FINAL
Site Inspection Report
Camp McCain
Grenada, Mississippi

Site Inspection for Perfluorooctanoic acid (PFOA), Perfluorooctanesulfonic acid (PFOS), Perfluorohexanesulfonic acid (PFHxS), Perfluorononanoic acid (PFNA), Hexafluoropropylene oxide dimer acid (HFPO-DA), and Perfluorobutanesulfonic acid (PFBS) at ARNG Installations, Nationwide

September 2023

Prepared for:

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

UNCLASSIFIED

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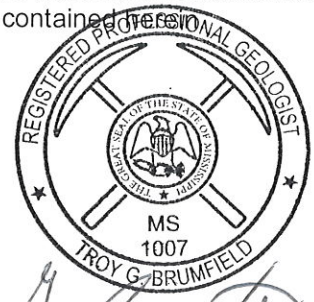
RPG Certification

ARNG PFAS Report:	Site Inspection (SI) Report for Camp McCain
Activity:	Site Inspection for Perfluorooctanoic acid (PFOA), Perfluorooctanesulfonic acid (PFOS), Perfluorohexanesulfonic acid (PFHxS), Perfluorononanoic acid (PFNA), Hexafluoropropylene oxide dimer acid (HFPO-DA), and Perfluorobutanesulfonic acid (PFBS)
Prepared for:	U.S. Army Corps of Engineers, Baltimore District
Prepared by:	AECOM Technical Services, Inc.
SI Location:	Camp McCain, Grenada Mississippi
Date:	28 June 2023

This report, prepared by AECOM Technical Services, Inc. (AECOM), documents the referenced Site Investigation activities and findings associated with the April 2022 field investigation. I, Troy Brumfield, have reviewed this document in sufficient depth to accept responsibility for its contents related to the geologic discussion contained herein.



Troy Brumfield, RPG (Mississippi)
28 June 2023

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
amsl	above mean sea level
AOI	Area of Interest
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DoD	Department of Defense
DPT	direct push technology
DPW	Department of Public Works
DQO	data quality objective
DUA	data usability assessment
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FedEx	Federal Express
GPRS	Ground Penetrating Radar Systems, LLC.
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
MIL-SPEC	military specification
MS	matrix spike
MSARNG	Mississippi Army National Guard
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
NPL	National Priority List
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid

PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TOC	total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WWTP	wastewater treatment plant

Executive Summary

The Army National Guard (ARNG) G-9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS). These compounds are collectively referred to as "relevant compounds" throughout the document, and the applicable screening levels (SLs) are provided **Tables ES-1**.

The PA identified two Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Tables ES-2**). The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on SLs for relevant compounds. This SI was completed at the Camp McCain in Grenada, Mississippi and determined further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for AOI 1 and AOI 2. Camp McCain will also be referred to as the "facility" throughout this document.

Camp McCain occupies 13,027 acres in Grenada, Mississippi and is primarily in Grenada County; however, a small portion is located south of the county line, in Montgomery County. The facility is used for weekend training area for Mississippi ARNG units located in northern Mississippi and other National Guard and Reserve units from Mississippi and adjacent states. Camp McCain currently accommodates training activities at small arms ranges and non-firing tactical maneuver areas for armor, armored cavalry, infantry, mechanized infantry, artillery, engineer, medical, aviation, and other troop units. Numerous support facilities are also present within the cantonment, including maintenance shops, dining halls, barracks, paint shop, fuel point, and recycling center (AECOM Technical Services, Inc., 2020).

The PA identified two AