample
		21SB-19-01-28-30	28-30	30	Native Sample
	21SB-19-02	21SB-19-02-0-0.5	0-0.5	30	Native Sample
		21SB-19-02-0.5-3	0.5-3	30	Native Sample
		21SB-19-02-3-7	3-7	30	Native Sample
		21SB-19-02-7-15	7-15	30	Native Sample
	21SB-19-03	21SB-19-03-0-0.5	0-0.5	30	Native Sample
		21SB-19-03-0.5-3	0.5-3	30	Native Sample
		21SB-19-03-3-7	3-7	30	Native Sample
		21SB-19-03-7-15	7-15	30	Native Sample
AOC 30	30SB-19-01	30SB-19-01-0-0.5	0-0.5	65	Native Sample
		30SB-19-01-0.5-3	0.5-3	65	Native Sample
		30SB-19-01-3-7	3-7	65	Native Sample
		30SB-19-01-7-15	7-15	65	Native Sample
		30SB-19-01-63-65	63-65	65	Native Sample

Table 5
Area 3 Soil Boring Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs)**	Sample Type
AOC 30	30SB-19-02	30SB-19-02-0-0.5	0-0.5	65	Native Sample
		30SB-19-02-0.5-3	0.5-3	65	Native Sample
		30SB-19-02-3-7	3-7	65	Native Sample
		30SB-19-02-7-15	7-15	65	Native Sample
	30SB-19-03	30SB-19-03-0-0.5	0-0.5	65	Native Sample
		30SB-19-03-0.5-3	0.5-3	65	Native Sample
		30SB-19-03-3-7	3-7	65	Native Sample
		30SB-19-03-7-15	7-15	65	Native Sample
	30SB-19-04	30SB-19-04-0-0.5	0-0.5	65	Native Sample
		30SB-19-04-0.5-3	0.5-3	65	Native Sample
		30SB-19-04-3-7	3-7	65	Native Sample
		30SB-19-04-7-15	7-15	65	Native Sample
		30SB-19-04-68-70	63-65	65	Native Sample
	30SB-19-05	30SB-19-05-0-0.5	0-0.5	65	Native Sample
		30SB-19-05-0.5-3	0.5-3	65	Native Sample
		30SB-19-05-3-7	3-7	65	Native Sample
		30SB-19-05-7-15	7-15	65	Native Sample
	30SB-19-06	30SB-19-06-0-0.5	0-0.5	65	Native Sample
		30SB-19-06-0.5-3	0.5-3	65	Native Sample
		30SB-19-06-3-7	3-7	65	Native Sample
		30SB-19-06-7-15	7-15	65	Native Sample
AOC 31	31SB-19-01	31SB-19-01-0-0.5	0-0.5	65	Native Sample
		31SB-19-01-0.5-3	0.5-3	65	Native Sample
		31SB-19-01-3-7	3-7	65	Native Sample
		31SB-19-01-7-15	7-15	65	Native Sample
		31SB-19-01-63-65	63-65	65	Native Sample
	31SB-19-02	31SB-19-02-0-0.5	0-0.5	65	Native Sample
		31SB-19-02-0.5-3	0.5-3	65	Native Sample
		31SB-19-02-3-7	3-7	65	Native Sample
		31SB-19-02-7-15	7-15	65	Native Sample
	31SB-19-03	31SB-19-03-0-0.5	0-0.5	65	Native Sample
		31SB-19-03-0.5-3	0.5-3	65	Native Sample
		31SB-19-03-3-7	3-7	65	Native Sample
		31SB-19-03-7-15	7-15	65	Native Sample
	31SB-19-04	31SB-19-04-0-0.5	0-0.5	65	Native Sample
		31SB-19-04-0.5-3	0.5-3	65	Native Sample
		31SB-19-04-3-7	3-7	65	Native Sample
		31SB-19-04-7-15	7-15	65	Native Sample
	31SB-19-05	31SB-19-05-0-0.5	0-0.5	65	Native Sample
		31SB-19-05-0.5-3	0.5-3	65	Native Sample
		31SB-19-05-3-7	3-7	65	Native Sample
		31SB-19-05-7-15	7-15	65	Native Sample
	31SB-19-06	31SB-19-06-0-1	0-1	65	Native Sample
		31SB-19-06-3-7	3-7	65	Native Sample
	31SB-19-07	31SB-19-05-0-1	0-1	65	Native Sample
		31SB-19-05-3-7	3-7	65	Native Sample
	31SB-19-08	31SB-19-08-0-0.5	0-0.5	67	Native Sample
		31SB-19-08-0.5-3	0.5-3	67	Native Sample
		31SB-19-08-3-7	3-7	67	Native Sample
		31SB-19-08-7-15	7-15	67	Native Sample
		31SB-19-08-65-67	65-67	67	Native Sample
AOC 50	50SB-19-01	50SB-19-01-0-0.5	0-0.5	55	Native Sample
		50SB-19-01-0.5-3	0.5-3	55	Native Sample
		50SB-19-01-3-7	3-7	55	Native Sample
		50SB-19-01-7-15	7-15	55	Native Sample

Table 5
Area 3 Soil Boring Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs)**	Sample Type
AOC 50	50SB-19-02	50SB-19-02-0-0.5	0-0.5	55	Native Sample
		50SB-19-02-0.5-3	0.5-3	55	Native Sample
		50SB-19-02-3-7	3-7	55	Native Sample
		50SB-19-02-7-15	7-15	55	Native Sample
		50SB-19-02-53-55	53-55	55	Native Sample
	50SB-19-03	50SB-19-03-0-0.5	0-0.5	55	Native Sample
		50SB-19-03-0.5-3	0.5-3	55	Native Sample
		50SB-19-03-3-7	3-7	55	Native Sample
		50SB-19-03-7-15	7-15	55	Native Sample
		50SB-19-03-53-55	53-55	55	Native Sample
	50SB-19-04	50SB-19-04-0-0.5	0-0.5	55	Native Sample
		50SB-19-04-0.5-3	0.5-3	55	Native Sample
		50SB-19-04-3-7	3-7	55	Native Sample
		50SB-19-04-7-15	7-15	55	Native Sample
	50SB-19-05	50SB-19-05-0-0.5	0-0.5	55	Native Sample
		50SB-19-05-0.5-3	0.5-3	55	Native Sample
		50SB-19-05-3-7	3-7	55	Native Sample
		50SB-19-05-7-15	7-15	55	Native Sample
	50SB-19-06	50SB-19-06-0-0.5	0-0.5	55	Native Sample
		50SB-19-06-0.5-3	0.5-3	55	Native Sample
		50SB-19-06-3-7	3-7	55	Native Sample
		50SB-19-06-7-15	7-15	55	Native Sample
		50SB-19-06-53-55	53-55	55	Native Sample
	50SB-19-07	50SB-19-07-0-0.5	0-0.5	55	Native Sample
		50SB-19-07-0.5-3	0.5-3	55	Native Sample
		50SB-19-07-3-7	3-7	55	Native Sample
		50SB-19-07-7-15	7-15	55	Native Sample
	50SB-19-08	50SB-19-08-0-0.5	0-0.5	55	Native Sample
		50SB-19-08-0.5-3	0.5-3	55	Native Sample
		50SB-19-08-3-7	3-7	55	Native Sample
		50SB-19-08-7-15	7-15	55	Native Sample
	50SB-19-09	50SB-19-09-0-0.5	0-0.5	55	Native Sample
		50SB-19-09-0.5-3	0.5-3	55	Native Sample
		50SB-19-09-3-7	3-7	55	Native Sample
		50SB-19-09-7-15	7-15	55	Native Sample
	50SB-19-10	50SB-19-10-0-0.5	0-0.5	55	Native Sample
		50SB-19-10-0.5-3	0.5-3	55	Native Sample
		50SB-19-10-3-7	3-7	55	Native Sample
		50SB-19-10-7-15	7-15	55	Native Sample
	50SB-19-11	50SB-19-11-0-0.5	0-0.5	52	Native Sample
		50SB-19-11-0.5-3	0.5-3	52	Native Sample
		50SB-19-11-3-7	3-7	52	Native Sample
		50SB-19-11-7-15	7-15	52	Native Sample
	50SB-19-12	50SB-19-12-0-0.5	0-0.5	62	Native Sample
		50SB-19-12-0.5-3	0.5-3	62	Native Sample
		50SB-19-12-3-7	3-7	62	Native Sample
		50SB-19-12-7-15	7-15	62	Native Sample
	50SB-19-13	50SB-19-13-0-0.5	0-0.5	57	Native Sample
		50SB-19-13-0.5-3	0.5-3	57	Native Sample
		50SB-19-13-3-7	3-7	57	Native Sample
		50SB-19-13-7-15	7-15	57	Native Sample
		50SB-19-13-55-57	55-57	57	Native Sample
	50SB-19-14	50SB-19-14-0-0.5	0-0.5	57	Native Sample
		50SB-19-14-0.5-3	0.5-3	57	Native Sample
		50SB-19-14-3-7	3-7	57	Native Sample
		50SB-19-14-7-15	7-15	57	Native Sample
		50SB-19-14-55-57	55-57	57	Native Sample

Table 5
Area 3 Soil Boring Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs)**	Sample Type
AOC 50	50SB-19-15	50SB-19-15-0-0.5	0-0.5	57	Native Sample
		50SB-19-15-0.5-3	0.5-3	57	Native Sample
		50SB-19-15-3-7	3-7	57	Native Sample
		50SB-19-15-7-15	7-15	57	Native Sample
		50SB-19-55-57	55-57	57	Native Sample
	50SB-19-16	50SB-19-16-0-0.5	0-0.5	57	Native Sample
		50SB-19-16-0.5-3	0.5-3	57	Native Sample
		50SB-19-16-3-7	3-7	57	Native Sample
		50SB-19-16-7-15	7-15	57	Native Sample
		50SB-19-16-55-57	55-57	57	Native Sample
	50SB-19-17	50SB-19-17-0-0.5	0-0.5	57	Native Sample
		50SB-19-17-0.5-3	0.5-3	57	Native Sample
		50SB-19-17-3-7	3-7	57	Native Sample
		50SB-19-17-7-15	7-15	57	Native Sample
		50SB-19-18-55-57	55-57	57	Native Sample
	50SB-19-18	50SB-19-18-0-0.5	0-0.5	57	Native Sample
		50SB-19-18-0.5-3	0.5-3	57	Native Sample
		50SB-19-18-3-7	3-7	57	Native Sample
		50SB-19-18-7-15	7-15	57	Native Sample
		50SB-19-18-55-57	55-57	57	Native Sample
QC Samples ***	20SB-19-01	A3-SB-DUP-MMDDYY	NA	NA	Field Duplicate
	20SB-19-02	20SB-19-02-3-7	NA	NA	MS/MSD
	NA	A3-SB-EB-MMDDYY	NA	NA	Equipment Blank
	NA	A3-SB-FRB-MMDDYY	NA	NA	Field Blank

Notes:

All samples analyzed for PFAS via isotope dilution. Select samples will be analyzed for total oxidizable precussor assay and total organic carbon.

If additional soil sampling locations are established at an AOC, the location identifiers, sample identifiers and QC sample identifiers will be sequential to the locations provided in the table above.

* Sample name may be modified in the field depending on sample depth.

** Approximate depth to groundwater is for planning purposes and is estimated from the water table elevations observed at nearby temporary wells or long-term monitoring wells sampled during the SI and LTM activities. Actual depth to water will be measured during advancement of the soil borings and the final depth of soil sampling intervals will end at the water table at locations where the water table is less than 15 feet. If the water table is encountered at a depth less than 17 ft bgs then the final soil sampling interval at the boring will be shortened by the appropriate amount to collect a separate 2-foot sample just above the water table to assess leaching threat to groundwater.

**** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week, the FRB will be collected is at least once during each sampling event. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used. Field quality control samples will not be collected for total oxidizable precussor analysis.

AOC = area of contamination
ft bgs = feet below ground surface
LTM = long-term monitoring
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
QC = quality control
SI = site inspection

XX = Final sample name to be determined in the field. For the QC samples XX respresents the sample number and will be incremented as each sample is collected. MS/MSD samples will be identified in the notes of the chain of custody (i.e., a unique field sample identifier will not be used to denote a MS/MSD sample).

Table 6
Area 3 New Monitoring Well Rationale
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Number of New Monitoring Wells	Rationale	Field Lithologic Classification	Screen Settings	TOC in Soil	Grain-Size Analysis
AOCs 20/21					
2	Installation of up to two new piezometers screened at the water table is planned. These piezometers will be used to measure depth to water and calculate groundwater flow direction to the west of AOC 20. The locations of piezometers were selected to support calculation of groundwater flow direction and may or may not be used as a potential groundwater monitoring location for PFAS.	No	TBD	No	No
4	Installation of up to four new overburden wells is planned to augment the existing monitoring well network. Locations will be based on a review of vertical profile data. The groundwater monitoring well network will be designed to monitor groundwater within the PFAS plume as well as provide bounding wells upgradient, cross gradient and downgradient of the plume.	Yes - at select locations from the water table to the bottom of the boring.	TBD	Soil samples collected at select locations will be submitted for TOC analysis.	Soil samples collected from select intervals at select locations will be submitted for grain-size analysis.
AOCs 30, 31, 50					
9	Installation of up to nine new piezometers screened at the water table is planned. These piezometers will be used to measure depth to water and calculate groundwater flow direction in the northwestern and southeastern portions of the MAAF. The locations of piezometers were selected to support calculation of groundwater flow direction and may or may not be used as a potential groundwater monitoring location for PFAS.	No	TBD	No	No
10	Installation of up to ten new overburden monitoring wells is planned. Locations will be based on a review of vertical profile data. The groundwater monitoring well network at the MAAF will be designed to monitor the groundwater within the PFAS plume as well as provide bounding wells upgradient, cross gradient and downgradient of the plume.	Yes - at select locations from the water table to the bottom of the boring.	TBD	Soil samples collected at select locations will be submitted for TOC analysis.	Soil samples collected from select intervals at select locations will be submitted for grain-size analysis.

Notes:
AOC = area of contamination
TBD = to be determined. Screen settings will be determined in consultation with the stakeholders after a review of the groundwater data.
TOC = total organic carbon

Table 7
Area 3 Soil Sampling During New Monitoring Well Installation Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs)**	Sample Type**
AOC 20/21	21MW-19-01X	21MW-19-01X-SO-XX-XX	TBD	Native Sample
	21MW-19-02X	21MW-19-02X-SO-XX-XX	TBD	Native Sample
	21MW-19-03X	21MW-19-03X-SO-XX-XX	TBD	Native Sample
	21MW-19-04X	21MW-19-04X-SO-XX-XX	TBD	Native Sample
AOCs 31, 31, and 50	G6M-19-01X	G6M-19-01X-SO-XX-XX	TBD	Native Sample
	G6M-19-02X	G6M-19-02X-SO-XX-XX	TBD	Native Sample
	G6M-19-03X	G6M-19-03X-SO-XX-XX	TBD	Native Sample
	30M-19-01X	30M-19-01X-SO-XX-XX	TBD	Native Sample
	30M-19-02X	30M-19-02X-SO-XX-XX	TBD	Native Sample
	30M-19-03X	30M-19-03X-SO-XX-XX	TBD	Native Sample
	31M-19-01X	31M-19-01X-SO-XX-XX	TBD	Native Sample
	31M-19-02X	31M-19-02X-SO-XX-XX	TBD	Native Sample
	31M-19-03X	31M-19-03X-SO-XX-XX	TBD	Native Sample
	31M-19-04X	31M-19-04X-SO-XX-XX	TBD	Native Sample
QC Samples**	21MW-19-02	A3-MW-SO-DUP-MMDDYY		Field Duplicate
	31M-19-03	A3-MW-SO-DUP-MMDDYY		Field Duplicate
	21MW-19-02	21MW-19-02X-SO-XX-XX		Matrix Spike Duplicate
	NA	A3-MW-SO-EB-MMDDYY		Equipment Blank
	NA	A3-MW-SO-FRB-MMDDYY		Field Reagent Blank

Notes:
Selected samples will be analzyed for total organic carbon, and grain size.

* It is estimated locations at each area of investigation will be drilled during monitoring well installation and soil samples may be collected at that time. The exact locations are not known. The locations where samples will be collected will be determined before the locations are drilled.

** Sample name will be determined in the field depending on sample depth. The sample depth will be determined before the locations are drilled.

*** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during each sampling event. The frequency will be applied to all of Area 3. Equipment blanks only collected if non-disposal equipment is used. Field quality control samples will not be collected for total oxidizable precussor analysis.

AOC = area of contamination
EB = equipment blank
FD = field duplicate
FRB = field reagant blank
MS/MSD = matrix spike/matrix spike duplicate
TBD = to be determined
QC = quality control

XX = Final sample name to be determined in the field. MS/MSD samples will be identified in the notes of the chain of custody (i.e., a unique field sample identifier will not be used to denote a MS/MSD sample).

Table 8
Area 3 New Monitoring Well Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Sample Type**
AOC 20/21	21MW-19-01X	21MW-19-01-MONYY	Native Sample
	21MW-19-02X	21MW-19-02-MONYY	Native Sample
	21MW-19-03X	21MW-19-03-MONYY	Native Sample
	21MW-19-04X	21MW-19-04-MONYY	Native Sample
MAAF (AOCs 31, 31, and 50)	G6M-19-01X	G6M-19-01-MONYY	Native Sample
	G6M-19-02X	G6M-19-02-MONYY	Native Sample
	G6M-19-03X	G6M-19-03-MONYY	Native Sample
	30M-19-01X	30M-19-01-MONYY	Native Sample
	30M-19-02X	30M-19-02-MONYY	Native Sample
	30M-19-03X	30M-19-03-MONYY	Native Sample
	31M-19-01X	31M-19-01-MONYY	Native Sample
	31M-19-02X	31M-19-02-MONYY	Native Sample
	31M-19-03X	31M-19-03-MONYY	Native Sample
	31M-19-04X	31M-19-04-MONYY	Native Sample
QC Samples**	21MW-19-02X	A3-MW-DUP-MMDDYY	Field Duplicate
	31M-19-03X	A3-MW-DUP-MMDDYY	Field Duplicate
	21MW-19-02X	21MW-19-02X-MONYY	Matrix Spike Duplicate
	NA	A3-MW-EB-MMDDYY	Equipment Blank
	NA	A3-MW-FRB-MMDDYY	Field Reagent Blank

Notes:

Notes:

All samples will be analyzed for PFAS via isotope dilution. Select samples will be analyzed for total oxidizable precursor assay and dissolved organic carbon.

* = The sample name will consist of the well identifier followed by the month and the year the sample was collected. The month will be represented by three letters and the year by two numbers.

** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during each sampling event per AOC. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used. Field quality control samples will not be collected for total oxidizable precursor analysis.

AOC = area of contamination
EB = equipment blank
FD = field duplicate
FRB = field reagent blank
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control

Table 9
Area 3 Existing Monitoring Well Construction Information - AOC 50
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Well ID	Well Screen Interval (ft bgs)	Well Screen Elevation (ft NGVD88)	Top of Casing Elevation (ft NGVD88)	Comment
Monitoring Wells				
G6M-92-10X	9-19	217.4-207.4	225.08	
G6M-92-11X	8.5-18.5	213.9-203.9	224.89	
G6M-93-13X	9-19	213.9-203.9	224.83	
G6M-94-15A	33-43	217.7-207.7	252.88	
G6M-95-19X	48-58	174-164	223.89	
G6M-95-20X	18-23	204.2-199.2	224.61	
G6M-96-13B	52.3-62.3	170.7-160.7	224.98	
G6M-96-22A	40-50	175.5-165.5	217.59	
G6M-96-22B	65.5-70.5	150.1-145.1	217.56	
G6M-96-25A	9-18.7	214.3-204.6	225.52	
G6M-96-25B	48-58	175.2-165.2	225.64	
G6M-96-26A	8-18	214.9-204.9	224.56	
G6M-96-26B	68-78	154.5-144.5	224.40	
G6M-97-05B	130-135	135.94-130.94	268.12	
G6M-97-08B	89.5-94.5	173.9-168.9	263.05	
G6M-97-09B	71.5-81.5	185.8-175.8	260.05	
G6M-97-27X	25-30	197-192	224.50	
G6M-97-28X	100-105	163.1-158.1	265.69	
G6M-97-29X	179-189	85.1-75.1	266.15	
G6M-98-30X	60-65	160.2-155.2	222.74	
G6M-98-32X	130-135	134.2-129.2	266.41	
G6M-01-01X	130-150	133.3-113.3	265.67	
G6M-02-01X	80-95	183-168	262.44	
G6M-02-02X	80-95	183.3-168.3	262.98	
G6M-02-03X	90-105	173.6-158.6	263.03	
G6M-02-04X	90-105	172.8-157.8	264.92	
G6M-02-05X	120-135	144.6-129.6	265.70	
G6M-02-06X	55-65	152.7-142.7	209.73	
G6M-02-07X	30-40	178.7-168.7	210.72	
G6M-02-08X	60-70	162.4-152.4	224.23	
G6M-02-09X	90-105	174.8-159.8	264.10	
G6M-02-10X	125-135	151.4-141.4	265.77	
G6M-02-11X	125-135	139.2-129.2	263.93	
G6M-02-12X	125-135	137.6-127.6	262.46	
G6M-02-13X	110-120	154-144	263.61	
G6M-02-31BR	85-95	178.3-168.3	255.71	
G6M-03-01X	50-70	172.5-152.5	225.09	
G6M-03-02X	28-43	172.4-157.4	224.31	
G6M-03-04X	15-30	207.5-192.5	225.20	
G6M-03-05B	UKN	UKN	UKN	

Table 9
Area 3 Existing Monitoring Well Construction Information - AOC 50
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Well ID	Well Screen Interval (ft bgs)	Well Screen Elevation (ft NGVD88)	Top of Casing Elevation (ft NGVD88)	Comment
G6M-03-07X	80-90	182.8-172.8	262.66	
G6M-03-08X	125-140	131.4-116.4	258.60	
G6M-03-09X	125-140	131.6-116.6	258.89	
G6M-03-10X	120-135	143.4-128.4	265.81	
G6M-03-11X	115-130	148.7-133.7	265.62	
G6M-04-01X	82-92	179.69-169.69	261.15	
G6M-04-02X	80-90	183.69-174.18	266.55	
G6M-04-03X	85-95	179.81-169.81	264.29	
G6M-04-04X	94-104	158.87-168.87	262.66	
G6M-04-05X	100-110	156.53-146.53	258.13	
G6M-04-06X	95-105	167.27-157.27	263.97	
G6M-04-07X	120-130	141.88-131.88	263.82	
G6M-04-08X	80-90	129.9-119.9	209.55	
G6M-04-09X	55-65	187.66-177.66	242.66	
G6M-04-10X	52-62	170.12-160.12	224.22	
G6M-04-10A	30-40	192.22-182.22	224.02	
G6M-04-11X	35-45	192.62-182.62	229.47	
G6M-04-12X	54-64	169.86-159.86	225.61	dry in 2019
G6M-04-13X	30-40	193.91-183.91	225.88	
G6M-04-14X	80-90	130.76-120.76	210.61	
G6M-04-15X	70-80	181.65-171.65	253.23	
G6M-04-22X	74-84	179.95-169.95	255.89	
G6M-04-31X	68-78	186.03-176.03	255.91	
G6M-05-02X	109-129	Not surveyed	Not surveyed	
G6M-06-01X	106-126	157.74-137.74	263.74	
G6M-07-01X	78-98	184.1-164.1	262.1	
G6M-07-02X	22.5-27.5	200.38-195.38	225.1	
G6M-13-01X	125-135	140.2-130.2	266.82	
G6M-13-02X	115-125	148.82-138.82	263.82	
G6M-13-03X	80-90	184.39-174.37	264.37	
G6M-13-04X	125-135	138.81-128.81	266.31	
G6M-13-05X	45-55	177.5-167.5	225.0	substituted for G6M-04-12X that was dry
G6M-13-06X	50-60	171.87-161.87	224.37	
G6P-97-05X	33-43	201.59-191.59	236.72	
MW-1	126-136	138.1-128.1	266.30	
MW-2	126-136	140.1-130.1	266.12	
MW-3	126-137	137.9-127.9	265.75	
MW-4	126-136	138.2-128.2	266.19	
MW-5	126-136	137.4-127.4	265.66	
MW-6	125-135	128.8-118.8	265.20	
MW-7	125-135	138.9-128.9	264.97	
MW-7 (IT)	22-32	213.2-203.2	UKN	

Table 9
Area 3 Existing Monitoring Well Construction Information - AOC 50
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Well ID	Well Screen Interval (ft bgs)	Well Screen Elevation (ft NGVD88)	Top of Casing Elevation (ft NGVD88)	Comment
Injection Wells				
IW-38/ G6M-94-18X	22.5-27.5	200.3-190.3	225.05	
Microwells				
XSA-00-88X	139.5-144.5	127.72-122.72	269.22	unable to sample due to corroded
XSA-00-89X	127-132	139.67-134.67	268.67	
XSA-00-90X	155.9-160.9	108.12-103.12	266.24	unable to sample due to corroded
XSA-00-91X	UKN	UKN	UKN	unable to sample due to corroded
XSA-12-95X	120 - 130	146.63-136.63	269.63	
XSA-12-96X	120 - 130	147.02-137.02	269.99	
XSA-12-97X	119.75-129.75	148.16-138.16	270.78	
XSA-12-98X	60 - 70	146.64-136.64	209.61	

bgs = below ground surface

ft = feet

NGVD29 = National Geodetic Vertical Datum 29

Wells designated to be sampled in RI

Changes were made based on field conditions, as noted in the comments.

UKN = unknown

Table 10
Area 3 Surface Water and Sediment Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name *	Sample Matrix	Sample Type	Sample Location **
Nashua River	NR-19-01	NR-SW-19-01-MONYY	surface water	Native Sample	Upstream of Dam
		NR-SED-19-01-MONYY	sediment	Native Sample	
	NR-19-02	NR-SW-19-02-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-02-MONYY	sediment	Native Sample	
	NR-19-03	NR-SW-19-03-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-03-MONYY	sediment	Native Sample	
	NR-19-04	NR-SW-19-04-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-04-MONYY	sediment	Native Sample	
	NR-19-05	NR-SW-19-05-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-05-MONYY	sediment	Native Sample	
	NR-19-06	NR-SW-19-06-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-06-MONYY	sediment	Native Sample	
	NR-19-07	NR-SW-19-07-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-07-MONYY	sediment	Native Sample	
	NR-19-08	NR-SW-19-08-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-08-MONYY	sediment	Native Sample	
	NR-19-09	NR-SW-19-09-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-09-MONYY	sediment	Native Sample	
	NR-19-10	NR-SW-19-10-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-10-MONYY	sediment	Native Sample	
	NR-19-11	NR-SW-19-11-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-11-MONYY	sediment	Native Sample	
	NR-19-12	NR-SW-19-12-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-12-MONYY	sediment	Native Sample	
	NR-19-13	NR-SW-19-13-MONYY	surface water	Native Sample	Located downstream of potential inputs from Devens
		NR-SED-19-13-MONYY	sediment	Native Sample	
	NR-19-14	NR-SW-19-14-MONYY	surface water	Native Sample	Located downstream of potential inputs from Devens
		NR-SED-19-14-MONYY	sediment	Native Sample	
	NR-19-15	NR-SW-19-15-MONYY	surface water	Native Sample	Located along depositional area along the west bank adjacent to AOC 20/21
		NR-SED-19-15-MONYY	sediment	Native Sample	

Table 10
Area 3 Surface Water and Sediment Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name *	Sample Matrix	Sample Type	Sample Location **
	NR-19-16	NR-SW-19-16-MONYY	surface water	Native Sample	Located along depositional area along the east bank adjacent to AOC 50
		NR-SED-19-16-MONYY	sediment	Native Sample	
	NR-19-17	NR-SW-19-17-MONYY	surface water	Native Sample	Located along depositional area along the west bank across from AOC 31 and 50
		NR-SED-19-17-MONYY	sediment	Native Sample	
	NR-19-18	NR-SW-19-18-MONYY	surface water	Native Sample	Located along depositional area along the east bank adjacent to AOC 31
		NR-SED-19-18-MONYY	sediment	Native Sample	
	NR-19-19	NR-SW-19-19-MONYY	surface water	Native Sample	Located along depositional area along the west bank across from AOC 31 and 50
		NR-SED-19-19-MONYY	sediment	Native Sample	
	NR-19-20	NR-SW-19-20-MONYY	surface water	Native Sample	Located along depositional area along the east bank north of AOC 31
		NR-SED-19-20-MONYY	sediment	Native Sample	
	NR-19-21	NR-SW-19-21-MONYY	surface water	Native Sample	Located along depositional area along the west bank north of AOC 31
		NR-SED-19-21-MONYY	sediment	Native Sample	
	NR-19-22	NR-SW-19-22-MONYY	surface water	Native Sample	Located along depositional area along the west bank adjacent north of AOC 30
		NR-SED-19-22-MONYY	sediment	Native Sample	
Unnamed Stream Adjacent to AOC 21	US -19-01	US-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		US-SED-19-01-MONYY	sediment	Native Sample	
Unnamed Pond North of AOC 20	UP-19-01	UP-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		UP-SED-19-01-MONYY	sediment	Native Sample	
Air Field Wetland (to the West of former MAAF)	AFW-19-01	AFW-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		AFW-SED-19-01-MONYY	sediment	Native Sample	
	AFW-19-02	AFW-SW-19-02-MONYY	surface water	Native Sample	Shoreline
		AFW-SED-19-02-MONYY	sediment	Native Sample	

Table 10
Area 3 Surface Water and Sediment Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name *	Sample Matrix	Sample Type	Sample Location **
Surface Water and Sediment QC Samples ***	NR-19-02	A3-SW-DUP-MMDDYY	surface water	Field Duplicate	West bank of Nashua River channel
		A3-SED-DUP-MMDDYY	sediment	Field Duplicate	
	NR-19-12	A3-SW-DUP-MMDDYY	surface water	Field Duplicate	East bank of Nashua River channel
		A3-SED-DUP-MMDDYY	sediment	Field Duplicate	
	NR-19-05	NR-SW-19-05-MONYY	surface water	Matrix Spike	West bank of Nashua River channel
		NR-SED-19-05-MONYY	sediment	Matrix Spike	
	NA	A3-SW-EB-MMDDYY	surface water	Equipment Blank	NA
	NA	A3-SED-EB-MMDDYY	sediment	Equipment Blank	
	NA	A3-SW-FRB-MMDDYY	NA	Field Reagent Blank	NA

Notes:

All samples will be analyzed for PFAS via isotope dilution. Analyte list is specified in UFP-QAPP Worksheet #15. Select samples will also be analyzed for Total Organic Carbon and grain size.

* = The sample name will consist of the location, followed by the matrix code, followed by the month and the year the sample was collected. The month will be represented by three letters and the year by two numbers.

**Main Channel: Samples will be collected from the main channel. Shoreline: Samples will be collected from the edge of the wetland system by accessing the shoreline by foot and wading approximately 3 feet from shore. All samples should be collected in an area that is conducive to deposition (i.e., away from areas of turbulent flow and/or wave action).

*** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during the sampling event. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used.

EB = equipment blank
FD = field duplicate
FRB = field reagant blank
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
QC = quality control

Table 11
Background Surface Water and Sediment Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name *	Sample Matrix	Sample Type	Sample Location **
Nashua River	NRBK-19-01	NRBK-SW-19-01-MONYY	surface water	Native Sample	Upstream of Dam, Shoreline
		NRBK-SED-19-01-MONYY	sediment	Native Sample	
	NRBK-19-02	NRBK-SW-19-02-MONYY	surface water	Native Sample	Shoreline
		NRBK-SED-19-02-MONYY	sediment	Native Sample	
Bowers Brook	BB-19-01	BB-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		BB-SED-19-01-MONYY	sediment	Native Sample	
	BB-19-02	BB-SW-19-02-MONYY	surface water	Native Sample	Shoreline
		BB-SED-19-02-MONYY	sediment	Native Sample	
Balch Pond	BP-18-01	BP-SW-18-01-MONYY	surface water	Native Sample	Shoreline
		BP-SED-18-01-MONYY	sediment	Native Sample	
	BP-19-01	BP-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		BP-SED-19-01-MONYY	sediment	Native Sample	
Flannagan Pond	FP-19-01	FP-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		FP-SED-19-01-MONYY	sediment	Native Sample	
	FP-19-02	FP-SW-19-02-MONYY	surface water	Native Sample	Shoreline
		FP-SED-19-02-MONYY	sediment	Native Sample	
	FP-19-03	FP-SW-19-03-MONYY	surface water	Native Sample	Shoreline
		FP-SED-19-03-MONYY	sediment	Native Sample	
Walker Brook	WAB-19-01	WAB-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		WAB-SED-19-01-MONYY	sediment	Native Sample	
Mulphus Brook	MB-19-01	MB-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		MB-SED-19-01-MONYY	sediment	Native Sample	
Squannacook River	SR-19-01	SR-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		SR-SED-19-01-MONYY	sediment	Native Sample	
Background Surface Water and Sediment QC Samples ***	NRBK-19-02	BK-SW-DUP-MMDDYY	surface water	Field Duplicate	Shoreline
		BK-SED-DUP-MMDDYY	sediment	Field Duplicate	
	FP-19-02	FP-SW-19-02-MONYY	surface water	Matrix Spike	Shoreline
		FP-SED-19-02-MONYY	sediment	Matrix Spike	
	NA	BK-SW-EB-MMDDYY	surface water	Equipment Blank	NA
	NA	BK-SED-EB-MMDDYY	sediment	Equipment Blank	
	NA	BK-SW-FRB-MMDDYY	NA	Field Reagent Blank	NA

Notes:

All samples will be analyzed for PFAS via isotope dilution. Analyte list is specified in UFP-QAPP Worksheet #15. Select samples will also be analyzed for Total Organic Carbon and grain size.

* = The sample name will consist of the location, followed by the matrix code, followed by the month and the year the sample was collected. The month will be represented by three letters and the year by two numbers.

**Shoreline: Samples will be collected from the edge of the wetland system by accessing the shoreline by foot and wading approximately 3 feet from shore. All samples should be collected in an area that is conducive to deposition (i.e., away from areas of turbulent flow and/or wave action).

*** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during the sampling event. The frequency will be applied to all of the background data. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used.

EB = equipment blank
FD = field duplicate
FRB = field reagant blank
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
QC = quality control
TBD = to be determined

APPENDIX A
Referenced PFAS RI QAPP Worksheets

QAPP WORKSHEET #3: DISTRIBUTION LIST FOR DEVENS

QAPP Recipients	Title	Organization	E-mail Address
Mark Applebee	Program Manager	KGS	mapplebee@komangs.com
James Ropp	Project Manager (PM)	KGS	jropp@komangs.com
John Rawlings	Corporate Director of Safety and Quality Control	KOMAN	jrawlings@komaninc.com
Katherine Thomas	Technical Lead	KGS	kthomas@komangs.com
Kevin Anderson	KGS Field Team Lead	KGS	kanderson@komangs.com
Laurie Ekes	Project Chemist	KGS	lekes@komangs.com
Denise Tripp	Hydrogeologist	Geosyntec	Dtripp@geosyntec.com
Spence Smith	PM	Jacobs	Spence.Smith@jacobs.com
Jerry Lanier	PM	Test America Savannah	Jerry.lanier@testamericainc.com
Penelope Reddy	PM	USACE	Penelope.Reddy@usace.army.mil
Yixian Zhang	Project Chemist	USACE	Yixian.Zhang@usace.army.mil
Robert Simeone	BRAC Environmental Coordinator	US Army	robert.j.simeone.civ@mail.mil
Carol Keating	Remedial PM	USEPA Region I	Keating.Carol@epa.gov
David Chaffin	Federal Sites Program	MassDEP	David.Chaffin@state.ma.us

QAPP WORKSHEET #4, 7 & 8: PERSONNEL TRAINING, RESPONSIBILITIES AND SIGN-OFF SHEET

ORGANIZATION: KGS

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Mark Applebee	Program Manager	Project Management Professional (PMP), Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Oversight responsibility for contractual and technical performance.	
James Ropp	Project Manager	Licensed Professional Engineer (PE), HAZWOPER 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Manages project technical and contractual requirements; coordinates between senior management, USACE, stakeholders, and project staff.	
Katherine Thomas	Technical Lead	PMP, HAZWOPER 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Manages remedial investigation technical task requirements; supports coordination at all levels.	
Kevin Anderson	Field Team Leader	HAZWOPER 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Supervises field sampling and coordinates all field activities; serves as the site KGS coordinator.	
Laurie Ekes	Project Chemist	HAZWOPER 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Verifies that the UFP-QAPP analytical requirements are met by the laboratory and field staff. Also provides direction regarding requirements for corrective actions for field and analytical issues; evaluates and releases validated analytical results to the KGS project team.	

QAPP WORKSHEET #4, 7 AND 8 - Continued

ORGANIZATION: Army/USACE

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Robert Simeone	BRAC Environmental Coordinator		BRAC Environmental Coordinator for Devens Environmental Remediation.	
Penelope Reddy	Technical Lead		USACE PM for Devens Environmental Remediation	
Yixian Zhang	Project Chemist	HAZWOPER 40-hour Training; 8-Hour Refresher	Coordinates with KGS project chemist. Reviews field activities and laboratory data.	

ORGANIZATION: Test America, Savannah

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Jerry Lanier	Project Manager	Not applicable	Primary point of contact for Test America Laboratory. Receives direction from KGS Project Chemist. Responsible for ensuring the UFP-QAPP requirements are met by the laboratory.	

ORGANIZATION: Test America, Sacramento

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Debby Wilson	Client Services Manager (PFAS)	Not applicable	Manages client services for TestAmerica Laboratories, Sacramento.	

QAPP WORKSHEET #4, 7 AND 8 - Continued

ORGANIZATION: Alpha Analytical

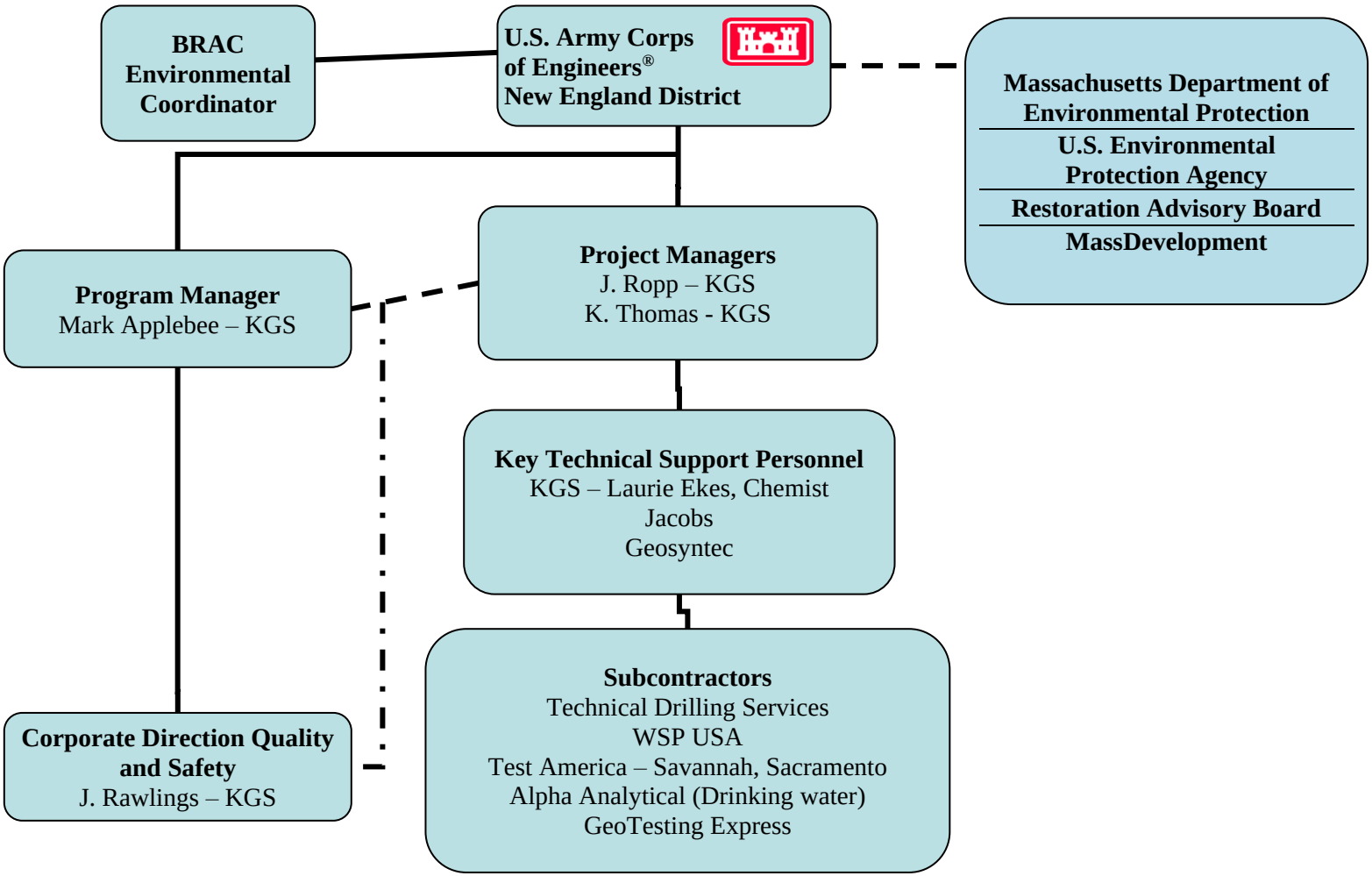
Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Jim Occhialini		Not applicable	Manages client services for Alpha Analytical.	

ORGANIZATION: GeoTesting Express

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Mark Dobday	Laboratory Manager	Not applicable	Primary point of contact for GeoTesting Express. Receives direction from KGS Project Chemist. Responsible for ensuring the UFP-QAPP requirements are met by the laboratory for grain size analysis.	

Signatures indicate personnel have read and agree to implement this QAPP as written

QAPP WORKSHEET #5: PROJECT ORGANIZATIONAL CHART



QAPP WORKSHEET #6: COMMUNICATION PATHWAYS

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Communication with USACE (lead agency)	USACE Program Manager	Penelope Reddy	(978) 318-8160	Primary point of contact with USACE. Coordinates contracting actions. Provides direction to KGS.
Communication with BRAC	BRAC EC	Robert Simeone	(978) 796-2205	Primary point of contact for Fort Devens.
Communication with EPA	EPA RPM	Carol Keating	(617) 918-1393	Primary point of contact for EPA. Provides technical and regulatory input and recommendations to USACE.
Communication with MassDEP	MassDEP RPM	David Chaffin	(617) 348-4005	Primary point of contact for MassDEP. Provides technical and regulatory input and recommendations.
Communication with KGS	KGS PM	James Ropp	(603) 395-7986	Primary point of contact for KGS. Provides project management input and recommendation to USACE PM. Receives direction from USACE.
Secondary point of contact for KGS	KGS Technical Lead	Katherine Thomas	(774) 273-1467	Primary point of contact for technical tasks; provides technical input and recommendations to UACE. Receives technical direction from USACE; provides input to KGS PM and project team on project status.
Progress of field program	KGS	Kevin Anderson	(508) 366-7442	Conveys progress of field activities. Communication with KGS technical lead. Oversees onsite safety activities.
Communication with KGS Project Chemist	Test America (TA) Savannah Laboratory Project Manager	Jerry Lanier	(912) 354-7858	Coordinates laboratory staff to assure timely deliverables. Communicates QA/QC issues with project chemist. Approves release of analytical data from laboratory.
	TA Sacramento Laboratory Project Manager	Debby Wilson	(949) 260-3228	
	Alpha Analytical	Jim Occhialini	(508) 898-9220	PFAS drinking water sample laboratory coordination.
	GeoTesting Express Laboratory manager	Mark Dobday	(978) 635-0424	Coordinates lab staff and approves release of grain size analysis

QAPP Worksheet #6 - Continued

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Review and release of analytical data	KGS Project Chemist	Laurie Ekes	(508) 366-7442	Verifies the UFP_QAPP analytical requirements are met by the laboratory and field staff. Coordinates sampling activities with analytical laboratory. Evaluates and releases analytical results to the KGS PM.

QAPP WORKSHEET #11: DATA QUALITY OBJECTIVES

Step 1: State the Problem

PFAS have been detected in groundwater, surface water, soil, and sediment at multiple Fort Devens AOCs at concentrations that may impact human health and the environment.

Step 2: Identify the Study Goals, Questions and Decision Statements

Study Goals

Site characterization data are needed to define the nature and extent of PFAS at Fort Devens and downgradient of Fort Devens in groundwater and determine migration flow paths to evaluate current and potential impacts to public and private drinking water supply wells and surface water discharge areas.

Site characterization data are needed to identify sources of PFAS in soil at Fort Devens, either currently known sources or newly identified potential sources determined through the investigation, contributing to PFAS in groundwater and characterize the nature and extent of those sources including evaluation of sources in soil as potential continuing sources.

Additional data are also needed to support a quantitative human health risk assessment and an ecological risk evaluation, which will be completed to estimate potential human health and ecological risk from exposure to PFAS in groundwater, soil, surface water, and sediment.

Principle Study Questions and Associated Decision Statements:

- Are the PFAS detected at AOCs 32/43, 57, 74, and 75 impacting the Grove Pond water supply wells?
    - Decision Statement: Determine nature and extent of PFAS in groundwater impacting the Grove Pond water supply wells, nature and extent of PFAS in groundwater attributable to each AOC, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer, and evaluate PFAS distribution using lines of evidence including ratios of select PFAS compounds.
- Are the PFAS detected in groundwater at AOCs 5, 20, 21, 32/43, and 76, impacting the MacPherson supply well?
    - Decision Statement: Determine nature and extent of PFAS in groundwater impacting the MacPherson supply well, nature and extent of PFAS in groundwater attributable to each AOC, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer, evaluate PFAS distribution using lines of evidence including ratios of select PFAS compounds.
- What is the predicted impact of AOCs to water supply wells over time?
    - Decision Statement: Determine nature and extent of PFAS in groundwater attributable to each AOC, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer to estimate velocity of contaminant transport and travel times), nature and extent of PFAS in soil, fate and

transport of PFAS from soil to groundwater, nature and extent of precursors in soil and groundwater, and evaluate potential for precursors to transform.

- Do other sources of PFAS exist that impact the Grove Pond and MacPherson supply wells?
    - Decision Statement: Determine nature and extent of PFAS in groundwater impacting the Grove Pond and MacPherson water supply wells, groundwater flow directions, evaluate PFAS distribution using lines of evidence including ratios of select PFAS compounds.
- Are there any other water supply wells that are potentially impacted by PFAS originating from Fort Devens?
    - Decision Statement: Determine nature and extent of PFAS associated with the AOCs, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer, identify other water supply wells and associated construction information through research of appropriate public records and interviews, and sampling of other water supply wells, if appropriate.
- Are the PFAS detected in groundwater attributable to identified AOC source areas?
    - Decision Statement: Determine if PFAS in groundwater exists up gradient or cross gradient of the AOC source, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer, and evaluate PFAS distribution using lines of evidence including ratios of select PFAS compounds.
- Are the PFAS detected in groundwater discharging to surface water bodies at concentrations that may pose a risk to human health and the environment?
    - Decision Statement: Determine PFAS concentrations in surface water and sediment where groundwater contaminated with PFAS is anticipated to discharge, human health and ecological risk from PFAS in surface water and sediment, hydraulic flow paths from the groundwater to the surface water, hydraulic characteristics of the aquifer, fate and transport of PFAS in the aquifer, and PFAS concentrations in groundwater discharging to surface water bodies.
- Are the PFAS detected in soil at concentration that may pose a risk to human health?
    - Decision Statement: Determine nature and extent of PFAS in soil and determine the human health risk from exposure to soil.
- Do PFAS concentrations in groundwater pose an unacceptable risk to human health?
    - Decision Statement: Determine nature and extent of PFAS in groundwater and human health risk from exposure to groundwater.
- Do PFAS concentrations in soil represent a significant continuing source impacting groundwater at concentrations that pose an unacceptable human health risk?
    - Decision Statement: Determine nature and extent of PFAS in soil, fate and transport of PFAS in soil to groundwater, nature and extent of PFAS concentrations in groundwater, hydraulic characteristics of the aquifer, groundwater flow direction,

fate and transport of PFAS in the aquifer, point of human exposure to groundwater, and human health risk via a complete exposure pathway.

Step 3: Identify Information Inputs

Information inputs include historical data gathered on the sites and analytical data collected during the investigation. PFAS concentrations in water samples collected from existing and new monitoring wells, vertical profile borings, and private and public water supply wells used for drinking water. PFAS concentrations in soil samples collected from the ground surface and soil borings. PFAS concentrations in surface water and sediment samples collected from potentially impacted water bodies. Organic carbon in soil and water collected from soil borings and existing and new monitoring wells. Inputs include the site-specific screening levels and detection level objectives as defined in Worksheet #15.

Grain size analysis of soil and sediment samples. Lithologic characterization of aquifer materials. Hydraulic conductivity test after installation of monitoring wells at select locations. Groundwater level measurements after installation of monitoring wells and/or piezometers. An inventory of water supply wells.

Step 4: Define the Boundaries of the Study

Each Area-specific Field Sampling Plan (FSP) addenda specifies drilling and sampling locations. Additional drilling and/or sampling locations may be added to the investigation based on initial investigation results and area-specific objectives.

Step 5: Develop the Analytic Approach

If data from this investigation are sufficient to adequately characterize the nature and extent of PFAS in groundwater, to determine all PFAS migration pathways, to assess the fate and transport of PFAS, to assess water supply impacts, and to adequately assess human health risk then additional data will not be collected. EPA Lifetime Health Advisories (LHA), site-specific screening levels (SSSL), EPA Regional Screening Levels (RSL), and/or appropriate MassDEP guidance will be used for comparison purposes to assess the adequacy of the data. If significant data gaps are identified, then further data will be collected.

If data from this investigation are sufficient to adequately characterize the nature and extent of PFAS in soils, surface water, and sediment and to adequately assess human health risk and conduct an ecological risk evaluation, then additional data will not be collected. If significant data gaps are identified, then further data will be collected.

Soil and groundwater containing PFAS at concentrations greater than EPA LHA, SSSLs, and/or EPA RSLs, will be evaluated for potential risk to human health. If no unacceptable risk is identified, then no further action will be recommended for soil and/or groundwater. If a CERCLA human health risk assessment indicates unacceptable risk to human health, then a feasibility study will be conducted.

Surface water and sediment containing PFAS, will be evaluated for potential risk to human health. If no unacceptable risk is identified, then no further action will be recommended for surface water and/or sediment. If a CERCLA human health risk assessment indicates unacceptable risk to human health, then a feasibility study will be conducted.

If a complete exposure pathway for ecological receptors to PFAS, is identified, then a qualitative ecological risk evaluation will be completed. PFAS data will be compared to latest ecotoxicology values presented in scientific literature and in accordance with Army Guidance (Department of the Army, 2018). If an unacceptable risk to ecological risk is identified, further evaluation will be conducted.

Step 6: Specify Performance or Acceptance Criteria

Analytical data performance criteria/data quality indicators are specified in QAPP Worksheet #12. These data quality indicators include indicators (performance criteria) for precision, accuracy/bias, sensitivity, and completeness. To determine whether the detection limits (DL), limits of detection (LOD), and limits of quantitation (LOQ) will meet the analytical DQOs, the DLs, LODs, and LOQs have been compared to the project-specific screening criteria in Worksheet #15. With respect to data verification, validation, and usability: QAPP Worksheet #34 provides Data Verification and Validation Inputs; QAPP Worksheet #35 provides Data Verification Procedures; QAPP Worksheet #36 provides Data Validation Procedures; and QAPP Worksheet #37 provides Data Usability Assessment.

Step 7: Develop the Detailed Plan for Obtaining Data

The sampling design and rationale was developed for each area of investigation and is presented in each Area-specific FSP Addendum.

QAPP WORKSHEET #15: REFERENCE LIMITS AND EVALUATION TABLE

One of the primary goals of the project-specific UFP-QAPP is to select appropriate analytical methods to achieve detection limits (DL), limits of detection (LOD), and/or limits of quantitation (LOQ) that will satisfy the overall project DQOs (as defined in Worksheets # 10 [Conceptual Site Model] and #11 [Data Quality Objectives]).

Groundwater and soil samples will be collected and submitted for PFAS analysis by "modified" method 537 (LC/MS/MS isotope dilution) compliant with QSM 5.1, Table B-15. Groundwater and soil samples from select locations will be processed by the laboratory through a total oxidizable precursor (TOP) assay. The TOP assay converts polyfluorinated precursors into fully fluorinated compounds (PFOS and PFOA) using a hydroxyl radical-based chemical oxidation method. The TOP assay replicates what micro-organisms in the environment would achieve after many years. Aqueous and soil samples that are oxidized via the TOP assay will have two sets of sample data reported, which will be designated pre-TOP and Post-TOP. The difference between PFAS concentrations before (Pre-TOP) and after (Post-TOP) oxidation can be used to estimate the concentration of the non-discrete oxidizable precursors in the sample. Select samples will also be submitted for organic carbon analysis, total organic carbon (TOC) for soil samples and dissolved organic carbon (DOC) for aqueous samples.

Worksheets #15-1a and #15-1b list the analytical method DLs, LODs, and LOQs for the target PFAS in aqueous samples and worksheets #15-2a and #15-2b list the analytical method DLs, LODs, and LOQs for the target PFAS in solid samples. Worksheets #15-1b and #15-2b list the respective DLs, LODs, and LOQs for post-TOP aqueous and soil samples. Slightly higher DLs, LODs and LOQs are reported for post-TOP samples due to the limited sample volume processed through the TOP assay.

Worksheets #15-1 and #15-2 show the LHA levels and SSSLs for PFAS with respect to the current analytical DL, LOD, and LOQ for each listed target compound. In all cases the expected detection levels are below the applicable LHAs, SSSLs and soil standards. If the LOD or the DL is below the screening criterion, the LOD and/or the LOQ are sufficient for quantitative use in a risk assessment.

Note that sample dilution because of target and or non-target compound concentrations or matrix interference may prevent DLs, LODs, or LOQs from being achieved. The samples must be initially analyzed undiluted when reasonable. If a dilution is necessary, both the original and diluted result must be delivered. Samples that are not analyzed undiluted must be supported by matrix interference documentation such as sample viscosity, color, odor, or results from other analyses of the same sample to show that an undiluted sample is not possible.

Worksheet #15-3 lists the analytical method DLs, LODs, and LOQs for target PFAS in drinking water samples, which will be analyzed by the drinking water method 537 Revision1.1.

Worksheet #15-4 lists the DLs, LODs, or LOQs for DOC in aqueous samples and TOC in soil.

QAPP WORKSHEET #15-1A: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (ng/L)	Project Action Limit Reference[2]	LOQ (ng/L)	LOD (ng/L)	DL (ng/L)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Groundwater/Surface Water	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	2.00	1.50	0.72	76	105	30
Direct Analysis/Pre-TOP Assay	375-73-5	Perfluorobutanesulfonic acid (PFBS)	40,100	EPA	2.00	1.00	0.46	87	120	30
PFAS Analysis by LC/MS/MS	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	2.00	1.00	0.48	85	113	30
Isotope Dilution Method	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	2.00	1.50	0.52	87	116	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	2.00	1.50	0.61	80	113	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	2.00	1.00	0.38	81	106	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	2.00	1.00	0.47	83	109	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	2.00	1.50	0.52	83	113	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	70/40.1	LHA/EPA	4.00	3.00	1.10	82	112	30
	335-67-1	Perfluorooctanoic acid (PFOA)	70/40.1	LHA/EPA	2.00	1.50	0.54	80	107	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	4.00	3.00	0.76	75	129	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	4.00	3.00	0.83	82	115	30
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	20.0	10.0	2.80	80	109	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	20.0	10.0	3.00	82	111	30
	27619-97-2	1H, 1H, 2H, 2H-perfluorooctane sulfonate (6:2 FTS)	NA	--	40.0	20.0	7.00	75	118	30
	39108-34-4	1H, 1H, 2H, 2H-perfluoroecane sulfonate (8:2 FTS)	NA	--	20.0	10.0	3.00	83	111	30

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

[2] LHA - Federal Register; Vol.81 #101, May 2016

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

QAPP Worksheet #15-1A - Continued

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
DL = detection limit
MS = Matrix Spike
MSD = matrix spike
ng/L = nanogram per liter
RPD = relative percent difference

QAPP WORKSHEET #15-1B: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (ng/L)	Project Action Limit Reference[2]	LOQ (ng/L)	LOD (ng/L)	DL (ng/L)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Groundwater/Surface Water	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	5.00	3.75	2.80	57	117	30
Post-TOP Assay	375-73-5	Perfluorobutanesulfonic acid (PFBS)	40,100	EPA	5.00	2.50	0.50	75	135	30
PFAS Analysis by LC/MS/MS	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	5.00	2.50	0.78	65	125	30
Isotope Dilution Method	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	5.00	3.75	1.40	66	126	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	5.00	3.75	0.63	104	171	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	5.00	2.50	0.43	64	124	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	5.00	2.50	1.40	81	141	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	5.00	3.75	0.68	66	126	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	70/40.1	LHA/EPA	5.00	3.00	0.80	68	128	30
	335-67-1	Perfluorooctanoic acid (PFOA)	70/40.1	LHA/EPA	5.00	3.75	2.10	158	454	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	5.00	3.50	3.20	65	136	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	5.00	3.00	0.73	63	123	30
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	50.0	12.5	7.80	0	10	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	50.0	12.5	4.80	0	10	30
	27619-97-2	1H, 1H, 2H, 2H-perfluorooctane sulfonate (6:2 FTS)	NA	--	50.0	12.5	5.00	0	10	30
	39108-34-4	1H, 1H, 2H, 2H-perfluoroecane sulfonate (8:2 FTS)	NA	--	50.0	12.5	5.00	0	10	30

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

[2] LHA - Federal Register; Vol.81 #101, May 2016

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
DL = detection limit
MS = Matrix Spike
MSD = matrix spike
ng/L = nanogram per liter
RPD = relative percent difference

QAPP WORKSHEET #15-2A: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (µg/Kg)	Project Action Limit Reference[2]	LOQ (µg/Kg)	LOD (µg/Kg)	DL (µg/Kg)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Soil/Sediment	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	0.300	0.200	0.100	74	114	30
Direct Analysis/Pre-TOP Assay	375-73-5	Perfluorobutanesulfonic acid (PFBS)	126,000/ 609,000	EPA Soil/Sediment	0.400	0.180	0.059	73	142	30
PFAS Analysis by LC/MS/MS	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	0.300	0.200	0.089	74	124	30
Isotope Dilution Method	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	0.300	0.200	0.100	75	123	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	0.300	0.200	0.078	76	124	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	0.300	0.200	0.062	75	121	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	0.300	0.200	0.071	75	125	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	0.300	0.200	0.081	74	126	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	126/609	EPA Soil/Sediment	1.00	0.500	0.240	69	131	30
	335-67-1	Perfluorooctanoic acid (PFOA)	126/609	EPA Soil/Sediment	0.300	0.200	0.100	76	121	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	0.300	0.200	0.100	43	116	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	0.400	0.300	0.110	22	129	30

QAPP Worksheet #15-2A - Continued

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (µg/Kg)	Project Action Limit Reference[2]	LOQ (µg/Kg)	LOD (µg/Kg)	DL (µg/Kg)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	2.00	1.00	0.300	65	135	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	2.00	1.00	0.300	65	135	30
	27619-97-2	1H, 1H, 2H, 2H-perfluorooctane sulfonate (6:2 FTS)	NA	--	4.00	2.00	0.660	65	135	30
	39108-34-4	1H, 1H, 2H, 2H-perfluoroecane sulfonate (8:2 FTS)	NA	--	2.00	1.00	0.300	65	135	30

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike duplicate
µg/Kg = microgram per kilogram
RPD = relative percent difference
DL = detection limit

QAPP WORKSHEET #15-2B: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (µg/Kg)	Project Action Limit Reference[2]	LOQ (µg/Kg)	LOD (µg/Kg)	DL (µg/Kg)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Soil	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	0.500	0.250	0.090	70	130	30
Post-TOP Assay	375-73-5	Perfluorobutanesulfonic acid (PFBS)	126,000	EPA	0.500	0.250	0.063	70	130	30
PFAS Analysis by LC/MS/MS	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	0.500	0.250	0.055	70	130	30
Isotope Dilution Method	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	0.500	0.250	0.170	70	130	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	0.500	0.250	0.073	70	130	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	0.500	0.250	0.078	70	130	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	0.500	0.250	0.110	70	130	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	0.500	0.250	0.090	70	130	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	126	EPA	1.25	0.625	0.500	70	130	30
	335-67-1	Perfluorooctanoic acid (PFOA)	126	EPA	0.500	0.250	0.220	70	130	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	0.500	0.250	0.130	70	130	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	0.500	0.250	0.140	70	130	30

QAPP Worksheet #15-2B - Continued

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (µg/Kg)	Project Action Limit Reference[2]	LOQ (µg/Kg)	LOD (µg/Kg)	DL (µg/Kg)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	5.00	2.50	0.930	70	130	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	5.00	2.50	0.980	70	130	30
	27619-97-2	1H, 1H, 2H, 2H-perfluorooctane sulfonate (6:2 FTS)	NA	--	5.00	2.50	0.380	70	130	30
	39108-34-4	1H, 1H, 2H, 2H-perfluoroecane sulfonate (8:2 FTS)	NA	--	5.00	2.50	0.630	70	130	30

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike
µg/Kg = microgram per kilogram
RPD = relative percent difference
DL = detection limit

QAPP WORKSHEET #15-3: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS DRINKING WATER SAMPLES

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (ng/L)	Project Action Limit Reference[2]	LOQ (ng/L)	LOD (ng/L)	DL (ng/L)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Drinking Water	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	2.00	0.80	0.218	70	130	30
PFAS Analysis by LC/MS/MS	375-73-5	Perfluorobutanesulfonic acid (PFBS)	40,100	EPA	2.00	1.6	0.650	70	130	30
Drinking Water Method 537 Revision1.1	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	2.00	0.80	0288	70	130	30
	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	2.00	0.80	0.284	70	130	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	2.00	0.80	0.238	70	130	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	2.00	0.80	0.328	70	130	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	2.00	1.6	0.404	70	130	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	2.00	0.80	0.257	70	130	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	70/40.1	LHA/EPA	2.00	0.80	0.225	70	130	30
	335-67-1	Perfluorooctanoic acid (PFOA)	70/40.1	LHA/EPA	2.00	0.80	0.261	70	130	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	2.00	1.6	0.576	70	130	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	2.00	1.6	0.515	70	130	30
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	2.00	1.6	0.595	70	130	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	2.00	1.6	0.636	70	130	30

Source: Alpha Analytical, June 2018

[1] See Worksheet #23 for Analytical SOP References

[2] LHA - Federal Register; Vol.81 #101, May 2016

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike duplicate
ng/L = nanogram per liter
DL = detection limit

LOD = limit of detection

RPD = relative percent difference

QAPP WORKSHEET #15-4: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit	LOQ	LOD	DL	Units	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Groundwater/Surface Water										
DOC analysis in aqueous samples	7440-44-0	Dissolved Organic Carbon (DOC)	NA	1.0	0.50	0.19	mg/L	88	112	20
Soil/Sediment										
TOC analysis in soil samples	7440-44-0	Total Organic Carbon (TOC)	NA	2,000	100	44.4	mg/Kg	50	140	35

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

[2] LHA - Federal Register; Vol.81 #101, May 2016

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike duplicate
mg/Kg = milligram per kilogram
mg/L = milligram per Liter
DL = detection limit
RPD = relative percent difference

QAPP WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

Sampling Design and Rationale

The sampling and analysis will be completed to gather the data to achieve the DQOs (Worksheet #11). The design of the sampling program and rationale for the areas of investigation is presented in each Area-specific FSP Addendum. If further investigation is warranted after receiving and reviewing results, the field program may be expanded to include the sampling of additional existing monitoring wells, the collection of samples from new groundwater vertical profile borings and/or soil boring, and/or installation of new monitoring wells.

Field Activities

Groundwater from monitoring wells will be purged and sampled in accordance with the Region 1, Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells (USEPA Region 1, 2017) and KGS-SOP-F003 (Groundwater Sampling). Water quality parameters will be recorded for dissolved oxygen, specific conductance, oxidation-reduction potential, temperature, pH, and turbidity in accordance with KGS-SOP-F003. Prior to sampling, each well condition will be evaluated and depth to water measurement recorded in accordance with KGS-SOP-F002 (Evaluation of Existing Monitoring Wells and Water Level Measurement. Samples will be collected from each residential, water supply well or extraction well port in accordance with KGS-SOP-F016 (Private and Water Supply Well Sampling). The stringent sampling procedures required for PFAS sampling are detailed in the KGS-SOP-F009 (PFAS Sampling). Surface water and sediment samples will be collected in accordance with KGS-SOP-F004 (Sediment-Surface Water Sampling). Shallow and surface soil samples will be collected in accordance with KGS-SOP-F015 (Soil Sampling – Surface and Shallow Depth). Samples collected will be handled in accordance with KGS-SOP-F008 (Sample Handling). Equipment will be decontaminated in accordance with KGS-SOP-F005 (Decontamination of Field Equipment). Field activities using direct push technology, vertical profiling and some soil sampling, will be conducted in accordance with KGS-SOP-F012 (Direct Push Technology). Monitoring wells will be construction and developed in accordance with KGS-SOP-F017 (Monitoring Well Construction and Development). Soils will be described in accordance with KGS-SOP-F018 (Soil Description). Samples will be analyzed for the analyses listed in the Area-specific FSP addendum for each media.

Vertical Profiling

Groundwater samples will be collected via vertical profiling using direct push technology. Temporary screens will be advanced using a Geoprobe® drill rig and SP22® groundwater sampler. Direct Push technology will be used to advance the SP22® sampler to the appropriate depth. Attachment A includes SOPs for the Geoprobe® SP22® sampling device. Temporary well groundwater samples shall be collected using the following procedure:

- Advance a 2.25-inch outer casing equipped with an expendable drive point into the appropriate depth using direct-push tooling and drill rig;
- Lower a 48-inch stainless steel screen to total depth inside the outer casing;

- Retract the outer casing to expel the expendable drive point and expose two feet of the screen;
- Measure the water level inserting a decontaminated electronic water level meter inside the inner rods and monitor the water level until it appears to stabilize;
- If necessary, the screen will be raised to coincide with the water table;
- Insert new high-density polyethylene tubing (HDPE) tubing into the screened interval to collect a groundwater sample via either a check valve sampling method or peristaltic pump;
- Measure field parameters and collect groundwater sample by filling sample containers directly from tubing;
- Remove tubing and direct-push tooling with screened-tip from the borehole and decontaminate equipment with Alconox or Liquinox and de-ionized water. Dispose of tubing.
- The process will be repeated for subsequent depths.

Where boreholes for soil sampling and groundwater sampling are collocated and as feasible, the borehole for the groundwater sample will be a continuation of the borehole used to collect the collocated shallow soil samples; otherwise, the groundwater sample borehole will be installed within 3 feet of the soil sample borehole.

As noted in Attachment A, most of the components of the Geoprobe® SP22® sampling device are comprised of stainless steel; however, several O-rings of unknown construction are depicted. Prior to sampling, the drilling subcontractor will be consulted regarding the O-ring material and its potential to cause false-positive PFAS detection in groundwater samples. If the potential for false positives is uncertain, then a field blank sample will be collected of PFAS free, de-ionized water run through the sampling device.

Boreholes will be abandoned after sample collection by filling the entire length of the borehole with cement-bentonite grout.

Groundwater sample collection will include using disposable non-Teflon tubing and pumps.

Sample Analysis

Various analysis will be used including analysis for PFAS, TOC, DOC, grain size. Groundwater and soil samples from select locations will be processed by the laboratory through a total oxidizable precursor (TOP) assay. The total oxidizable precursor assay (TOP) converts polyfluorinated precursors into fully fluorinated compounds (PFOS and PFOA) using a hydroxyl radical-based chemical oxidation method. The TOP assay replicates what micro-organisms in the environment would achieve after many years. Two sets of sample results will be reported for these samples. The difference between PFAS concentrations before (Pre-TOP) and after (Post-TOP) oxidation can be used to estimate the concentration of the non-discrete oxidizable precursors in the sample. The results will allow evaluation of the total PFOS and PFOA mass in each sample through evaluation of the presence of PFOS and PFOA along with other PFAS compounds that

degrade into PFAS compounds including PFOS and PFOA. The results will be used in evaluation of potential continuing sources.

Sample Nomenclature

The nomenclature for identifying locations, samples collected in the field, and quality assurance/quality control (QA/QC) samples is presented below.

Location Identifier

All new locations will be assigned a unique location identifier (ID), which will identify the specific point where measurements or samples are collected. Location IDs for new locations will be assigned prior to the sampling event. The location ID will include codes to identify the AOC or area of investigation, the location type, year established, and the location number.

The AOC or areas of investigation may be two- or three-characters and will be numbers or letters. Examples include "74" for AOC 74, "CSB" for Cold Spring Book, and "GP" for Grove Pond.

The location types are listed below.

SB – Soil Boring

VP – Vertical Profile

M – Monitoring Well

The year established will be indicated by two numerals, such as "18" to indicate 2018. The location number will be a unique sequential number for respective locations established within each AOC or area of investigation. The location ID for the second vertical profile conducted at AOC 75 in 2018 would be "75VP-18-02".

Surface water and sediment locations will be assigned location IDs designating the area of investigation only. For example, the location ID for a surface water/sediment location established at Cold Spring Brook would be "CSB-18-01".

Field Sample ID

A unique field sample ID will incorporate the location ID, described above, and will be used to identify individual field samples collected for a specific sampling event. The field sample ID will be used on sample labels, chain of custody forms, field logbooks, field sheets and other applicable documentation. The field sample IDs will include the location ID appended with a sample matrix code (for soil samples collected from monitoring well borings and surface water and sediment samples), and sample depth or sample date code (depending on the location type).

The sample matrix codes include:

SO – soil

SED – sediment

SW – surface water

A sample depth code will be used for soil samples and groundwater samples collected via vertical profiling. The depth will represent the depth interval of the sample with respect to feet below ground surface (ft bgs).

A sample date code (MONYY) will be used for groundwater samples collected from monitoring wells and for surface water and sediment samples to identify the sampling events and to aid in comparison of results from the same location. The sample date code will be represented by three letters representing the month and two digits representing the year the sample was collected.

The following are examples of field sampling IDs:

GPVP-18-02-25-27 represents a groundwater sample collected from the second 2018 vertical profile location at Grove Pond collected from 25 to 27 ft bgs.

75SB-18-01-0-0.5 represents a soil sample collected from the first 2018 soil boring location at AOC 75 collected from 0 to 0.5 ft bgs.

74M-19-02X-SO-55-56 represents a soil sample collected from 55 to 56 ft bgs during drilling for the second monitoring well installed at AOC 74 in 2019.

5701M-19-03-FEB19 represents a groundwater sample collected in February 2019 from the third 2019 monitoring well installed at AOC 57 Area 1.

CSB-18-04-SED-DEC18 represents a sediment sample collected in December 2018 from the fourth Cold Spring Brook location.

Field Quality Assurance/Quality Control Samples

Quality assurance/quality control (QA/QC) samples will be designated to indicate the type of QA/QC sample. The QA/QC sample IDs will include the AOC or area of investigation, location types or sample matrix, QA/QC sample type, and sequential numbering (01, 02, 03).

The QA/QC sample types will include the following and be identified as:

DUP – Field Duplicate

FRB – Field Reagent Blank

EB – Equipment Rinseate Blank

Field duplicate samples will include the AOC or area of investigation and the location type or sample matrix appended with DUP01, DUP02 etc. For example, the field sample ID for a field duplicate sample collected from soil boring location 74SB-18-01 would be "74SB-DUP01". A field reagent blank sample associated with vertical profile samples from AOC 74 would be "74VP-FRB01". Matrix spike and matrix spike duplicate samples (MS/MSD) will be identified in the notes of the chain of custody; the laboratory will append MS or MSD to the sample ID for reporting.

The specific location IDs and field sample IDs are presented in each Area-specific field sampling plan addendum.

Investigation-Derived Waste Management

Investigation Derived Waste (IDW) will be handled in a manner consistent with USACE and EPA guidance for managing IDW and applicable Federal and state regulations. Waste soil generated from drilling activities will be containerized, characterized, and disposed. USACE may delegate authority to KGS via email for signature of manifest of non-hazardous waste. Signed manifest will be sent to the USACE upon signature and pick up of IDW. Any groundwater generated will be containerized and upon completion of sampling, discharged back to the ground at the site of generation. IDW will be managed in accordance with KGS-SOP-F011 (IDW Management).

QAPP WORKSHEET #17A: SAMPLING DESIGN AND RATIONALE

Vertical Profiling Using Hand-Held Percussion Hammer

Groundwater samples will be collected via vertical profiling using direct push technology. A hand-held percussion hammer will be used to drive the drill rod. The first rod will consist of a 2-foot mill-slotted screen with a drive point on the end of the rod. The rod will be advanced using a hand-held percussion hammer. Groundwater samples will be collected every 10 feet to refusal. The rod will remain in the ground and will not be extracted between sample intervals or after refusal is reached. The groundwater samples shall be collected using the following procedure:

- Decontaminate all the rods;
- Advance the rod using the hand-held percussion hammer;
- Measure the water level inserting a decontaminated electronic water level meter inside the rod and monitor the water level until it appears to stabilize;
- Insert new high-density polyethylene tubing (HDPE) tubing into the slotted portion of the rod to collect a groundwater sample via either a check valve sampling method or peristaltic pump;
- Purge two rod volumes;
- Measure field parameters and collect groundwater sample by filling sample containers directly from tubing;
- Remove and dispose of tubing.
- The process will be repeated for subsequent depths until refusal is reached.

After refusal is attained, the portion of the rod remaining above ground will be completed at an appropriate height and the completed well point will be capped.

QAPP WORKSHEET #19 AND 30: SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES

Worksheets #19 and #30 summarize the analytical methods/matrix, required sample volume, containers, preservation, and holding time requirements. Laboratory analytical SOPs are provided in Worksheet #23 (Analytical SOP). The primary point of contact is through the Test America-Savannah laboratory. PFAS groundwater, surface water, soil, and sediment samples will be analyzed at Test America-Sacramento and DOC/TOC samples will be analyzed at Test America-Seattle. PFAS drinking water samples will be analyzed at Alpha Analytical. Grain size samples will be submitted directly to GeoTesting Expresss in Acton, MA.

Primary Analytical Laboratory
Test America
Point of Contact: Jerry Lanier, Phone: (912) 354-7858

Matrix	**Analytical Group**	**Analytical / Preparation Method SOP Reference[1]**	**Containers** (number, size, and type)	**Preservation Requirements** (chemical, temperature)	**Maximum Holding Time[2]** (preparation/analysis)
ORGANIC ANALYSES					
Groundwater, Surface Water	PFAS	WS-LC-0025 Rev 3.0 (4/13/2018) (TAL-Sacramento)	2 x 250-ml HDPE Bottles (NO Teflon lids)	Cool to 4 ± 2°C	Extraction: 14 Days from Collection Analysis: 40 days from Extraction
Sediment, Soil	PFAS	WS-LC-0025 Rev 3.0 (4/13/2018) (TAL-Sacramento)	1-4-ounce HDPE Jar	Cool to 4 ± 2°C	Extraction: 14 Days from Collection Analysis: 40 days from Extraction
Drinking Water	PFAS	SOP 23511, Revision 4 (6/29/2017) (Alpha Analytical)	2 C -250ml polypropylene Bottles (NO Teflon Lids)	Trizma® Cool to 4 ± 2°C	Extraction: 14 Days from Collection Analysis: 40 days from Extraction
MISCELLANEOUS ANALYSES					
Groundwater, Surface Water	DOC	EPA 415.1, SW9060 SOP TA-WC-156 (TAL - Seattle)	1-500-ml Amber Glass	H_3PO_4 to pH 2 Cool to 4 ± 2°C	28 days from collection.
Sediment, Soil	TOC	EPA 9060A SOP TA-WC-192 (TAL - Seattle)	1-4-ounce glass jar	Cool to 4 ± 2°C	28 days from collection.

QAPP Worksheets #19 and 30 - Continued

Primary Analytical Laboratory
Test America
Point of Contact: Jerry Lanier, Phone: (912) 354-7858

Matrix	Analytical Group	Analytical / Preparation Method SOP Reference[1]	Containers (number, size, and type)	Preservation Requirements (chemical, temperature)	Maximum Holding Time[2] (preparation/analysis)
MISCELLANEOUS ANALYSES					
Sediment, Soil	Grain size	ASTM D-422 SOP ASTM D-422-07 (GeoTesting Express)	1-1-gallon ziplock bag	Cool to 4 ± 2°C	Not specified

[1] See Worksheet #23. Laboratory SOPs are provided in Attachment B.
[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

QAPP WORKSHEET #20: FIELD QC SAMPLE SUMMARY

The table below provides a summary of the types of samples to be collected and analyzed. Its purpose is to show the relationship between the number of field samples and associated QC samples for each combination of analyte/analytical group and matrix. Area-specific sample locations are summarized in tables included in each Area-specific field sampling plan addendum.

Matrix	Analysis[1]	Field Samples	Field Duplicates	Matrix Spikes	Matrix Spike Duplicates	Equipment Rinseate Blanks[2]	Field Reagent Blanks[3]
Groundwater Drinking Water	PFAS	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	PFAS-free source water
Surface Water	PFAS	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	PFAS-free source water
Soil	PFAS	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	PFAS-free source water
Sediment	PFAS	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	PFAS-free source water
Aqueous	DOC	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	NA
Soil/Sediment	TOC	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	NA
Soil/Sediment	Grain Size	See Area-specific FSP addendum	10%	NA	NA	NA	NA

The frequency will be applied to the entire Area where samples are being collected during an event.

[1] Field QC samples for TOP assay will not be collected.

[2] Equipment rinseate blanks (EBs) are collected by pouring PFAS-free water (supplied by the laboratory) over decontaminated sampling equipment. The frequency of EB collection should be at least once a week per piece of equipment.

[3] Field Reagent Blanks (FRBs) are PFAS-free water poured into a sample bottle in the field at the time of sampling. The frequency of FRB collection is at least once during each sampling event.

QAPP WORKSHEET #21: FIELD SOPS

The field SOPs associated with the sampling acquisition tasks (including, but not limited to, sample collection, sample handling and custody) are listed in the following table. Copies of the field SOPs are provided in Attachment A.

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)
SOP-F001	Monitoring Equipment Calibration	KGS	N/A	N
SOP-F002	Evaluation of Existing Monitoring Wells and Water Level Measurement	KGS	Water Level Meter	N
SOP-F003	Groundwater Sampling	KGS	Various Sampling Equipment	N
SOP-F004	Sediment-Surface Water Sampling	KGS	Various Sampling Equipment	N
SOP-F005	Decontamination of Field Equipment	KGS	N/A	N
SOP-F007	Field Documentation	KGS	N/A	N
SOP-F008	Sample Handling	KGS	N/A	N
SOP-F009	PFAS Sampling	KGS	Various Sampling Equipment	N
SOP-F010	Global Positioning System (GPS) Measurements	KGS	Trimble, GeoXH	N
SOP-F011	Investigation Derived Waste (IDW) Management	KGS	Sampling Equipment, 55-gallon drums, bung wrench, drum funnel	N

QAPP Worksheet #21 - Continued

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)
SOP-F012	Pore Water Sampling	KGS	N/A	N
SOP-F013	Site-Specific Health and Safety Training	KGS	N/A	N
SOP-F014	Direct Push Technology	KGS	Various	N
SOP-F015	Soil Sampling - Surface and Shallow Depth	KGS	Stainless steel equipment, hand auger, core sampler	N
SOP-F016	Private and Water Supply Well Sampling	KGS	N/A	N
SOP-F017	Monitoring Well Construction and Development	KGS	Various	N
SOP-F018	Soil Description	KGS	N/A	N
SOP-F019	Water and/or Soil Sampling Methods – Sonic Drilling	KGS	Sonic Drill Rig	N
SOP-F020	Drive and Wash Drilling	KGS	Drill Rigs	N
SOP-F021	Rock Coring Logging	KGS	Coring with Drill Rig	N
	Geoprobe® Screen Point 16 Groundwater Sampler	Kefr, Inc.	GeoProbe	N
	Geoprobe® Screen Point 22 Groundwater Sampler	Kefr, Inc.	GeoProbe	N

QAPP WORKSHEET #22: FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

Field sampling equipment will be leased from a reputable equipment leasing supplier. All equipment shall be received in good working order from the supplier. The field equipment and instruments expected to be used during the sampling events discussed in this QAPP may include:

- Water level meter
- Water quality instrument(s)
- Submersible pump and controller, bladder pump and controller, and peristaltic pump for sample acquisition
- Bladder pump and controller for sample acquisition
- Data logger and transducers
- Power generator
- Trimble GeoExplorer
- Camera

Additional equipment may be needed depending on field conditions. Manufacturer's calibration instructions shall be followed when using rental field equipment. The calibration, maintenance, testing, and/or inspection requirements are discussed in the field specific SOPs included in Attachment A.

QAPP WORKSHEETS #26 & 27: SAMPLE HANDLING, CUSTODY, AND DISPOSAL

Sampling Organization: KOMAN Government Solutions (KGS) Team
Laboratories: Test America – Sacramento (PFAS), Test America – Seattle (DOC/TOC), Alpha Analytical (PFAS), and GeoTesting Express (Grain Size)
Method of sample delivery (shipper/carrier): Test America - sample courier, sample drop off and/or Fedex overnight, Alpha Analytical – sample courier, GeoTesting Express – sample courier
Number of days from reporting until sample disposal: 30 days from invoice

Activity	Description	Organization responsible for the activity
Sample labeling	Sample labels will be affixed to each sample collected to identify the field sample with the following information: unique sample identification number, analytical method, sampler's initials, date and time collected, and preservation method used.	KGS field team
Chain-of-custody form completion	KGS will maintain the chain-of-custody records for all normal field and QC samples. A sample is defined as being under a person's custody if any of the following conditions exist: • It is in their possession/view; • It was placed in a locked location; • It is in a designated secure area The following sample information will be documented on the chain-of-custody form: • Unique sample identification • Date and time of sample collection • Source of sample (including location/sample ID, and sample type) • Analyses required • Preservative used • Designation of matrix spike/matrix spike duplicate (MS/MSD) Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory.	KGS field team

Activity	Description	Organization responsible for the activity
Packaging and Shipping	Samples for PFAS, TOC, DOC analysis - Sample containers will be placed inside sealed plastic bags as a precaution against cross-contamination caused by leakage or breakage. Bagged sample containers will be placed in insulated coolers with bubble wrap or other wrapping to eliminate the chance of breakage during delivery or shipment. Ice in plastic bags will be placed in the coolers to keep the samples between 2 and 6 ºC throughout storage and shipment. Sample delivery or shipment will be performed in strict accordance with all applicable U.S. Department of Transportation regulations. The samples will be transported from the site to the laboratory by laboratory personnel or shipped to the laboratory by an overnight courier service. Soil samples collected for grain size analysis will be placed in coolers and delivered to Geo Testing Express in Acton, MA or picked up by a courier.	KGS team, Test America courier, Alpha Analytical courier and/or Geo Testing Express courier
Sample receipt, inspection, & log-in	A designated laboratory representative will accept the shipped samples and verify that the received samples match those on the chain-of-custody record. The condition, temperature, and preservation of the samples should be checked and documented on the chain-of-custody form. Any anomalies in the received samples and their resolution should be documented in the laboratory records. All sample information will then be entered into a tracking system, and unique laboratory sample identifiers will be assigned. The laboratory must supply sample receipt confirmation within 24 hours of sample receipt that includes the following: • A fully executed copy of the chain-of-custody received with the samples; • Sample acknowledgement and log-in report; • Cooler and sample receipt form noting any problems, breakages, holding time issues, temperature exceedances, or inconsistencies between the chain of custody.	Test America, Alpha Analytical, Geo Testing Express

Activity	Description	Organization responsible for the activity
Sample custody and storage	Sample holding-time tracking begins with the collection of samples and continues until the analysis is complete. Holding times for analytical methods required for this project are specified in Worksheet #19 and #30 (Sample Containers, Preservation and Hold Times). Analytical batches will be created, and laboratory QC samples will be introduced into each batch. Samples will be stored in limited-access, temperature-controlled areas.	Test America Alpha Analytical, Geo testing Express,
Sample disposal	Samples will be stored for 30 days after analysis and reporting, at which time the samples will be disposed of. Organic sample extracts will be stored for 30 days, if sufficient volume remains. The samples will be disposed of by the laboratory in accordance with applicable local, state, and federal regulations. Disposal records will be maintained by the laboratory. SOPs describing sample control and custody will be maintained by the laboratory.	Test America Alpha Analytical, Geo testing Express,

QAPP WORKSHEETS #31, #32 & #33: ASSESSMENTS AND CORRECTIVE ACTIONS

Periodic assessments may be performed during the course of the project so that the planned project activities are implemented in accordance with this UFP-QAPP. The routine data quality verification steps described in Worksheet #34 will be used to assess the effectiveness of the project data reporting system. No additional project assessment activities are planned in the project scope. If additional assessments become necessary; this worksheet will be amended as needed.

Assessment Type	Responsible Party and Organization	Frequency	Assessment Deliverable	Timeframe of Response	Person(s) Responsible for Response and Implementing Corrective Actions	Person(s) Responsible for Monitoring Corrective Action Implementation
Field Procedure Assessment	Kevin Anderson or designee/KGS	Weekly	Internal e-mail	1 business day	Kevin Anderson or designee/KGS	Katherine Thomas/KGS
Field Documentation Reviews	Lynne Klosterman/KGS	Weekly	Internal e-mail	3 business days	Kevin Anderson or designee/KGS	Lynne Klosterman/KGS
Sample Condition Report/ Log in receipt	Laurie Ekes/KGS	After sample receipt at laboratory.	External e-mail, if laboratory issue. Internal e-mail, if KGS issue.	24 hours after notification	Laboratory log in personnel, if sample ID error, or Kevin Anderson or designee/KGS, if sample collection issue.	Lynne Klosterman/KGS
Analytical Discrepancy	Laurie Ekes/KGS	After data receipt from laboratory and during data validation.	External e-mail	7 business days	Jerry Lanier/Test America Jim Occhalini/Alpha Analytical Mark Dobday/GeoTesting	Laurie Ekes/KGS
Data Validation Reports	Laurie Ekes/KGS	Prepared for each Sample Delivery Group (SDG).	Data Validation reports and validated data spreadsheet per SDG.	3 weeks after receipt of completed data package.	Laurie Ekes/KGS	Katherine Thomas/KGS

APPENDIX B
Responses to Comments

U.S. ARMY RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE DRAFT AREA 3 FIELD SAMPLING PLAN ADDENDUM TO THE REMEDIAL INVESTIGATION WORK PLAN FOR PFAS FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MASSACHUSETTS September 2019

General Comments

1. While useful for determining permanent monitoring well locations and screen settings, drive point data collected during the SI should not be used to make decisions regarding groundwater flow gradients and direction. Data collected during the profiling work should be used to determine permanent monitoring well locations and screen settings for purposes of defining the boundaries of PFAS contamination in these media and confirm groundwater elevation and flow gradients and direction. In addition, water level measurements from a limited number of temporary drive points should not be relied upon to accurately predict or support decisions regarding groundwater flow gradients and directions.

   Response: The SI results were not used to make decisions regarding groundwater flow gradients and direction. The Area 3 FSP for the RI does not propose utilizing water level measurements from temporary drive points. PFAS results obtained during vertical profiling and from existing monitoring wells, in addition to hydraulic data from existing monitoring wells and existing and proposed piezometers, will be used to locate new monitoring wells and screen settings for defining the boundaries of PFAS contamination. Water level measurements from piezometers and monitoring wells will be used to determine groundwater flow direction.

2. EPA recommends that vertical profiling groundwater samples be collected at 5-foot intervals (from the top of the water table to bedrock) instead of the 10-foot intervals proposed. The collection of samples from more discrete sampling intervals will more accurately delineate PFAS contamination in this area.

   Response: A 10-foot sampling interval is expected to provide sufficient numbers of samples to characterize the vertical extent of PFAS in the groundwater column associated with the approximately 100-foot thick glacial overburden deposits in Area 3. Given the solubility of PFAS, a 5-foot interval is unlikely to further resolve a PFAS plume (i.e., PFAS is not expected to be narrowly limited in the aquifer formation). However, it should be noted that the planned screen to collect the vertical profile sample is 4 feet long; therefore, the bottom of the screen will be close to 5 feet from the top of the next sample, similar to what EPA is requesting. Use of a 10-foot sampling interval at the Area 3 groundwater vertical profile borings is expected to adequately delineate the vertical distribution of PFAS in groundwater at Area 3, while providing the opportunity for more spatial coverage at each Area of Concern (AOC).

3. Preferential pathways for possible PFAS migration should be explored during or concurrent with implementation of the initial phase of RI work. Former and current underground utility corridors, sewer lines, floor and trench drains (and associated piping), catch basins, oil/water separators, storm water drainage systems (exterior trench drains) should be identified and evaluated as potential sources and/or conduits of PFAS contamination.

Response: As indicated in the last paragraph of Section 4.5, utility maps will be reviewed and evaluated as potential preferential pathways, if review of analytical results suggests additional potential point sources or secondary sources. It is anticipated in the Area 3 setting, however, that most historic subsurface structures and utilities are located at relatively shallow depths within the vadose zone and likely have bedding composed of natural glacial outwash or similar materials with permeabilities similar to surrounding undisturbed natural deposits and would not be likely preferential pathways for infiltrating surface water.

4. "Results Only" data summary tables, while useful for determining the presence/absence of PFAS at a specific sample location at a specific point in time, they do not contain the level of detail needed to fully and adequately assess sample data. Moving forward, EPA requests that Data Summary Packages include the additional items listed below:

   - Narrative explaining the method of analysis and any issues with sample receipt and analysis;
   - Sample results (including field blanks and field duplicates) plus surrogate recoveries; and all raw data
   - Quality control results (MB, LCS, MS & MSD or FD); and,
   - Executed Chains of Custody.

   Response: The Data Summary Tables included in the PFAS RI Program weekly reports are preliminary data presented for evaluation of the ongoing investigation. The electronic data deliverable (EDD) is loaded directly to the database by the laboratory where it is screened against chain-of-custody information. The data undergoes an EPA Stage 2A electronic review as defined in 'Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use', (January 2009). Analytical data present in the EDD are evaluated against the project's electronic Quality Assurance Project Plan (eQAPP) using automated data review software only.

   In accordance with EPA's request on 10 May 2019 and after a 31 May 2019 conference call with the EPA chemist, Nora Conlin, a *PFAS Summary Report* was created to present validated PFAS data. The PFAS summary reports include: the sample location ID, the field sample ID, sample depths, sampling date, laboratory SDG number, and sample type. Normal and field duplicate data are presented. The summary report can be prepared by investigation AOC and matrix. The referenced laboratory SDGs and associated Data Review Reports are available to download from the Former Fort Devens database library.

Page-Specific Comments

1. Page 2, Section 4.0, ¶ 2 – While the proposed approach will admittedly "allow for timely collection…" of data, EPA remains concerned about the limitations/inabilities of the DPT samplers to meet the DQOs required of a CERCLA RI (i.e. identification of nature *and extent* (laterally and *vertically*). The same concerns were raised in comments on the Areas 1 and 2 Field Sampling Plans (FSP) and were well-founded given the failure of the DPT to reach the depths required to confirm vertical extent of contamination (i.e. to bedrock) or in many instances reach "target" depths specified in the FSPs as determined, in many cases, during the installation of monitoring wells.

   Response: Section 4.2 of the Area 3 FSP indicates sonic drilling technology may be used to conduct groundwater vertical profiling. Section 4.6 of the Area 3 FSP indicates well

installation would be conducted using DPT, sonic, and/or drive and wash.

At the completion of the RI investigation activities, the nature and extent of PFAS will be determined through application of several drilling technologies that will best suited for the depth and media being investigated.

2. Page 2, Section 2, Section 4.1, ¶ 2 – Please amend the second part of the sentence to read, "… (LHA) of 70 nanograms per liter (ng/L) for Perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) individually or combined."

   Response: The second part of this sentence was revised as requested.

3. Page 2, Section 4.2, ¶ 1 – Please expand the discussion to state that additional monitoring wells will be installed in Area 3 to supplement the existing monitoring well network, if any, at Area 3 AOCs at locations indicated by the sampling results from existing monitoring wells and vertical profiling *and water level measurements* from any existing monitoring wells and piezometers that may be installed. As previously stated in comments on the draft Areas 1 and 2 FSP, while piezometers are useful tools for determining new monitoring well locations, permanent monitoring wells are required to confirm site-specific groundwater flow directions in the CERCLA RI Report.

   Response: The groundwater investigation discussion presented in Section 4.2 was expanded as EPA suggests. Specifically, Paragraph 2 of this section was revised to read as follows:

   "*During the RI, piezometers will be installed at the water table and will be used to provide depth to water measurements to calculate local groundwater flow direction in portions of Area 3 that have little to no existing groundwater monitoring well coverage. As discussed in Section 4.6 of this Area 3 FSP, new monitoring wells will be installed within Area 3 to supplement the existing monitoring well network to provide for chemical and hydraulic monitoring of the aquifer across areas of PFAS contamination that are delineated during the RI at Area 3."*

4. Page 2, Section 4.2 – Although EPA appreciates the inclusion of "sonic drilling technology" as a possible tool for augmenting existing monitoring well data, it disagrees that DPT sampling alone can provide all of the groundwater data needed to define, with certainty, the vertical extent of PFAS in groundwater from the top of the water table to the top of *confirmed bedrock* -- not to "*DPT refusal*".

   Response: See the response to EPA Page Specific Comment #1. Also, as stated in Section 4.2 of the Area 3 FSP,

   "*The existing groundwater monitoring well network will be augmented with groundwater vertical profile sampling ("profiling") involving direct push technology (DPT) and/or possibly sonic drilling technology…. The groundwater vertical profiling will be conducted in conjunction with sampling of existing monitoring wells to delineate PFAS groundwater contamination vertically and laterally in the aquifer."*

   Per Section 4.5 of the Area 3 FSP (Initial Data Review), if after a review of the data set collected under this FSP, significant data gaps are identified, then additional field activities will be completed to address data gaps.

5. Page 2, Section 4.2 – Based on results obtained during the AOC 50 RI, confirming the presence of site-related COCs on the far side of the Nashua River, the PFAS groundwater sampling

program must be extended to confirm/deny the presence of PFAS on the far side of the River, especially in areas with significant upgradient detections.

Response: Sampling of groundwater on the far (i.e., western) side of the Nashua River is proposed as part of the Area 3 FSP. As shown on Figure 4 of the Area 3 FSP, sampling of the two existing monitoring wells (G6M-04-08X and G6M-04-14X) and advancement of a groundwater vertical profile (50VP-19-08) is planned across the Nashua River from AOC 50. In addition, a groundwater vertical profile is planned across the Nashua River from AOC 31 (31VP-19-05).

6. Page 3, Section 4.5, last sentence – Please change "may" to "will". As stated in comments on the Areas 1 and 2 FSPs, the PFAS RI must include the identification and investigation of former and current underground utility corridors, sewer lines, floor and trench drains (and associated piping), catch basins, oil/water separators, storm water drainage systems (exterior trench drains), etc. for evaluation as potential source areas and/or possible conduits of PFAS contamination in all areas of the former military installation (i.e. base-wide) where PFAS has been detected.

   Response: The text was revised as follows:

   "If additional potential point sources or secondary sources, such as sewer lines and storm water drainage systems are identified through review of the results, then additional groundwater vertical profiling and/or soil sampling will be completed to further delineate the nature and extent of PFAS related to these potential sources."

7. Page 4, Section 4.7 – EPA recommends that a subset of groundwater samples from areas with detections at or near the LHA (and possibly some yet-to-be-determined distance downgradient) be also be submitted for TOP assay analysis.

   Response: The fifth sentence of Section 4.7 was revised as follows:

   "A subset of samples from select wells will also be sampled for dissolved organic carbon (DOC) and TOP assay analysis to assess the potential for total PFAS mass in each sample to biotransform into fully fluorinated PFAS compounds including PFOS and PFOA."

8. Page 4, Section 5.1.1 – Please elaborate on the statement "Wastewater treated at the WWTP is derived primarily from domestic sources, with less than 1% of total flow derived from industrial sources…." What is the source of this information and how was this determined? Has the historic fraction of wastewater always been 1% of total flow? Also, while discussions are focus primarily on post-transfer (i.e. Devens) operations, there were at least nine additional infiltration beds in use during Army's ownership/operation of the plant. Samples should be collected from both historic and existing beds. Also, please include a brief discussion of daily operations during pre-transfer operation of the WWTP. Was the sludge spread on site or transported to another location on base? Please expand the conceptual model discussion to discuss/consider both pre- and post- transfer plant operations and the high likelihood, given the lack of regulatory oversight of WWTPs during this timeframe and the levels of PFAS detected throughout the former military installation (and the likely transfer of PFAS contamination through the sewer system), that pre-transfer treatment plant effluent contained significant levels of PFAS when it was discharged to the infiltration beds.

   Response: Sources for information were derived from review of historical documents during the preliminary assessment (PA) which was performed by KGS in 2017. The specific

reference to "1% of total flow" came from the Master Environmental Plan for Fort Devens (Environmental Assessment and Information Sciences Division, 1992). Historically, there were a total of 22 beds in operation. Currently, there are 18 beds, as four of them were removed to build other (existing) structures. The current placement of vertical profiles and soil borings are placed within the beds and the results will be representative of all of the beds since they were used in rotation. As indicated in the Area 3 FSP text, a detailed summary of past and current operations regarding wastewater treatment in provided in the Remedial Investigation Work Plan (RI WP). As indicated in the RI WP, once dried, the sludge was spread onto the former Moore Army Airfield (AOC 50), which is part of the investigation. The CSM recognizes pre- and post-transfer plant operations as a source for PFAS contamination. This was confirmed during the SI. The current distribution of vertical profile and soil boring locations will provide both vertical and lateral coverage within the infiltration beds, within the former sludge drying beds, and downgradient, cross-gradient, and upgradient of the sludge and infiltration beds.

9. Page 5, Section 5.1.1 – As stated above, locations of the storm water sewers and associated discharge locations should be identified and investigated.

   Response: There are no storm water structures at AOC 20/21.

10. Page 5, Section 5.1.1 – EPA recommends that samples of wastewater influent be collected for TOP analysis to rule it out as an ongoing source.

    Response: Samples of the WWTP influent and effluent were analyzed for PFAS during the SI and confirmed that the WWTP influent is a potential ongoing source of PFAS at AOC 20. Additional sampling and analysis of WWTP influent is not necessary for the RI.

11. Page 7, Section 5.1.3.3 – Given the number of pre-transfer infiltration beds (see comment 8. above) in use during pre-transfer WWTP operations and that PFAS-containing effluent would not have uniformly released/applied to the infiltration beds, EPA requests that additional soil samples be collected within the boundaries/berms of current and historic infiltration beds.

    Response: See the response to EPA Specific Comment #8.

12. Page 8, Sec 5.1.3.6 - See Page-Specific Comment 7. above.

    Response: The text of Section 5.1.3.6 was revised as follows:

    "Samples from selected wells (approximately two per AOC) will be analyzed for PFAS via the TOP assay and for DOC."

13. Page 13, Section 5.2.2.2 – Please revise the first full sentence to clarify its intent. Also, additional piezometers are needed to more accurately define groundwater flow direction on the western side of the site, including areas west of AOC50-17-01 and AOC50-17-03.

    Response: The first full sentence on Page 13, Section 5.2.2.2 was revised as follows:

    "If rig refusal is encountered significantly shallower than the anticipated depth to bedrock, then one 10-ft step-out will be conducted."

    Piezometers are planned to the west of AOC50-17-01 and AOC50-17-03. As discussed in the last paragraph of Section 5.2.2.2, piezometers will be installed to determine groundwater flow direction in areas to the west, east, and north of AOC 50 where there is little coverage by existing monitoring wells. Specifically, a piezometer is planned adjacent to AOC50-17-

01 at 50VP-19-06 and via Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated July 15, 2019, there are five piezometers planned to the west of AOC50-17-01/AOC50-17-03. Additionally, monitoring well G6P-97-05X was discovered during field reconnaissance (April 2019). These piezometers and G6P-97-05X will be included in synoptic water level gauging events and will help provide groundwater flow assessment in the north, west, portion of the site. Depth to water measurements obtained at these piezometers and wells are expected to provide data to be used to calculate groundwater flow direction on the western side of the site. The text, tables, and figures have been updated appropriately to reflect the changes described in the Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated July 15, 2019.

14. Page 13, Section 5.2.2.2 - Additional vertical profiles locations should be included to address data gaps downgradient of the northern end of the sludge drying beds. Specifically, two should be installed east of the service road, one just downgradient of the northern end of the sludge drying beds and another farther downgradient from the initial location. Based on analytical results, it may be necessary to determine if there are impacts to the river by constructing a vertical profile closer to the river and adding additional SW/SED samples and eventually adding permanent monitoring wells northwest of the drying beds.

    Response: Section 5.2.2.2 of the Area 3 FSP discusses groundwater vertical profiling approach to be used at the AOCs associated with the former MAAF (AOCs 30, 31, and 50). There are no sludge drying beds associated with the former MAAF. There are, however, areas of historic sludge application (i.e., disposal areas) on portions of the airfield, as shown on Figure 5. There are groundwater vertical profiles planned within the historic sludge applications areas, downgradient of the historic sludge application areas, closer to the river downgradient of the historic sludge application areas, and surface water and sediment sampling is planned within the Nashua River downgradient of the historic sludge application areas. Groundwater vertical profiles 50VP-19-13, G6M-18-01VP, G6M-18-02VP, and 50VP-19-10 are located within these historic sludge application areas. Vertical profiles 50VP-19-07, -12, -13 and 31VP-19-04 are downgradient of historic sludge application areas. Vertical profile 31VP-19-08 is downgradient of a historic sludge application area and closer to the Nashua River Surface water and sediment is planned in the Nashua River at locations downgradient of the historic sludge application areas.

    Via the Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated 5 September 2019, vertical profile locations 31VP-19-06, -07, and -08 were moved closer to the river, a staff gauge was added, and a co-located (shallow/deep) pair of piezometers will be installed at location 31VP-19-07. It should be noted, that an attempt to get to these locations on the floodplain with the drill rig will be made, however drilling these locations via hand tooling may be a possibility. The note in the text (Section 5.2.2.2, page 12) was revised and the other text, tables, and figures were updated to reflect the changes noted in the Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated 5 September 2019.

    Also, as stated in Section 5.2.2.5 of the Area 3 FSP, the final location and screen settings of newly installed monitoring wells at Area 3 will be reviewed in conjunction with the USEPA and MassDEP, and will be based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring well sampled at Area 3.

15. Page 13, Section 5.2.2.3 – Additional soil samples are needed at the water table in areas of elevated PFAS concentrations.

    Response: After the data from the existing monitoring wells, groundwater vertical profiles, and soil samples are evaluated and the areas of elevated PFAS concentrations are identified, if significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps.

16. Page 15, Section 5.2.2.6 - See Page-Specific Comment 7. above.

    Response: The text of Section 5.2.2.6 will be revised as follows:

    "Samples from selected wells (approximately two per AOC) will be analyzed for PFAS via the TOP assay and for DOC."

17. Page 16, Section 5.3 – Please expand the proposed field sampling program to collect additional surface water and sediment samples from depositional areas at river bends.

    Response: One surface water and sediment sample location was added to the Nashua River downstream of the former Fort Devens boundary. A total of 13 surface water and sediment samples are planned to be collected along the portion of the Nashua River that runs through Areas 2 and 3 and, one surface water and sediment sample is planned within the Nashua River downgradient of Area 3. Locations along the run of the Nashua River within Area 3 were selected to determine if PFAS are present in areas most likely to be impacted by PFAS originating (either through groundwater discharge or overland flow of contaminated surface soils and/or aqueous film forming foams) from the Area 3 AOCs.

    Please note that additional surface water and sediment samples will be collected as part of the PFAS RI at Devens and are located within various surface water bodies that are situated topographically and hydraulically upgradient of the former Main Post and North Post. The locations of upstream surface water and sediment samples are shown on a newly added Figure 8 (attached) and incorporated into Table 11 of the Area 3 FSP.

    The following text will be added after the fourth paragraph of Section 5.3 – Surface Water and Sediment Sampling.

    "In addition, surface water and sediment samples will be collected from the shores of surface water bodies *that are located topographically and hydrologically upgradient of known AOCs on the former Main Post and North Post in support of the RI. Refer to Table 11 for sample details and Figure 8 for locations. The land use around these upstream sampling locations is primarily residential or light industrial and they are expected to have similar physical characteristics and habitat to surface water bodies downgradient of or adjacent to the AOCs. The PFAS results from these locations will be used to evaluate if detections of PFAS in surface waters and sediment potentially impacted by known AOCs on the former Main Post are elevated compared to upstream conditions."*

18. Page 17, Section 7.0 – Currently one equipment blank will be collected per week and one field reagent blank will be collected per event. Please define "event". Given that PFAS is the contaminant of concern and number of samples to be collected, equipment blanks should be collected more often – either daily or 1 per 20 samples. Also, please clarify which tasks will use dedicated equipment and thus not require equipment blanks. If mostly dedicated or disposable

equipment is being used, the frequency of the field reagent blanks many need to be adjusted upwards as well.

Response: Equipment blanks will be collected at the frequency specified in Worksheet #20 of the QAPP, which was reviewed by EPA prior to starting RI sampling activities in Fall of 2018.

19. Figure 2 – Please add the additional vertical profiles locations requested in Page-Specific Comment 14 above.

Response: See the response to EPA Page-Specific Comment #14.

20. Figure 2 – Please add the additional surface water and sediment sample locations requested in Page-Specific Comment 17 above.

Response: See the response to EPA Page-Specific Comment #17.

21. Figure 3 – Please add the additional piezometers requested in Page-Specific Comment 13 above.

Response: See the response to EPA Page-Specific Comment #13.

22. Figure 4 – Please confirm that the existing wells to be sampled are screened at elevations consistent with the depth of detections at G6M-18-01VP and G6M-18-02VP. If not, additional vertical profiles should be installed downgradient of G6M-18-02VP.

In addition, the discussion on page nine describing groundwater flow as west to west-southwest, seems inconsistent with the high detections of PFAS in G6M-18-01VP especially it's located more than 200 feet east-northeast (upgradient?) of the bermed FTA.

Response: The existing monitoring wells that appear to be located hydraulically downgradient of vertical profiles G6M-18-01VP and G6M-18-02VP (XSA-12-98X, XSA-12-96X, XSA-00-88X, and G6M-02-07X) have mid-screen elevations that range between 126 ft and 174 ft NGVD. The interval of maximum PFOS/PFOA detections at vertical profile G6M-18-02VP ranges from 139-179 ft NGVD in the aquifer. Therefore, it appears that the screen settings at apparent downgradient wells are consistent with the elevation of detections at G6M-18-01VP and G6M-18-02VP.

The source of PFAS at groundwater vertical profile G6M-18-01VP has yet to be determined. There are multiple potential sources upgradient of G6M-18-01VP, specifically a former sludge disposal area, the former fire station, former hangars, foam application along the runways, and PFAS has been detected in the AOC 50 source area. As stated earlier, the direction of groundwater flow in this area will be evaluated as described in response to EPA comments #13 and #14.

23. Figure 5 – Please add missing location G6M-18-01VP to the figure.

Response: This location will be added to Figure 5.

24. Figure 5 - Additional new wells are needed between boring 50SB-19-06 and former well AOC50-17-11 to fill a spatial data gap between the source areas and the river.

Response: As stated in Section 5.2.2.5 of the Area 3 FSP, the final location and screen settings of newly installed monitoring wells at Area 3 will be reviewed in conjunction with the USEPA and MassDEP and will be based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling and existing monitoring well sampled at Area 3.

25. Figure 6 - There is evidence of an east to east-northeast component of groundwater flow component on the eastern side of this figure. Additional vertical profile locations are needed farther east to investigate this area. Has the source of elevated PFAS north of Route 2A been identified?

    Response: Historic data reported in the AOC 50 RI indicates that there may potentially be a component of flow to the north/northeast from the AOC 50 source area. As shown on Figure 6 and discussed in the first sub-bullet on page 12 of the Area 3 FSP, three groundwater vertical profiles (50VP-19-01, -02, and -03) will be advanced to the north side of Route 2A to determine the extent of PFAS in groundwater to the north/northeast of the AOC 50 PCE source area. A source for PFAS on the north side of Route 2 has not been identified yet. The data obtained from these three groundwater vertical profiles and nearby monitoring wells will be reviewed and additional field activities will be evaluated after review of the data.

26. Figure 7 – EPA disagrees with the groundwater flow direction as depicted on this figure; Additional piezometers are recommended to more accurately define groundwater flow direction on the western side of this site, including areas west of AOC50-17-01 and AOC50-17-03. There are also an inadequate number of soil samples with samples at the water table in areas of elevated PFAS concentrations.

    Response: The groundwater flow direction within the AOC 50 groundwater plume was measured to flow to the southwest, across the former MAAF has been measured repeatedly in support of the ongoing AOC 50 long-term monitoring (LTM) program and presented in numerous monitoring reports. There are no groundwater monitoring wells located to the north and west of the AOC 50 PCE groundwater plume near the former hangars and former fire station.

    As discussed in the last paragraph of Section 5.2.2.2, piezometers will be installed to determine groundwater flow direction in areas to the west, east and north of AOC 50 where there is little coverage by existing monitoring wells. Specifically, a piezometer is planned adjacent to AOC50-17-01 at 50VP-19-06 and via Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated 15 July 2019, there are five piezometers planned to the west of AOC50-17-01/AOC50-17-03. Additionally, monitoring well G6P-97-05X was discovered during field reconnaissance (April 2019). These piezometers and G6P-97-05X will be included in synoptic water level gauging events and will help provide groundwater flow assessment in the north, west, portion of the site. Depth to water measurements obtained at these piezometers and wells are expected to provide data to be used to calculate groundwater flow direction on the western side of the site. The text, tables, and figures were updated appropriately to reflect the changes described in the Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated July 15, 2019.

    After the data from the existing monitoring wells, the groundwater vertical profiles, and the soil samples are evaluated and the areas of elevated PFAS concentrations are identified, if significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps.

27. Table 5 - Given the elevated PFAS at G6M-18-01VP, an additional soil sample at the water table is needed at 31SB-19-02 and an additional boring and water sample are needed near G6M-18-01VP.

Response: The leaching potential for soils located at the water table at AOC 31 will be assessed with the collection of a water table soil sample at nearby soil boring 31SB-19-01, which is located approximately 40 feet of the 31SB-19-02. Both soil borings 31SB-19-01 and 31SB-19-02 are located within the approximately 100-ft x 100-ft bermed area where former AFFF application occurred during fire training activities. Given the proximity of these soil borings to each other, the PFAS results obtained from the water table at 31SB-19-01 are expected to be representative of PFAS concentrations at the soil/water interface that may be present beneath the fire training area. Minor changes were made to estimated sample intervals on Table 5 and Table 3.

After the data from the existing monitoring wells, groundwater vertical profiles, and soil samples are evaluated and the areas of elevated PFAS concentrations are identified, if significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps.

28. Table 5 - Additional borings are needed in the AOC-50 central area (Figure 7) and multiple soil samples at the water table are also needed in the source areas where there are none currently proposed.

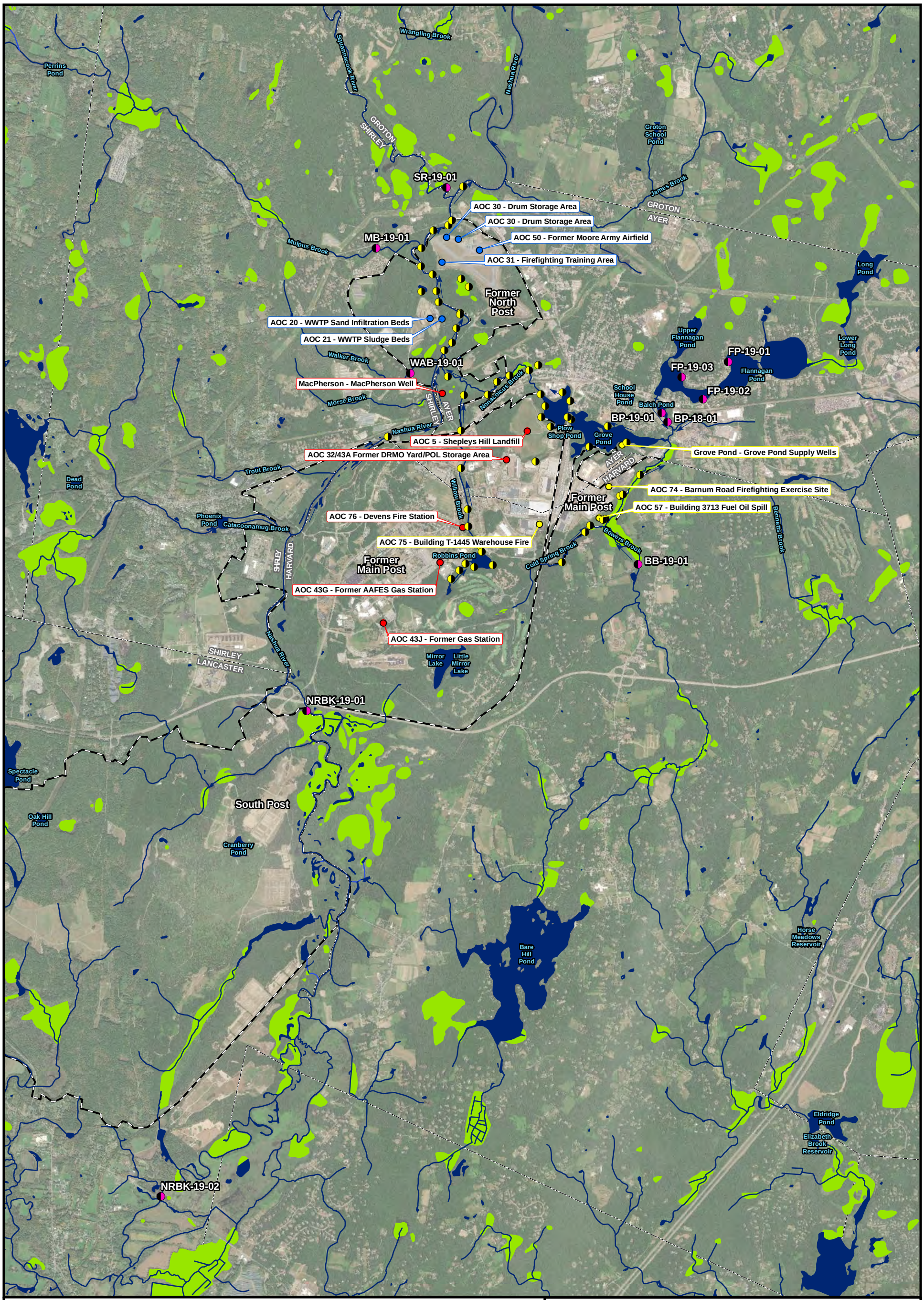
    Response: See the response to EPA page-specific comment #26.

29. Tables 6 and 7 - Add the piezometers and additional new wells requested above.

    Response: See the response to EPA Page-Specific Comments #13 and #14.

30. Table 9 - Review and adjust the existing wells to be sampled, if necessary, to reflect data obtained prior to finalizing this FSP.

    Response: Sampling of the existing monitoring wells proposed in the Area 3 FSP was completed on 8 May 2019 and the results were provided to EPA in June. The PFAS data obtained from these existing monitoring wells, along with the PFAS data obtained from the groundwater vertical profiling borings to be advanced at Area 3 will continue to be reviewed to determine if any data gaps that may be identified can be addressed through sampling of other existing groundwater monitoring wells.



Legend

- Proposed Background Surface Water and Sediment Sampling Location
- Proposed Surface Water and Sediment Sampling Location
- Area 1 - Grove Pond Supply Wells, AOCs 57, 74, and 75
- Area 2 - MacPherson Water Supply Well, SHL, AOCs 32/43A, 76, 43G and 43J
- Area 3 - AOCs 20, 21, 30, 31, and 50
- Surface Water Flow Direction
- City/Town Boundary
- Former Fort Devens Boundary

National Hydrography Dataset

- Stream/River
- Connector
- Lake/Pond
- Swamp/Marsh

Background Surface Water Body Sample Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Army Installation Devens
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 2,000 4,000
Feet

Date: 09/09/2019

Figure 8

File: 0919_FSPADD_A3FSP_F8_BkgrndPond.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

U.S. ARMY RESPONSES TO MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION COMMENTS ON THE DRAFT AREA 3 FIELD SAMPLING PLAN ADDENDUM TO THE REMEDIAL INVESTIGATION WORK PLAN FOR PFAS FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MASSACHUSETTS September 2019

The following Army responses pertain to the Massachusetts Department of Environmental Protection (MassDEP) comments, dated 7 December 2018, on the draft *Area 3 Field Sampling Plan, Addendum to Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA*, dated November 2018.

Comment #1: Section 4.4: The cited Human Health Risk Assessment and Screening Level Ecological Risk Assessment (HERA) Work Plan has not been submitted; consequently, MassDEP will reserve judgment on the screening levels presented there.

Response: The draft HERA work plan was submitted to the MassDEP and EPA for review on 15 February 2019.

Comment #2: Figure 1: Surface water and sediment sample location NR-19-02 should be identified.

Response: NR-19-02 is identified on Figure 2.

Comment #3: Figure 2: The location of the Ayer WWTP outfall should be determined with the same accuracy used to locate the surface water and sediment samples (e.g., GPS survey).

Response: The location of the Ayer WWTP outfall was identified and was posted on figure 2 in the final FSP.

Comment #4: Figure 3: The proposed scope of investigation for AOC 30 is insufficient to characterize groundwater beneath either storage area. As indicated in Section 5.2.1 (and discussed during the 11 October 2018 conference call), groundwater flow directions in both areas are not known. In addition, PFAS concentrations upgradient, downgradient, and vertically within the aquifer should be determined in both areas to pin-point source locations, target soil samples, and determine the contribution of each source to more extensive contamination that may originate at upgradient locations. To close these datagaps:

<u>Western Storage Area:</u>

- A minimum of three equally-spaced piezometers and/or monitoring wells should be installed near the perimeter of the area to obtain water level measurements that can be used to estimate groundwater flow directions. MassDEP recommends the configuration shown in Attachment 1.
- The distribution of PFAS east and south of the area should be determined by sampling groundwater in the vicinity of proposed soil boring 30SB-19-05 (upgradient of area?). One of the piezometers or wells installed to determine groundwater flow directions could be located here for this purpose (e.g., refer to Attachment 1).

<u>Eastern Storage Area:</u>

- A minimum of three equally-spaced piezometers and/or monitoring wells should be installed near the perimeter of the area to obtain water level measurements that can be used to estimate groundwater flow directions. MassDEP recommends the configuration shown in Attachment 1.
- The vertical distribution PFAS beneath this area should be determined by obtaining a vertical profile in the vicinity of proposed soil boring 30SB-19-02.

Response:

Western Storage Area:

- Based on review of existing well results from samples collected in 2019, the vertical profile and piezometers for AOC 30 were revised. The revisions were included in Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated 15 July 2019. Appropriate text, tables, and figures in the Area 3 FSP were updated with the revisions.

Eastern Storage Area:

- Based on review of existing well results from samples collected in 2019, the vertical profile and piezometers for AOC 30 were revised. The revisions were included in Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated 15 July 2019. Appropriate text, tables, and figures in the Area 3 FSP were updated with the revisions.

Comment #5: Figure 7: The proposed scope of investigation is insufficient to characterize groundwater in the vicinity of the fire station and northern aircraft hangar (Building 3818). As demonstrated by the conditions encountered at the Main Post fire station, the airfield fire station should be assessed as a potential independent PFAS source area. To accomplish this, groundwater flow directions beneath the fire station must be determined and PFAS concentrations upgradient, downgradient, and vertically within the aquifer must be determined to pin-point source locations, target soil samples, and determine the contribution of fire station source(s) to more extensive contamination that may originate at upgradient locations (e.g., the aircraft hangars). As indicated in Section 5.2.1 (and discussed during the October 11 conference call), groundwater flow directions beneath the fire station are not known, and available data are not sufficient to determine if the PFAS contamination reported in samples collected from locations AOC50-17-01 and AOC50-17-02 originates from a source near the fire station or an upgradient source (e.g., the aircraft hangars). In addition, existing water level control points are insufficient to determine groundwater flow directions beneath the northern aircraft hangar, a probable PFAS source area. To close these datagaps:

Airfield Fire Station:

- A minimum of three equally-spaced piezometers and/or monitoring wells should be installed around the fire station to obtain water level measurements that can be used to estimate groundwater flow directions beneath the fire station. MassDEP recommends the configuration shown in Attachment 2. As indicated in the attachment, the proposed piezometer at location 50VP-19-06 could serve as one of the measuring points.
- The distribution of PFAS north and west of the fire station should be determined by sampling groundwater in those directions. Two of the piezometers or wells installed to determine groundwater flow directions could be sampled for this purpose (e.g., refer to recommended locations in Attachment 2).

Northern Aircraft Hangar (Building 3818):

- To establish a minimum of three water level control points around the northern aircraft hangar, an additional piezometer or monitoring well should be installed near proposed vertical profile location 50VP-19-05 (near the southwest corner of the building, refer to Attachment 2). Well 6GM-02-01X and proposed well G6M-19-01 can serve as the other two water level control points for the northern hangar.

Response:

Airfield Fire Station:

- A historic well, that was previously believed to be abandoned, was found north of the former fire station (G6P-97-05X). The well was sampled for the RI and will be used for hydraulic evaluations in the future. Piezometers were also added to the RI north of the former fire station. These additional locations will provide information on nature and extent of PFAS and groundwater flow direction north and west of the former fire station. Figure and table updates were made to the FSP to include G6P-97-05X.

Northern Aircraft Hangar (Building 3818):

- The proposed piezometers at vertical profile locations 50VP-19-04 and 50VP-19-06 along with numerous existing wells provide adequate coverage to determine groundwater flow paths in the area.

Comment #6: Table 1: Missing data (denoted by "UNK") should be acquired via records review or field measurement.

Response: Table 1 was updated with all available information.

Comment #7: Table 2: Table 2 should also list monitoring well G6M-97-09B (refer to Figure 5 and Table 9).

Response: G6M-97-09B was added to Table 2.

Comment #8: Table 9: The following well IDs should be shaded: G6M-02-01X, G6M-04-12X, and XSA-00-91X (refer to Table 2). The following well ID should not be shaded: G6M-02-12X (refer to Table 2).

Response: Table 9 and Table 2 was cross-referenced for accuracy. The recommendation changes were incorporated into Table 2 and Table 9. G6M-97-09B was added to Table 2.

U.S. ARMY RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE PFAS RI AREA 3 RECOMMENDATIONS FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MASSACHUSETTS September 2019

The following responses are intended to supplement the Army's responses to EPA's July 25, 2019 comments on the Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated July 15, 2019.

AOC 30

- Existing well construction logs and available cross-sections should be provided to support changes to the Area 3 FSP Addendum.

  Response: There are no existing wells or available cross-sections at AOC 30. Cross sections will be prepared during the RI based on the data to be collected.

- Additional VPs and/or PZs are needed north of 30M-19-03, in low ground area near the Nashua River.

  Response: After the chemical data from the existing monitoring wells at the former MAAF, groundwater vertical profiles, surface water and sediment samples, and soil samples are evaluated and the groundwater flow is assessed, if significant data gaps are identified, then additional field activities will be completed to address data gaps.

- Additional PZs are needed to more accurately define groundwater flow direction on the western side of the site.

  Response: After the chemical data from the existing monitoring wells at the former MAAF, groundwater vertical profiles, surface water and sediment samples, and soil samples are evaluated and the groundwater flow is assessed, if significant data gaps are identified, then additional field activities will be completed to address data gaps.

- Additional PZs are needed to confirm groundwater flow direction; assumptions based on site topography and proximity to the River must be supported by additional site-specific data; the six, temporary drive point samples advanced during the SI must be supplemented with VP and/PZ data.

  Response: The SI results were not used to make decisions regarding groundwater flow gradients and direction. The Area 3 FSP for the RI does not propose utilizing water level measurements from temporary drive points. The five piezometers that will be installed in the north/northwestern portion of the site in conjunction with using existing wells, and piezometers at vertical profile locations 50VP-19-06 and 50VP-19-04, will provide the data to assess groundwater flow direction. After the chemical data from the existing monitoring wells at the former MAAF, groundwater vertical profiles, surface water and sediment samples, and soil samples are evaluated and the groundwater flow is assessed, if significant data gaps are identified, then additional field activities will be completed to address data gaps.

- Additional soil samples/soil borings are needed to define the extent of elevated PFAS concentrations detected in source area, some of which are three orders of magnitude greater than many LHA exceedances in groundwater.

  Response: After the chemical data from the existing monitoring wells at the former MAAF, groundwater vertical profiles, surface water and sediment samples, and soil samples are evaluated and the groundwater flow is assessed, if significant data gaps are identified, then additional field activities will be completed to address data gaps.

- Another VP and PZ northeast of G6P-97-05X based on the topography and associated groundwater flow direction.

  Response: After the chemical data from the existing monitoring wells at the former MAAF, groundwater vertical profiles, surface water and sediment samples, and soil samples are evaluated and the groundwater flow is assessed, if significant data gaps are identified, then additional field activities will be completed to address data gaps.

- Assumptions regarding the presence or absence of groundwater impacts in a specific area (i.e. south of the drum storage areas), must be confirmed via the collection of site-specific sample data.

  Response: Groundwater impacts south of the drum storage areas will be assessed via analysis of data.

AOC 20

- Existing well construction logs and available cross-sections should be provided to support changes to the Area 3 FSP Addendum.

  Response: Various investigations and assessments at or near the Devens wastewater treatment plant area have been completed and documented in reports. Copies of reports provided by MassDevelopment Utilities Department will be forwarded to EPA and MassDEP.

- EPA concurs with the movement of 20VP-19-02 as proposed if the assumption is that PFAS concentrations exceed the LHA extend all the way to river at the north end of the infiltration beds.

  Response: Comment noted.

- EPA disagrees with the proposed deletion of 20VP-19-03; rationale similar to that used to support the proposed movement of 21VP-19-02 towards the river, should be employed here; EPA recommends instead that it be moved toward the river downgradient of MW-2A to characterize PFAS in this area (i.e. "understand fate and transport as potential contamination flows toward the river"); otherwise, the Area 3 PFAS Report must assume that PFAS concentrations exceeding the LHA extend all the way to the river.

  Response: Based on results from other sites at Devens, it is anticipated that PFAS concentrations exceeding the LHA extend to the river.

- EPA concurs with the proposed addition of 20VP-19-04, adjacent to MW-WC1A, in the previous location of 20VP-19-03.

  Response: Comment noted.

- EPA recommends moving currently designated 20VP-19-04 farther east southeast between PZ-5 and the river, half-way between former 20VP-19-04 and new 20VP-19-03;

  Response: The location recommended by EPA is a steep slope which leads into a wetland and is inaccessible to the drill rig.

- EPA disagrees with the proposed movement of 20VP-19-04; without knowledge of overburden depth at and downgradient of MW-01A, additional vertical characterization is warranted at the currently proposed location; Also, the reduction of PFAS at MW-01A suggests downgradient movement of PFAS in this area.

  Response: Proposed vertical profile 20VP-19-04 will provide information on overburden thickness and vertical characterization of PFAS in the general area of MW-01A.

- Unless Army can verify, with site-specific data, that there is no saturated overburden there, former 20VP-19-07 should be moved from adjacent to MW-07 to the east southeast 400 feet from MW-07 and co-located with an additional PZ; EPA believes contamination at PZ-05 is directly from the infiltration beds which are 35 feet higher in elevation than PZ-05. Similarly, the infiltration beds are likely impacting the area west of the beds, warranting further investigation to assess/confirm the extent of PFAS contamination in this area.

  Response: After 20VP-19-08 and 20VP-19-05 are drilled and the vertical profiling and groundwater samples and existing wells are evaluated, if significant data gaps are identified, then additional field activities will be completed to address data gaps.

- EPA disagrees with the proposed deletion of 20VP-19-07 at MW-07; documentation must be provided to support Army's rationale.

  Response: Various investigations and assessments at or near the Devens wastewater treatment plant area have been completed and documented in reports. Copies of reports provided by MassDevelopment Utilities Department will be forwarded to EPA and MassDEP.

- Given that PFAS impacts west of the infiltration beds on the north have yet to be assessed/defined, EPA questions the movement of former 20VP-19-10 to new location at 20VP-19-08; further discussion is warranted prior to implementing the proposed move;

  Response: After the vertical profiles have been drilled and the vertical profiling and groundwater samples from existing wells are evaluated, if significant data gaps are identified, then additional field activities will be completed to address data gaps.

- Additional VPs must be included to address data gaps downgradient of the northern edge of the sludge drying beds and to define the nature and extent of PFAS contamination associated with the sludge beds as a confirmed source area;

  Response: After the chemical data from the existing monitoring wells, the groundwater vertical profiles, surface water and sediment samples, and the soil samples are evaluated and the groundwater flow is assessed, if significant data gaps are identified, then additional field activities will be completed to address data gaps.

- Historic drawings and design documents for the former Devens Fire Station and Hangar buildings must be obtained from Army personnel/historic records and submitted to regulators to

support the extent of any proposed investigation of potential PFAS source areas within the former MAAF;

Response: Historical drawings and design documents for the former Devens Fire Station and Hangar buildings were previously provided in Appendix A of the *Final Expedited Site Inspection Work Plan for Per- and Polyfluoroalkyl Substances (PFAS)* (May 2017).

- An additional SW/SED location should be located at the depositional areas of river bends.

  Response: One surface water and sediment sample location was added to the Nashua River downstream of the former Fort Devens boundary. A total of 13 surface water and sediment samples are planned to be collected along the portion of the Nashua River that runs through Areas 2 and 3 and, one surface water and sediment sample is planned within the Nashua River downgradient of Area 3. Locations along the run of the Nashua River within Area 3 were selected to determine if PFAS are present in areas most likely to be impacted by PFAS originating (either through groundwater discharge or overland flow of contaminated surface soils and/or aqueous film forming foams) from the Area 3 AOCs.

  After the chemical data from the existing monitoring wells, the groundwater vertical profiles, and surface water and sediment samples are evaluated and the groundwater flow is assessed, if significant data gaps are identified, then additional field activities will be completed to address data gaps.

- The locations of all historic and current storm water sewers and associated discharge areas/points investigated to adequately evaluate potential off-site migration pathways.

  Response: There are no storm water structures at AOC 20/21.

U.S. ARMY RESPONSES TO MASSDEVELOPMENT COMMENTS ON THE DRAFT AREA 3 FIELD SAMPLING PLAN ADDENDUM TO REMEDIAL INVESTIGATION WORK PLAN FOR PFAS
October 2019

The following Army responses pertain to the MassDevelopment comments, dated 26 August 2019, on the *Draft Area 3 Field Sampling Plan (FSP) Addendum to the Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA*, dated November 2018.

General Comments

GC Comment #1: The Army's proposed approach of identifying key locations and sampling depth intervals based on vertical profiling is cost-effective and consistent with the state-of-the-practice for high-resolution expedited site characterization. It is suggested that profiling is most effective when multiple points are installed in transects that are typically aligned perpendicular and/or parallel to the interpreted direction of plume migration. The Army proposes transects, for example, downgradient of the Area 31 source zone through profiling points 31VP-19-02 through 04 and 31PV-19-06 through 08. As presented herein in subsequent comments, it is suggested that there are other opportunities to use the transect approach with vertical profiling to help address identified data gaps.

> **Response:** Comment noted. The locations of proposed groundwater vertical profiles at Area 3 were selected with consideration of PFAS source area information and groundwater flow field information that was available at the time of work planning stages for this Remedial Investigation (RI). At some AOCs, the source of PFAS and groundwater flow direction is well documented, while at other AOCs in Areas 3 the source is suspected (i.e., former hangar buildings, former fire station and drum storage areas). Additional investigation will be competed to address any data gaps identified.

GC Comment #2: With respect to the idea that preferential pathways including utility corridors, drains, and sewer lines be further explored, and given the age of Devens infrastructure, historic plans and drawings may identify only a limited number of utilities. It is suggested that surface geophysics, accordingly, may be an effective tool for identifying and tracing shallow utilities near former and existing buildings.

> **Response:** Comment noted. After the data from the existing monitoring wells, the groundwater vertical profiles, and the soil samples are reviewed, if significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps.

Page-Specific Comments

SC Comment #1: Page 2, Section 4.2, ¶ 1 – The proposed piezometers are to be screened near the water table. The upland settings of the ice-contact features on both sides of the Nashua River and the depth and thickness of the water-bearing glacial deposits are conducive to vertical variations in hydraulic head. Accordingly, we believe that monitoring wells screened at discrete intervals are needed to confirm groundwater flow directions, which may vary with depth in the formation.

> **Response:** Groundwater flow direction in both the shallow and deeper portions of the unconfined aquifer across the central portion of the former MAAF was extensively

investigated during the AOC 50 RI and has been routinely monitored in support of long term monitoring (LTM) since that time. A review of depth to water measurements reported during the AOC 50 RI and subsequent LTM events indicate a general agreement in groundwater flow direction across the entire thickness of the aquifer across the central portion of the former MAAF.

A review of cross sections presented in the AOC 50 RI indicate that lower conductivity units (till and fine/sand and clay deposits) are located near top of bedrock with much of the stratigraphic column beneath the former MAAF consisting of fine to medium sand deposits. Based on the general agreement in groundwater flow direction reported in both the shallow and deeper portions of the aquifer and the predominantly medium to fine sand deposits presented in the AOC 50 RI, the proposed piezometers are expected to provide depth to water measurements that can be used to estimate regional groundwater flow throughout much of the aquifer thickness.

It is noted that a vertical component of flow likely exists in portions of the aquifer beneath Area 3. A groundwater monitoring well network, consisting of existing and newly installed wells and/or piezometers will be developed after review of groundwater vertical profiling data. The objectives for the monitoring network across Area 3 will be to confirm PFAS concentrations in the aquifer and establish hydraulic monitoring points that will be used to evaluate horizontal and vertical components of flow in the aquifer.

SC Comment #2: Page 2, Section 4.2 – Transects of shallow vertical profiling points near 50VP-19-08, both parallel and perpendicular to the likely eastward gradient, may be a cost-effective approach to a preliminary assessment of PFAS extent on the western side of the Nashua River.

Response: After the data from the existing monitoring wells, the groundwater vertical profiles, and the soil samples are reviewed, if significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps.

SC Comment #3: Page 13, Section 5.2.2.2 – Piezometers are recommended in the area west/northwest of AOC50-17-01 and AOC50-17-03 where data are sparse for characterizing hydraulic gradient and PFAS extent. Given the elevated PFAS concentrations at these two monitoring points (834 to 3043 ng/L), a northeast-southwest aligned vertical-profiling transect, located west/southwest of AOC50-17-01 and 03 would provide a more direct measure of PFAS extent and migration pathways for the purpose of siting permanent monitoring wells.

Response: As document in the Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated 15 July 2019, there are five piezometers planned to the west of AOC50-17-01/AOC50-17-03. Additionally, monitoring well G6P-97-05X was discovered during field reconnaissance (April 2019). These piezometers and G6P-97-05X will be included in synoptic water level gauging events and will help provide groundwater flow assessment in the north, west, portion of the site. Depth to water measurements obtained at these piezometers and wells are expected to provide data to be used to calculate groundwater flow direction on the western side of the site.

After the data from the existing monitoring wells, the groundwater vertical profiles, and the soil samples are reviewed, if significant data gaps are identified in order to delineate

the extent of PFAS contamination, then additional field activities will be completed to address data gaps.

SC Comment #4: Page 13, Section 5.2.2.2 – The area downgradient of the sludge drying beds is another location where vertical-profiling transects constructed parallel and perpendicular to the likely flow direction would expedite the assessment of PFAS extent and migration pathways. The likely groundwater flow direction from the drying beds is east/northeast toward the Nashua River.

Response: The PFAS groundwater contamination originating at the former sludge drying beds (AOC 21) is likely to be a smaller plume that falls within the footprint of PFAS impacted groundwater emanating from the infiltration beds to the WWTP (AOC 20). The intent of vertical profiles proposed at and downgradient of AOC 21 is to assess the vertical distribution of PFAS that may be originating at the former sludge drying beds and at the probable downgradient discharge point (Nashua River), which is approximately 600 feet downgradient of AOC 21.

After the data from the existing monitoring wells, the groundwater vertical profiles, and the soil samples are reviewed, if significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps.

SC Comment #5: Figure 3 – (Western Storage Area.) The plan should identify well screen intervals (depths/elevations and target water-bearing strata) of the piezometers or monitoring wells and provide some rationale for those intervals based on the depths where PFAS are encountered in the Western Storage Area. Vertical profiling should be considered to characterize the vertical distribution of PFAS.

Response: As described in the Area 3 FSP, piezometers will be installed at the water table and the locations and screen intervals of monitoring wells will be determined following review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells, as well as groundwater flow direction determined through synoptic water level events using new and existing piezometers and monitoring wells.

As indicated in the Area 3 FSP, vertical profiling is planned for AOC 30. Based on review of existing well results from samples collected in 2019, the vertical profile and piezometers for AOC 30 were revised. The revisions were included in Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated 15 July 2019. Appropriate text, tables, and figures in the Area 3 FSP was updated with the revisions.

SC Comment #6: Figure 3 – (Eastern Storage Area.) The plan should identify well screen intervals (depths/elevations and target water-bearing strata) of the piezometers or monitoring wells and provide some rationale for those intervals based on the depths where PFAS are encountered in the Eastern Storage Area. Vertical profiling should be considered to characterize the vertical distribution of PFAS.

Response: See response to comment #5.

SC Comment #7: Figure 4 – It is reported that G6M-18-01VP contained "high detections of PFAS." The aerial photographic base shows evidence of a rectangular area of disturbed ground that abuts G6M-18-01VP to the south and includes the delineated Area of Contamination (AOC). Is there evidence that fire training occurred within this disturbed area, such that the elevated detections in G6M-18-01VP indicate a localized source rather than eastward groundwater

migration from the AOC as it is delineated on Figure 4? Vertical profiling points near G6M-18-01VP may help distinguish a localized source from a contaminant migration pathway toward this profiling point.

Response: As identified on Figure 4 and 5, the area of disturbed ground that abuts G6M-18-01VP to the south is AOC 31, a former Fire Training Area (FTA). AOC 31 is addressed in the *Final Base-wide Preliminary Assessment for Evaluation of Perfluoroalkyl Substances, Former Fort Devens Army Installation* (KGS, 2017), the *Draft Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS)* (KGS, 2018), and in the Area 3 FSP.

Groundwater flow in this area is toward the Nashua River and thus G6M-18-01VP is upgradient of AOC 31. The top of PFOS/PFOA contamination at groundwater vertical profile G6M-18-01VP is located approximately 30 feet below the water table, indicating that the source of PFAS in groundwater at this boring is located at a suitable distance to allow the development of an accretionary wedge over the top of the PFAS contamination delineated at this location. In addition, the PFAS reported at vertical profile G6M-18-01VP is dominated by PFOA while the PFAS reported at the nearby by FTA (AOC 31) is dominated by PFOS.

The groundwater flow direction, vertical distribution of PFAS in groundwater at G6M-18-01VP, coupled with the apparently different PFAS signature compared to AOC31 indicate that the PFAS at G6M-18-01VP is not originating at AOC 31 but from a source upgradient of this location.

The source of PFAS at groundwater vertical profile G6M-18-01VP has yet to be determined. There are multiple potential sources upgradient of G6M-18-01VP, specifically the former sludge disposal areas at the former MAAF, the former fire station, former hangars, potential foam application along the runways of the former MAAF, and PFAS has been detected in the AOC 50 source area.

After the data from the existing monitoring wells, the groundwater vertical profiles, and the soil samples are reviewed, if significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps.

SC Comment #8: Figure 5 – See comment No. 3 above.

Response: Please see response to Specific Comment # 3.

SC Comment #9: Figure 6 – The evidence in this figure for an east-northeast component of groundwater flow is unclear. Regardless, if elevated PFAS are not detected in the proposed vertical profiling transect, comprising 50VP-19-01 through 50VP-19-03, additional data may be needed west and southwest of the Fire Pond to assess PFAS sources and extent.

Response: While groundwater flow direction at AOC 50 source area has been measured to be predominantly to the west/southwest, there has been a minor component of flow to the east/northeast as evidenced the AOC 50 contaminant of concern, tetrachloroethene (PCE), historically reported in groundwater monitoring wells located on the northeast side of Route 2A.

Groundwater west/southwest of the Fire Pond will be evaluated for PFAS during this RI through sampling of monitoring wells G6M-96-25A, G6M-96-25B, G6M-04-12X, and G6M04-11X (Figure 6) and the advancement of a groundwater vertical profile 50VP-19-04, located northeast of the Building 3818 (Figures 5 and 7).

SC Comment #10: Figure 7 – See comment No. 3 above.

Response: Please see response to Specific Comment # 3.

SC Comment #11: Figure 7 – (Airfield Fire Station.) Consider moving proposed locations 2 and 3 west/southwest of AOC50-17-01 and AOC50-17-02. The gradient is likely west/southwest in this area; therefore, installing wells/piezometers west of these locations, where elevated PFAS concentrations were detected, will help characterize extent of PFAS as well as refining the gradient. Further, the plan should identify well screen intervals (depths/elevations and target water-bearing strata) of the piezometers or monitoring wells and provide some rationale for those intervals based on the depths where PFAS are encountered.

Response: Army assumes location 2 refers to planned monitoring well G6M-19-02 and that location 3 refers to soil boring 50SB-19-03. Soil boring 50SB-19-03 is located adjacent to the former fire station building (where AFFF concentrate was reportedly stored) and slightly upgradient of the PFAS contamination reported at the water table at temporary well points AOC50-17-01 and AOC50-17-02 during the SI. Because this soil boring will be located at a former storage area of AFFF concentrate and upgradient of known water table contamination, it is suitably located to assess the potential for soil contamination in this area.

As indicated in the Area 3 FSP, the final location of overburden monitoring well G6M-19-02 will be selected based on a review if the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells. The final location and screen settings of the permanent monitoring wells will be reviewed with the EPA and MassDEP.

SC Comment #12: Figure 7 – (Northern Aircraft Hangar – Building 3818.) The plan should identify well screen intervals (depths/elevations and target water-bearing strata) of the piezometers or monitoring wells and provide some rationale for those intervals based on the depths where PFAS are encountered.

Response: As described in the Area 3 FSP, piezometers will be installed at the water table and the locations and screen intervals of monitoring wells will be determined following review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells, as well as groundwater flow direction determined through synoptic water level events using new and existing piezometers and monitoring wells.

SC Comment #13: Figure 7 – Consistent with previous comments, it is suggested that additional transects of vertical-profiling points be advanced, roughly perpendicular to the likely hydraulic gradient, to site locations and depth intervals of additional permanent monitoring wells or piezometers.

Response: After the data from the existing monitoring wells, the groundwater vertical profiles, and the soil samples are reviewed, if significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps.

U.S. ARMY SECOND SET OF RESPONSES TO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE AREA 3 FIELD SAMPLING PLAN ADDENDUM REMEDIAL INVESTIGATION WORK PLAN FOR PER- AND POLYFLUORINATED SUBSTANCES (PFAS)
FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MASSACHUSETTS

January 2020

The following Army responses pertain to the Environmental Protection Agency (EPA) original comments received 25 July 2019, on the *Area 3 Field Sampling Plan (FSP) Addendum, Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA*, dated November 2018 and to EPA follow-on comments received 19 November 2019, to Army's 09/10/2019 Responses to EPA's 07/25/19 comments on the *Area 3 Field Sampling Plan (FSP) Addendum, Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA*, dated October 2019. All comments and responses are shown for completeness.

Page-Specific Comments

Comment 4. Page 2, Section 4.2 – Although EPA appreciates the inclusion of "sonic drilling technology" as a possible tool for augmenting existing monitoring well data, it disagrees that DPT sampling alone can provide all of the groundwater data needed to define, with certainty, the vertical extent of PFAS in groundwater from the top of the water table to the top of *confirmed bedrock* -- not to "*DPT refusal*".

Army Response 9/10/2019: See the response to EPA Page Specific Comment #1. Also, as stated in Section 4.2 of the Area 3 FSP,

> "*The existing groundwater monitoring well network will be augmented with groundwater vertical profile sampling ("profiling") involving direct push technology (DPT) and/or possibly sonic drilling technology…. The groundwater vertical profiling will be conducted in conjunction with sampling of existing monitoring wells to delineate PFAS groundwater contamination vertically and laterally in the aquifer."*

Per Section 4.5 of the Area 3 FSP (Initial Data Review), if after a review of the data set collected under this FSP, significant data gaps are identified, then additional field activities will be completed to address data gaps.

EPA Response 11/19/2019: EPA notes that at some locations PFAS concentrations close to the LHA have been detected at shallow to moderate depths, followed by a deeper zone with minimal PFAS concentrations, followed again by a deep zone with very elevated PFAS concentrations. This speaks to the data gaps that could be present when DPT drilling hits refusal where deeper overburden may be present. Additional profiling must be performed at locations where shallower refusal was encountered to confirm refusal depths.

Army Response 01/17/20: Additional profiling will be conducted with sonic drilling where shallower refusal was encountered.

Comment 5. Page 2, Section 4.2 – Based on results obtained during the AOC 50 RI, confirming the presence of site-related COCs on the far side of the Nashua River, the PFAS groundwater sampling program must be extended to confirm/deny the presence of PFAS on the far side of the River, especially in areas with significant upgradient detections.

Army Response 9/10/2019: Sampling of groundwater on the far (i.e., western) side of the Nashua River is proposed as part of the Area 3 FSP. As shown on Figure 4 of the Area 3 FSP, sampling of the two existing monitoring wells (G6M-04-08X and G6M-04-14X) and advancement of a groundwater vertical profile (50VP-19-08) is planned across the Nashua River from AOC 50. In addition, a groundwater vertical profile is planned across the Nashua River from AOC 31 (31VP-19-05).

EPA Response 11/19/2019: EPA will await results of the planned sampling to determine if the four locations proposed west of the Nashua River are sufficient for confirming the extent of PFAS contamination emanating from AOC 50. It is likely, based on existing data and newly proposed sample locations, that additional investigations will be required west and northwest of AOC 30 and 50VP-19-13.

Army Response 01/17/20: Based on preliminary results of vertical profiles on the east side of the river, more investigation may be needed on the west side of the river. After all of the vertical profiles and existing well sample data has been reviewed, piezometers installed, and groundwater flow directions are evaluated, specific data gaps will be identified, and then additional field activities will be proposed and completed to address these data gaps.

Comment 6. Page 3, Section 4.5, last sentence – Please change "may" to "will". As stated in comments on the Areas 1 and 2 FSPs, the PFAS RI must include the identification and investigation of former and current underground utility corridors, sewer lines, floor and trench drains (and associated piping), catch basins, oil/water separators, storm water drainage systems (exterior trench drains), etc. for evaluation as potential source areas and/or possible conduits of PFAS contamination in all areas of the former military installation (i.e. base-wide) where PFAS has been detected.

Army Response 9/10/2019: The text was revised as follows:

"If additional potential point sources or secondary sources, such as sewer lines and storm water drainage systems are identified through review of the results, then additional groundwater vertical profiling and/or soil sampling will be completed to further delineate the nature and extent of PFAS related to these potential sources."

EPA Response 11/19/2019: While EPA appreciates Army's revision of the requested text, this issue remains one of EPA's largest concerns and expects that Army will provide a figure showing former and current subsurface features (i.e. underground utility corridors, sewer lines, floor and trench drains (and associated piping), catch basins, oil/water separators, storm water drainage systems (exterior trench drains, etc.) associated with each PFAS AOC. Evaluation of these features as "potential point source or second sources" cannot be performed without AOC-specific maps/figures.

Army Response 01/17/20: The Army has contacted MassDevelopment for information on former and current subsurface features. Maps showing these features will be developed to assist the investigation.

Comment 8. Page 4, Section 5.1.1 – Please elaborate on the statement "Wastewater treated at the WWTP is derived primarily from domestic sources, with less than 1% of total flow derived from industrial sources…." What is the source of this information and how was this determined? Has the historic fraction of wastewater always been 1% of total flow? Also, while discussions are focus primarily on post-transfer (i.e. Devens) operations, there were at least nine additional infiltration beds in use during Army's ownership/operation of the plant. Samples should be collected from both historic

and existing beds. Also, please include a brief discussion of daily operations during pre-transfer operation of the WWTP. Was the sludge spread on site or transported to another location on base? Please expand the conceptual model discussion to discuss/consider both pre- and post- transfer plant operations and the high likelihood, given the lack of regulatory oversight of WWTPs during this timeframe and the levels of PFAS detected throughout the former military installation (and the likely transfer of PFAS contamination through the sewer system), that pre-transfer treatment plant effluent contained significant levels of PFAS when it was discharged to the infiltration beds.

Army Response 9/10/2019: Sources for information were derived from review of historical documents during the preliminary assessment (PA) which was performed by KGS in 2017. The specific reference to "1% of total flow" came from the Master Environmental Plan for Fort Devens (Environmental Assessment and Information Sciences Division, 1992). Historically, there were a total of 22 beds in operation. Currently, there are 18 beds, as four of them were removed to build other (existing) structures. The current placement of vertical profiles and soil borings are placed within the beds and the results will be representative of all of the beds since they were used in rotation. As indicated in the Area 3 FSP text, a detailed summary of past and current operations regarding wastewater treatment in provided in the Remedial Investigation Work Plan (RI WP). As indicated in the RI WP, once dried, the sludge was spread onto the former Moore Army Airfield (AOC 50), which is part of the investigation. The CSM recognizes pre- and post-transfer plant operations as a source for PFAS contamination. This was confirmed during the SI. The current distribution of vertical profile and soil boring locations will provide both vertical and lateral coverage within the infiltration beds, within the former sludge drying beds, and downgradient, cross-gradient, and upgradient of the sludge and infiltration beds.

EPA Response 11/19/2019: Please confirm that all former infiltration beds were located proximate to the current, existing infiltration beds. EPA would like to see a figure(s) showing the locations of historic and current infiltration beds.

Army Response 01/17/20: Yes, the former infiltration beds were located immediately adjacent to the current, existing infiltration beds. The current treatment plant structures, shown on the east side of the current infiltration beds on Figure 2, were constructed on top of four of the former infiltration beds. The other beds remain unchanged. The current and former operations and infiltration beds at the waste-water treatment plant will be considered as part of the data evaluation. A historic photograph, that shows the historic infiltration beds, has been added to Figure 2.

Recent information on Devens WWTP influent was acquired from MassDevelopment. The third sentence of the first paragraph of Section 5.1.1 was deleted and the following text added at the end of the paragraph:

"Based on 2018 billing records provided by MassDevelopment, the Devens WWTP influent is comprised of the following categories:

- *26.03% from the towns of Ayer and Shirley (unknown origins),*
- *25.48% from the prison facility at Devens (MCI Shirley),*
- *18.74% from Industrial,*
- *14.30% from Institutional,*
- *11.37% from Commercial,*
- *2.58% from Residential,*

- *0.81% from Military,*
- *0.27% from Municipal,*
- *0.21% from Small Business,*
- *0.17% from Non-Profit, and*
- *0.04% from National Guard."*

Comment 10. Page 5, Section 5.1.1 – EPA recommends that samples of wastewater influent be collected for TOP analysis to rule it out as an ongoing source.

Army Response 9/10/2019: Samples of the WWTP influent and effluent were analyzed for PFAS during the SI and confirmed that the WWTP influent is a potential ongoing source of PFAS at AOC 20. Additional sampling and analysis of WWTP influent is not necessary for the RI.

EPA Response 11/19/2019: Army's response is unacceptable. See EPA Comment 5. below.

Army Response 01/17/20: The Area 3 FSP has been revised to indicate a sample of the Devens WWTP influent and effluent will be collected and analyzed for TOP assay analysis.

Comment 12. Page 8, Sec 5.1.3.6 - See Page-Specific Comment 7. above.

Army Response 9/10/2019: The text of Section 5.1.3.6 was revised as follows:

"Samples from selected wells (approximately two per AOC) will be analyzed for PFAS via the TOP assay and for DOC."

EPA Response 11/19/2019: Army's response is unacceptable. Two samples are inadequate especially at larger AOCs. Please revise the text to read, "… (approximately two to four per AOC)…

Army Response 01/17/20: The text will be revised as follows:

"*Samples from selected wells (approximately two to four per AOC)…."*

Comment 14. Page 13, Section 5.2.2.2 - Additional vertical profiles locations should be included to address data gaps downgradient of the northern end of the sludge drying beds. Specifically, two should be installed east of the service road, one just downgradient of the northern end of the sludge drying beds and another farther downgradient from the initial location. Based on analytical results, it may be necessary to determine if there are impacts to the river by constructing a vertical profile closer to the river and adding additional SW/SED samples and eventually adding permanent monitoring wells northwest of the drying beds.

Army Response 9/10/2019: Section 5.2.2.2 of the Area 3 FSP discusses groundwater vertical profiling approach to be used at the AOCs associated with the former MAAF (AOCs 30, 31, and 50). There are no sludge drying beds associated with the former MAAF. There are, however, areas of historic sludge application (i.e., disposal areas) on portions of the airfield, as shown on Figure 5. There are groundwater vertical profiles planned within the historic sludge applications areas, downgradient of the historic sludge application areas, closer to the river downgradient of the historic sludge application areas, and surface water and sediment sampling is planned within the Nashua River downgradient of the historic sludge application areas. Groundwater vertical profiles 50VP-19-13, G6M-18-01VP, G6M-18-02VP, and 50VP-19-10 are located within these historic sludge application areas. Vertical profiles 50VP-19-07, -12, -13 and 31VP-19-04 are downgradient of historic sludge application areas. Vertical profile 31VP-19-08 is downgradient

of a historic sludge application area and closer to the Nashua River. Surface water and sediment is planned in the Nashua River at locations downgradient of the historic sludge application areas.

Via the Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated 5 September 2019, vertical profile locations 31VP-19-06, -07, and -08 were moved closer to the river, a staff gauge was added, and a co-located (shallow/deep) pair of piezometers will be installed at location 31VP-19-07. It should be noted, that an attempt to get to these locations on the floodplain with the drill rig will be made, however drilling these locations via hand tooling may be a possibility. The note in the text (Section 5.2.2.2, page 12) was revised and the other text, tables, and figures were updated to reflect the changes noted in the Proposed Revisions to Groundwater Profiling and Piezometer Location in Area 3, dated 5 September 2019.

Also, as stated in Section 5.2.2.5 of the Area 3 FSP, the final location and screen settings of newly installed monitoring wells at Area 3 will be reviewed in conjunction with the USEPA and MassDEP, and will be based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring well sampled at Area 3.

EPA Response 11/19/2019: EPA's original comment incorrectly referenced Section 5.2.2.2 instead of Section 5.1.3.2. Please respond to EPA's comment in that context.

Army Response 01/17/20: A vertical profile (21VP-19-03) was added to the FSP. The vertical profile is located east of the northern end of the sludge drying beds close to the service road. East of the service road, near the northern end of the sludge drying beds, there are extensive wetlands and it is unlikely a rig will be able to access a suitable drilling location. Eight surface water and sediment sampling locations (NR-19-15 through -22) were added to the Nashua River. The figures and tables have been revised accordingly. Monitoring wells will be installed after consultation with EPA and MassDEP and review of the groundwater data.

Comment 16. Page 15, Section 5.2.2.6 - See Page-Specific Comment 7. above.

Army Response 9/10/2019: The text of Section 5.2.2.6 will be revised as follows:

"Samples from selected wells (approximately two per AOC) will be analyzed for PFAS via the TOP assay and for DOC."

EPA Response 11/19/2019: As stated above, two samples are inadequate especially at larger AOCs. Please revise the text to read, "… (approximately two to four per AOC)…"

Army Response 01/17/20: The text will be revised as follows:

"Samples from selected wells (approximately two to four per AOC)…."

Comment 17. Page 16, Section 5.3 – Please expand the proposed field sampling program to collect additional surface water and sediment samples from depositional areas at river bends.

Army Response 9/10/2019: One surface water and sediment sample location was added to the Nashua River downstream of the former Fort Devens boundary. A total of 13 surface water and sediment samples are planned to be collected along the portion of the Nashua River that runs through Areas 2 and 3 and, one surface water and sediment sample is planned within the Nashua River downgradient of Area 3. Locations along the run of the Nashua River within Area 3 were selected to determine if PFAS are present in areas most likely to be impacted by PFAS originating (either through groundwater discharge or overland flow of contaminated surface soils and/or aqueous film forming foams) from the Area 3 AOCs.

Please note that additional surface water and sediment samples will be collected as part of the PFAS RI at Devens and are located within various surface water bodies that are situated topographically and hydraulically upgradient of the former Main Post and North Post. The locations of upstream surface water and sediment samples are shown on a newly added Figure 8 (attached) and incorporated into Table 11 of the Area 3 FSP.

The following text will be added after the fourth paragraph of Section 5.3 – Surface Water and Sediment Sampling.

"In addition, surface water and sediment samples will be collected from the shores of surface water bodies *that are located topographically and hydrologically upgradient of known AOCs on the former Main Post and North Post in support of the RI. Refer to Table 11 for sample details and Figure 8 for locations. The land use around these upstream sampling locations is primarily residential or light industrial and they are expected to have similar physical characteristics and habitat to surface water bodies downgradient of or adjacent to the AOCs. The PFAS results from these locations will be used to evaluate if detections of PFAS in surface waters and sediment potentially impacted by known AOCs on the former Main Post are elevated compared to upstream conditions."*

EPA Response 11/19/2019: Army's response is unacceptable. There are no SW/SED samples at the big beds at AOCs 20 and 31 which are depositional areas. Samples must be collected in this area to adequately evaluate SW/SED contamination in the PFAS RI. EPA will continue to raise this issue as an existing data gap if not addressed in this field sampling program.

Army Response 01/17/20: Five additional surface water and sediment sampling locations have been added at big bends of the river along the western bank of the Nashua River. Three additional surface water and sediment sampling locations have been added at big bends of the river along the eastern bank of the Nashua River. The specific locations are shown on figures and Table 10 clarifies from which side of the river the sample will be collected. The text, tables, and figures have been updated accordingly.

Comment 19. Figure 2 – Please add the additional vertical profiles locations requested in Page-Specific Comment 14 above.

Army Response 9/10/2019: See the response to EPA Page-Specific Comment #14.

EPA Response 11/19/2019: See EPA Comment on PSC #14.

Army Response 01/17/20: See the 01/17/20 response to EPA PSC # 14.

Comment 20. Figure 2 – Please add the additional surface water and sediment sample locations requested in Page-Specific Comment 17 above.

Army Response 9/10/2019: See the response to EPA Page-Specific Comment #17.

EPA Response 11/19/2019: See EPA Comment on PSC #17.

Army Response 01/17/20: See the 01/17/20 response to EPA PSC # 17.

Comment 22. Figure 4 – Please confirm that the existing wells to be sampled are screened at elevations consistent with the depth of detections at G6M-18-01VP and G6M-18-02VP. If not, additional vertical profiles should be installed downgradient of G6M-18-02VP.

In addition, the discussion on page nine describing groundwater flow as west to west-southwest, seems inconsistent with the high detections of PFAS in G6M-18-01VP especially it's located more than 200 feet east-northeast (upgradient?) of the bermed FTA.

Army Response 9/10/2019: The existing monitoring wells that appear to be located hydraulically downgradient of vertical profiles G6M-18-01VP and G6M-18-02VP (XSA-12-98X, XSA-12-96X, XSA-00-88X, and G6M-02-07X) have mid-screen elevations that range between 126 ft and 174 ft NGVD. The interval of maximum PFOS/PFOA detections at vertical profile G6M-18-02VP ranges from 139-179 ft NGVD in the aquifer. Therefore, it appears that the screen settings at apparent downgradient wells are consistent with the elevation of detections at G6M-18-01VP and G6M-18-02VP.

The source of PFAS at groundwater vertical profile G6M-18-01VP has yet to be determined. There are multiple potential sources upgradient of G6M-18-01VP, specifically a former sludge disposal area, the former fire station, former hangars, foam application along the runways, and PFAS has been detected in the AOC 50 source area. As stated earlier, the direction of groundwater flow in this area will be evaluated as described in response to EPA comments #13 and #14.

EPA Response 11/19/2019: One or more vertical profiles are required southwest of G6M-18-02VP on the east side of the river to better define the vertical distribution and magnitude of PFAS concentrations east of the river. Detections at G6M-04-08X, G6M-04-14X, and G6M-01-01X indicate that PFAS has migrated deeper than the deepest detection at G6M18-02 (vp). Screens at XSA-12-96X, XSA-12-97X, XSA-12-98X are all at the same elevation so they provide limited information. Although one vertical profile is currently proposed west of the river, it is expected that additional vertical profiles will be necessary to adequately define the magnitude and extent of contamination west of the river.

Army Response 01/17/20: A vertical profile (31VP-19-09) was added southwest of G6M18-02. At the vertical profile, the samples will be collected in 10-foot intervals from the water table to refusal. The text, tables, and figures were updated accordingly. If after a review of the data, significant data gaps are identified and discussed with the EPA and MassDEP, then additional field activities will be completed to address data gaps.

Comment 24. Figure 5 - Additional new wells are needed between boring 50SB-19-06 and former well AOC50-17-11 to fill a spatial data gap between the source areas and the river.

Army Response 9/10/2019: As stated in Section 5.2.2.5 of the Area 3 FSP, the final location and screen settings of newly installed monitoring wells at Area 3 will be reviewed in conjunction with the USEPA and MassDEP and will be based on a review of the PFAS data obtained from groundwater vertical profiling, soil sampling and existing monitoring well sampled at Area 3.

EPA Response 11/19/2019: The elevated PFAS detections at 50VP-19-13 reinforce EPA's comment that one or more wells are necessary to fill a spatial data gap between the source areas and the river.

Army Response 01/17/20: Monitoring wells will be installed after consultation with EPA and MassDEP and review of the groundwater data.

Comment 25. Figure 6 - There is evidence of an east to east-northeast component of groundwater flow component on the eastern side of this figure. Additional vertical profile locations are needed farther east to investigate this area. Has the source of elevated PFAS north of Route 2A been identified?

Army Response 9/10/2019: Historic data reported in the AOC 50 RI indicates that there may potentially be a component of flow to the north/northeast from the AOC 50 source area. As shown on Figure 6 and discussed in the first sub-bullet on page 12 of the Area 3 FSP, three groundwater vertical profiles (50VP-19-01, -02, and -03) will be advanced to the north side of Route 2A to determine the extent of PFAS in groundwater to the north/northeast of the AOC 50 PCE source area. A source for PFAS on the north side of Route 2 has not been identified yet. The data obtained from these three groundwater vertical profiles and nearby monitoring wells will be reviewed and additional field activities will be evaluated after review of the data.

EPA Response 11/19/2019: A vertical profile is warranted east of G6M-95-20X, southeast of 50VP-19-03 to fully address this issue.

Army Response 01/17/20: A vertical profile (50VP-19-14) was added east of G6M-95-20X. At the vertical profile, the samples will be collected in 10-foot intervals from the water table to refusal. The text, tables, and figures have been revised accordingly.

Comment 28. Table 5 - Additional borings are needed in the AOC-50 central area (Figure 7) and multiple soil samples at the water table are also needed in the source areas where there are none currently proposed.

Army Response 9/10/2019: See the response to EPA page-specific comment #26.

EPA Response 11/19/2019: EPA anticipates that additional soil borings to the water table will be necessary to complete the RI; however, the selection of specific soil boring locations can be deferred until Army's proposed borings are installed.

Army Response 01/17/20: Comment noted.

U.S. ARMY SECOND SET OF RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE PFAS RI AREA 3 RECOMMENDATIONS FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MASSACHUSETTS

January 2020

The following Army responses pertain to the Environmental Protection Agency (EPA) comments received 25 July 2019, on the *PFAS RI Area 3 Recommendations, Former Fort Devens Army Installation, Devens, MA Area 3 Field Sampling Plan (FSP) Addendum, Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA,* dated July 2019 and to EPA comments received 19 November 2019, on Army's 9/10/19 Responses to EPA's 11/19/19 comments on the *PFAS RI Area 3 Recommendations, Former Fort Devens Army Installation, Devens, MA,* dated October 2019. All comments and responses are shown for completeness.

AOC 20

- Existing well construction logs and available cross-sections should be provided to support changes to the Area 3 FSP Addendum.

  Army Response 9/10/2019: Various investigations and assessments at or near the Devens wastewater treatment plant area have been completed and documented in reports. Copies of reports provided by MassDevelopment Utilities Department will be forwarded to EPA and MassDEP.

  EPA Response 11/19/2019: Army's response states that copies of reports documenting various investigations and assessments completed at or near the Devens WWTP area would be forwarded to EPA and MassDEP but EPA has yet to receive the referenced MassDevelopment Utilities Department reports.

  Army Response 12/6/2019: The Hydrogeologic Evaluation for Groundwater Discharge Permit, 1998 and Hydrogeological Baseline Data Report, June 2008 have been loaded to the Former Fort Devens database library and are available within the miscellaneous folder.

U.S. ARMY RESPONSES TO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE DRAFT FINAL AREA 3 FIELD SAMPLING PLAN ADDENDUM REMEDIAL INVESTIGATION WORK PLAN FOR PER- AND POLYFLUORINATED SUBSTANCES (PFAS) FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MASSACHUSETTS

January 2020

The following Army responses pertain to the Environmental Protection Agency (EPA) comments received 19 November 2019, on the Draft Final *Area 3 Field Sampling Plan (FSP) Addendum, Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA*, dated October 2019.

Comment 1. Page 3, Section 4.6 – Please insert ""new piezometers" prior to groundwater vertical profiling in the first sentence. Additional piezometers must be installed, AOC-wide water level measurements collected, and groundwater flow directions determined/confirmed before installation of new, permanent monitoring wells.

Army Response 01/17/20: The text will be revised as follows:

"The Army plans to install overburden monitoring wells in Area 3 following a review of the PFAS data obtained from new piezometers, groundwater vertical profiling, soil sampling, and existing monitoring wells, which will aid in determining the location and screen settings of the permanent monitoring wells."

Piezometers at AOCs 20, 30, and 50 have been added to the FSP per AOC-specific comments from EPA and MassDEP. The text, tables, and figures have been updated accordingly.

Comment 2. Page 4, Section 4.7, 3rd sentence – Please insert "in consultation with the MassDevelopment, MassDEP and EPA" after "will be identified" and insert "and piezometers, if present" after "new monitoring wells".

Army Response 01/17/20: The text will be revised as follows:

"The specific wells for the synoptic water level event will be identified in consultation with the MassDevelopment, MassDEP, and EPA, after the locations and screen settings of the new monitoring wells and piezometers, if present, are determined."

Comment 3. Page 4, Section 4.8 - Please change "identified" to "suspected".

Army Response 01/17/20: The change will be made per EPA's request.

Comment 4. Page 5, Section 5.1.1, ¶ 1 – What evidence does Army have that storm drains at the former MAAF were *not* connected to the sanitary sewer system? EPA requests that Army generate figures showing the locations of all former and existing storm drain discharge points within each AOC or Area (i.e. 1, 2 and 3).

Army Response 01/17/20: The storm water systems were mapped in support of the *Storm Sewer System Evaluation (AREE70) Report* (ADL, 1994), and the storm water systems at the airfield are not connected to the sanitary sewer system. Also, historic maps of the storm drains at the former MAAF in Appendix A of the *Final Expedited Site Inspection Work Plan for Per- and Polyfluoroalkyl Substances* (KGS, 2017) indicate the storm drains at the former MAAF are not connected to the sanitary sewer system. The Army has contacted MassDevelopment for information on former and current subsurface features. Maps showing these features will be developed to assist the investigation.

Comment 5. Page 5, Section 5.1.1, ¶ 1 – While EPA understands and supports Army's findings regarding the presence of PFAS in former WWTP effluent, there is little evidence (i.e. existing data) to explain why current WWTP operations and maintenance activities are being ruled out as possible continuing sources of PFAS contamination. As requested in EPA comments on the draft Area 3 FSP Addendum, the proposed field sampling program must be expanded to collect additional influent/effluent and sludge drying bed supernatant samples and confirm groundwater mounding and flow conditions beneath the infiltration beds. The limited number of samples collected during the SI are insufficient for adequately evaluating ongoing sources of PFAS at the WWTP.

Army Response 01/17/20: The Army has indicated that current WWTP operations/activities are a continuing source for PFAS. A sample will be collected from the influent and effluent and analyzed for TOP assay. The text, tables, and figures were revised accordingly. The sludge drying beds are no longer active and do not have supernatant. Soil samples were collected within the infiltration beds and sludge drying bed during the Site Inspection and indicate PFAS is present in the beds. The soil data from the Site Inspection and the Remedial Investigation will be evaluated to determine if the beds represent a continuing source.

Comment 6. Page 5, Section 5.1.1, ¶ 2 – Please show the expected area of sludge drying bed discharge to the Nashua River on an existing or above-requested map/figure.

Army Response 01/17/20: Prior to 1985, the supernatant was discharged to the wetland east of the sludge drying beds. This approximate location was added to Figure 2.

Comment 7. Page 5, Section 5.1.3 – Please revise the third sentence to read: "Soil borings will also be advanced to collect soil samples throughout the vadose zone (including within 2 ft of the water table) to determine if PFAS are present in vadose zone soils at concentrations that represent a risk to human health and the environment or a significant source for groundwater contamination."

Army Response 01/17/20: The text will be revised as follows:

"*Soil borings will also be advanced to collect soil samples throughout the vadose zone (including within 2 ft of the water table) to determine if PFAS are present in vadose zone soils at concentrations that represent a risk to human health and the environment or a significant source for groundwater contamination."*

Comment 8. Page 6, Section 5.1.3.2 – Please explain Army's deletion of the entire fourth paragraph. As noted in EPA's comments, additional piezometers are needed to confirm hydraulic control west of the infiltration beds. EPA will continue to raise this issue as an existing data gap if not addressed in this field sampling program.

Army Response 01/17/20: Information on the groundwater flow direction west of AOC 20/21 was acquired through review of information from The Hydrogeologic Evaluation for Groundwater Discharge Permit, 1998 and Hydrogeological Baseline Data Report, June 2008 and the piezometers were eliminated from the FSP. The Hydrogeologic Evaluation for Groundwater Discharge Permit, 1998 and Hydrogeological Baseline Data Report, June 2008 have been loaded to the Former Fort Devens database library and are available within the miscellaneous folder.

Two piezometers, one collocated with vertical profile 20VP-19-05 (20PZ-19-02), and one collocated with a new vertical profile 20VP-19-09 (20PZ-19-01) were added to the FSP. Both piezometers will be installed at the water table. The text, tables, and figures have been updated accordingly.

Comment 9. Page 7, Section 5.1.3.5 - Edit the sixth sentence to include "new piezometer data". As discussed in Comment 1. above, additional piezometers must be installed, AOC-wide water level measurements collected, and groundwater flow directions determined/confirmed before new, permanent monitoring wells are installed.

Army Response 01/17/20: The text will be revised as follows:

"*However, monitoring well installation will be completed following a review of the PFAS data obtained from new piezometers, groundwater vertical profiling, soil sampling, and existing monitoring wells; the final location and screen settings of the permanent monitoring wells will be reviewed with the USEPA and MassDEP and will be based on that data."*

Two piezometers one collocated with vertical profile 20VP-19-05 (20PZ-19-02) and one collocated with a new vertical profile 20VP-19-09 (20PZ-19-01) was added to the FSP. Both piezometers will be installed at the water table. The text, tables, and figures were updated accordingly.

Comment 10. Page 8, Section 5.1.3.5, last sentence – Please change "may" to "will".

Army Response 01/17/20: The text will be revised per EPA's request.

Comment 11. Page 8, Section 5.1.3.6 - Edit the second sentence to read: "... (approximately two to four per AOC) …."

Army Response 01/17/20: The text will be revised as follows:

"*Samples from selected wells (approximately two to four per AOC)…."*

Comment 12. Page 8, Section 5.1.3.6, ¶ 2 - Please insert "in consultation with the MassDevelopment, MassDEP and EPA" after "will be identified" and insert "and piezometers, if present" after "new monitoring wells".

Army Response 01/17/20: The text will be revised as follows:

"The specific wells for the synoptic water level event will be identified in consultation with the MassDevelopment, MassDEP, and USEPA, after the locations and screen settings of the new monitoring wells and piezometers, if present, are determined."

Comment 13. Page 8, Section 5.2.1, 4th bullet – "3815" should be changed to "3818".

Army Response 01/17/20: "3815" will be changed to "3818".

Comment 14. Page 12, Section 5.2.2.2, 2nd bullet - Regarding 50VP19-07 and -08, document that there is no overburden beneath the existing well screens referred to in this paragraph. EPA notes that both existing wells have PFAS contamination; therefore, the depth of PFAS contamination will not have been defined with this profiling plan.

Army Response 01/17/20: Vertical profile 50VP-19-07 was advanced to refusal. A new vertical profile (50VP-19-15) will be added next to 50VP-19-08. The groundwater samples will be collected from 90 ft bgs to refusal. The text, tables, and figures were revised accordingly.

Comment 15. Page 15, Section 5.2.2.5, ¶ 1 – Please edit the sixth sentence to read: "... existing monitoring wells and piezometers."

Army Response 01/17/20: The text will be revised as follows:

"Monitoring well installation will be completed following a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells and piezometers."

Comment 16. Page 15, Section 5.2.2.6 - Edit the second sentence to read: "... (approximately two to four per AOC) …."

Army Response 01/17/20: The text will be revised as follows:

"*Samples from selected wells (approximately two to four per AOC)…."*

Comment 17. Figure 2 – As discussed in Comment 5. above, Army's proposed field sampling activities around the filtration beds will leave spatial data gaps that will likely have to be addressed with additional vertical profile locations. Army previously responded that it has assumed exceedances of the PFAS LHA all the way to the river on the east, but there are no investigations planned east of the river. West of the infiltration beds the profile spacing is 1000 feet. Once the current locations are sampled the locations for the additional vertical profiling on the west to close the data gaps can be determined. Based on the available data, the hydrologic control on the west is inadequate. A SW/SED sample at the inside bank on the river bend is needed. Sampling of the Town of Ayer WWTP discharge would be appropriate.

Army Response 01/17/20: The Town of Ayer WWTP discharge was sampled in support of the Area 2 FSP.

A vertical profile (20VP-19-10) was added east of the northern end of the infiltration beds. A vertical profile (20VP-19-11) was added northeast of the infiltration beds. A vertical profile with a collocated piezometer (20VP-19-09/20PZ-19-01) was added west of the infiltration beds.

Five additional surface water and sediment sampling locations have been added at big bends of the river along the western bank of the Nashua River. Three additional surface water and sediment sampling locations have been added at big bends of the river along the eastern banks of the Nashua River. The specific locations are shown on figures and Table 10 clarifies from which side of the river the sample will be collected.

Two piezometers one collocated with vertical profile 20VP-19-05 and one collocated with a new vertical profile 20VP-19-09 was added to the FSP. Both piezometers will be installed at the water table. The text, tables, and figures have been updated accordingly.

Comment 18. Figure 3 – While EPA understands re access concerns closer to the river; however, it is expected to be necessary to collect data closer to the river to define the magnitude and extent of PFAS contamination and the potential impact on the river. Also, the piezometer would preferably be installed closer to the river. Investigation west of the river is also expected to be a component of this investigation. Collect SW/SED on the inside bank of the sharp river bend.

Army Response 01/17/20: A vertical profile (30VP-19-07) and collocated piezometer (30PZ-19-07), located downgradient of AOC 30, were added to the FSP. At the vertical profile the samples will be collected in 10-foot intervals from the water table to refusal. The piezometer will be installed at the water table. The text, tables, and figures have been updated accordingly. Surface water and sediment sample locations NR-19-21 and -22 are located on bends in the river in this area.

Comment 19. Figure 4 - There is insufficient profiling planned downgradient of the fire training area, particularly to the southwest and south. The existing wells to the southwest do not provide adequate depth differentiation to characterize the depth of contamination (three wells are screened at the same elevation). The wells to the south do cover a range of depths; however, the deepest well, XSA-00-90X, was not sampled; neither was XSA-00-91X. The next deepest well, XSA-00- 88, to the southwest, was also not sampled based on the data provided by Army. All three of these wells are highlighted in blue indicating that that were to be sampled. EPA recommends soil sampling at the water table for one of the two borings outside the fire training limits.

> **Army Response 01/17/20:** A vertical profile (31VP-19-09) located downgradient of G6M-18-02, was added to the FSP. The text, tables, and figures have been updated accordingly.
>
> Wells XSA-00-88, XSA-00-90X, and XSA-00-91X could not be sampled because the casings have degraded and a pump could not be lowered to the well screen. A note was added to Table 9 indicating as such. XSA-00- 88, XSA-00-90X, and XSA-00-91X are located down gradient of 50VP-19-07 and MW-6. MW-6 was added to the list of existing monitoring wells to be sampled and the vertical profile samples from 50VP-19-07 will be used to assess PFAS in the aquifer at the elevations of XSA-00- 88, XSA-00-90X, and XSA-00-91X.
>
> The soil borings at AOC 31 have been completed. Soil boring 31SB-19-08 was added to the FSP. Soil samples will be collected from 0-0.5, 0.5-3 3-7, 7-15 ft bgs and two feet above the water table.

Comment 20. Figure 5 - The only investigations currently proposed downgradient (southwest) of AOC50-17-08 are SW/SED samples. That alone will not be sufficient to characterize contamination and evaluate impacts in that portion of the site.

> **Army Response 01/17/20:** A vertical profile (50VP-19-16) and piezometer (50PZ-19-08) will be added southwest of AOC50-17-08.

Comment 21. Figure 6 - This figure was not changed. The investigations north of Route 2A are outside Devens; however, since wells have been placed and sampled there it is assumed that an agreement has been reached allowing sampling in the proposed locations.

> **Army Response 01/17/20:** A Right of Entry agreement was signed between the property owner and the Army and sampling has been conducted at the proposed locations. The figure been updated to included newly added vertical profile 50VP-19-14.

Comment 22. Figure 7 - Vertical profiling locations are needed southwest of the former fire station to identify PFAS contamination separate from the downgradient detections near the fire training area. Additional borings are also needed in the vicinity of the former fire station because a local PFAS source is indicated by the elevated PFAS concentrations in groundwater. A more comprehensive investigation around buildings 3813 and 3818 is warranted based on the elevated PFAS concentrations detected in groundwater at these two buildings. The magnitude of the concentrations suggests a local source rather than an upgradient source. Soil borings and vertical profiling is warranted.

> **Army Response 01/17/20:** Southwest of the former fire station two vertical profiles (50VP-19-17 and 50VP-19-18) with a piezometer (50PZ-19-09) collocated with vertical profile 50VP-19-18 were added to the FSP. Two soil borings, one to the north (50SB-19-14) and one to the east (50SB-19-13) of the former fire station were added to the FSP. A vertical profile (50VP-19-19) and piezometer was also added north of the former fire station (50PZ-19-10).

Also, west-southwest of the former fire station, a vertical profile (50VP-19-25) with a collocated piezometer (50PZ-19-12) was added to the FSP.

By the former hangars, piezometer 50PZ-19-11 (collocated with 50VP-19-05) were added. East of Building 3818 a vertical profile (50VP-19-21) and soil boring (50SB-19-15) were added. West of Building 3818 a vertical profile (50VP-19-22) and soil boring (50SB-19-16) were added. East of Building 3813 a vertical profile (50VP-19-20) was added. West of Building 3813 a vertical profile (50VP-19-23) and a soil boring (50SB-19-17) were added. South of Building 3813 a vertical profile (50VP-19-24) and a soil boring (50SB-19-18) were added.

Soil samples will be collected from 0-0.5, 0.5-3 3-7, 7-15 ft bgs and two feet above the water table. At the vertical profiles the samples will be collected in 10-foot intervals from the water table to refusal. The piezometers will be installed at the water table. The text, tables, and figures were revised accordingly.

Comment 23. Table 2 - Only 43 of the proposed 46 wells were sampled. XSA-00-90X was an important omission because of its depth.

Army Response 01/17/20: Refer to the response to Comment # 19.

Comment 24. Table 3 - Additional soil borings will be needed at the former fire station and at buildings 3813 and 3818 as there are likely local source areas at these locations based on the elevated groundwater PFAS concentrations. Additional vertical profiles are also anticipated to complete the investigation of these areas.

Army Response 01/17/20: Refer to the response to Comment # 22.

Comment 25. Table 4 - Vertical profiles beyond the scope of this table are anticipated to complete the RI. This table note states: "*****50VP-19-07 will be advanced adjacent to existing monitoring well G6M-13-04X. Vertical profiling at this boring will be completed to 125 ft bgs, which is the depth to the top of the monitoring well screen at G6M-13-04X. 50VP-19-08 will be advance adjacent to existing monitoring well G6M-04-14X. Vertical profiling at this boring will be completed to 80 ft bgs, which is the depth to the top of the monitoring well screen at G6M-04-14X." This limitation for these two vertical profiles is inappropriate because both G6M-04-14X and G6M-13-04X are impacted with PFAS concentrations exceeding the LHA; therefore, there will be a data gap at depth both south and southwest of the fire training area. EPA has commented on Figure 4 that there are data gaps downgradient of the fire training area based on Army's current plan. Limiting these (and other) VPs will not address those data gaps.

Army Response 01/17/20: Vertical profile 50VP-19-07 was advanced to refusal. A new vertical profile (50VP-19-15) will be added next to 50VP-19-08. The groundwater samples from 50VP-19-15 will be collected from 90 ft bgs to refusal. The text, tables, and figures were revised accordingly.

Comment 26. Table 5 - An additional boring to the water table is needed outside the limits of the fire training area (AOC 31). Additional soil borings will be needed at the former fire station and at buildings 3813 and 3818 because there are likely local source areas at these locations based on the elevated groundwater PFAS concentrations. Additional vertical profiles are also anticipated to complete the investigation of these areas. Make the first footnote in Table 5 consistent with that in Table 4 or change both to read: " Select samples will be analyzed for total oxidizable precursor assay and total organic carbon."

Army Response 01/17/20: The first footnote in Table 5 will be revised to read:

"*All samples will be analyzed for PFAS via isotope dilution. Select samples may be analyzed for total oxidizable precursor assay and total organic carbon."*

Soil boring 31SB-19-08 was added to the FSP. The soil boring is located outside the limits of the former fire training area. Soil samples will be collected from 0-0.5, 0.5-3 3-7, 7-15 ft bgs and two feet above the water table.

Refer to the response to Comment # 22 for details on additional soil borings and vertical profiles at the former fire station and at buildings 3813 and 3818.

Comment 27. Table 9 – Please confirm that there is no well construction information for XSA-000-91X.

Army Response 01/17/20: Confirmed. All available historical documents were reviewed and a well construction log for XSA-00-91X could not be found.

Comment 28. Table 10 - EPA has indicated the need for SW/SED samples at inside banks on bends in the river.

Army Response 01/17/20: Five additional surface water and sediment sampling locations have been added at big bends of the river along the western bank of the Nashua River. Three additional surface water and sediment sampling locations have been added at big bends of the river along the eastern banks of the Nashua River. The specific locations are shown on figures and Table 10 clarifies from which side of the river the sample will be collected. The text, tables, and figures have been updated accordingly.

A surface water and sediment sampling location was added to Bowers Brook. Table 11 and Figure 8 have been updated accordingly.

U.S. ARMY RESPONSES TO MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION COMMENTS ON THE DRAFT FINAL AREA 3 FIELD SAMPLING PLAN ADDENDUM REMEDIAL INVESTIGATION WORK PLAN FOR PER- AND POLYFLUORINATED SUBSTANCES (PFAS)FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MASSACHUSETTS

January 2020

The following Army responses pertain to the Massachusetts Department of Environmental Protection (MassDEP) comments received 04 December 2019, on the Draft Final *Area 3 Field Sampling Plan (FSP) Addendum, Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA*, dated October 2019.

Comment 1. Figure 3: The scope of the proposed investigation is insufficient to determine whether the AOC 30 storage areas are active sources of PFAS contamination in groundwater. Significant datagaps will exist if site-specific groundwater flow directions, upgradient and downgradient PFAS concentrations, and the vertical extent of contamination at each storage area are not determined. The Army is aware of this concern, and has responded previously (e-mail dated October 1, 2019), indicating that the proposed work may be sufficient to characterize these areas. MassDEP disagrees for the reasons given previously (e-mail dated December 7, 2018).

> **Response:** A vertical profile (30VP-19-07) and collocated piezometer (30PZ-19-07), located downgradient of AOC 30, were added to the FSP. A piezometer (30PZ-19-06) was added northeast of the eastern drum storage area and a piezometer (30PZ-19-08) was added to the southeast of the eastern drum storage area. At the vertical profile, the samples will be collected in 10-foot intervals from the water table to refusal. The piezometers will be installed at the water table. The text, tables, and figures have been updated accordingly.

Comment 2. Figure 7: The scope of the proposed investigation is insufficient to determine whether the airfield fire station is an active source of PFAS contamination in groundwater, and the scope of the proposed investigation is insufficient to characterize groundwater impacted by PFAS releases from the two aircraft hangars. Significant datagaps will exist if site-specific groundwater flow directions, upgradient and downgradient PFAS concentrations, and the vertical extent of contamination at the fire station and hangars are not determined. The Army is aware of this concern, and has responded previously (e-mail dated October 1, 2019), indicating that the proposed work may be sufficient to characterize these areas. MassDEP disagrees for the reasons given previously (e-mail dated December 7, 2018).

> **Response:** Southwest of the former fire station two vertical profiles (50VP-19-17 and 50VP-19-18) with a piezometer (50PZ-19-09) collocated with vertical profile 50VP-19-18 were added to the FSP. Two soil borings, one to the north (50SB-19-14) and one to the east (50SB-19-13) of the former fire station were added to the FSP. A vertical profile (50VP-19-19) and piezometer was also added north of the former fire station (50PZ-19-10).
>
> By the former hangars, piezometer 50PZ-19-11 (collocated with 50VP-19-05) were added. East of Building 3818 a vertical profile (50VP-19-21) and soil boring (50SB-19-15) were added. West of Building 3818 a vertical profile (50VP-19-22) and soil boring (50SB-19-16) were added. East of Building 3813 a vertical profile (50VP-19-20) was added. West of Building 3813 a vertical profile (50VP-19-23) and a soil boring (50SB-19-17) were added. South of Building 3813 a vertical profile (50VP-19-24) and a soil boring (50SB-19-18) were added.

Soil samples will be collected from 0-0.5, 0.5-3 3-7, 7-15 ft bgs and two feet above the water table. At the vertical profiles, the samples will be collected in 10-foot intervals from the water table to refusal. The piezometers will be installed at the water table. The text, tables, and figures were revised accordingly.

ARMY RESPONSES TO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE AREA 3 FIELD SAMPLING PLAN ADDENDUM REMEDIAL INVESTIGATION WORK PLAN FOR PER- AND POLYFLUORINATED SUBSTANCES FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MASSACHUSETTS

The following Army responses pertain to the Environmental Protection Agency (EPA) comments dated 11 February 2020 on the draft final *Area 3 Field Sampling Plan (FSP) Addendum, Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS), Former Fort Devens Army Installation, Devens, MA*, dated 17 January 2020.

The Army agrees that more data are necessary for Area 3. The Army is currently completing the Area 3 Preliminary Site Characterization Summary (PSCS) to synthesize the data collected at Area 3 and to comprehensively evaluate the data and formulate data gaps.

At this time, the Army would like to request that the Area 3 FSP Addendum be finalized with the understanding that overall data gaps at Area 3 will be discussed and addressed with EPA and MassDEP at the PSCS meeting for Area 3. Data gaps based on the comprehensive review and meeting would then be addressed in a subsequent addendum to the Area 3 FSP Addendum. The Army will retain these attached comments for discussion at the Area 3 PSCS meeting.

General Comments

GC #1. At some point, in order to complete the RI, it is expected that sampling of bedrock groundwater will be necessary to define the full extent of vertical contamination and to determine if Devens source areas are responsible for PFAS contamination detected off site.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

GC #2. As data gaps are identified as the remaining proposed sampling is completed it will be necessary to establish additional investigation locations to address the data gaps to define the full extent of PFAS contamination both horizontally and vertically.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

GC #3. EPA expects to receive a comprehensive data package and associated figures and tables prior to completing the field investigations for Area 3. This package will allow the Team to evaluate the adequacy of the investigations to date and to identify data gaps, if any, that will need to be addressed before the RI can be finalized for Area 3.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

GC #4. Army indicated in RTCs that additional profiling with sonic drilling will be performed at locations where shallow DPT refusal was obtained.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

GC #5. The extent of PFAS contamination across the Nashua River will require additional investigation.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

Specific Comments

Comment 1. Page 16, Section 5.3, bullet – The total number of samples should be 23 not 22. Please correct.

> **Response (revised 7/30/20)**: There are a total of 22 samples as shown on the figures and Table 10. The text will be revised to match 22 total samples.

Comment 2. Figure 2 – Neither WC-1A nor WC-2 are deep enough to monitor for PFAS that been detected at 20VP-19-03 and 20VP-19-04. These are water table wells extending to 19 feet bgs whereas PFAS has been detected in excess of the LHA from 19 to at least 58 feet bgs at the two vertical profiles. More appropriately screened wells are required south of the filter beds.

> **Response**: Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 3. Figure 2 – EPA notes a lack of adequate water level control and vertical profile data east of the filter beds. Without additional data it must be assumed that PFAS in excess of the LHA is present in groundwater from the filter beds to the river and perhaps beyond the river.

> **Response:** Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 4. Figure 2 – Once all the vertical profile data for this site has been reported, especially west of the filter beds, additional data gaps may become apparent. Note 20ZP-19-01 should be 20PZ-19-01.

> **Response:** Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 5. Figure 3 – Another piezometer is required south of NR-19-11 and west of the western drum storage area to better define the groundwater flow direction and for better placement of the proposed wells 30M-19-02 and 30M-19-03.

> **Response**: Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 6. Figure 3 – Wider spacing of the three piezometers at the eastern drum storage areas would be appropriate to better define water level differences.

> **Response**: Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 7. Figure 4 – XSA-00-88X and XSA-00-90X are reportedly not usable per Army RTCs; however, these wells were needed to provide data for deeper groundwater downgradient of AOC 31 (PFAS was detected in excess of the LHA at G6M-01-01X which is screened at 134-114 NGVD29; none of the other wells proposed for sampling are that deep.). If these wells cannot be made usable then it will be necessary to install vertical profiles at XSA-00-88X and XSA-00-90X to refusal to determine the depth of PFAS contamination in these locations.

> **Response**: Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 8. Figure 4 – The extent of PFAS contamination at the southern end of AOC 31 has not been defined as indicated by LHA exceedances in downgradient wells.

> **Response:** Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 9. Figure 5 – Add another vertical profile and piezometer at AOC50-17-14 and at or north of AOC50-17-15, add a vertical profile at 50SB-19-07, and add a piezometer in the vicinity of AOC50-17-

13. These locations will check for deep contamination and/or provide better groundwater flow characterization in this area which has very limited existing flow characterization.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 10. Figure 5 – Add another vertical profile and piezometer halfway between G6M-01-01X and 50VP-19-16 to define the extent of PFAS south of G6M-01-01X and to provide better groundwater flow characterization.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 11. Figure 5 – Considering the known PFAS concentrations at the south end of the flight line it will be necessary to install permanent monitoring wells along the property boundary in that area.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 12. Figure 7 – Add G6M-04-04X for monitoring (shade blue) and for better groundwater flow characterization.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 13. Figure 7 – Add a vertical profile and piezometer downgradient of the fire station within the grassy area between the flightlines.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.

Comment 14. Tables – Edit the tables to address these comments.

Response: Comment retained for discussion at the Area 3 PSCS Meeting.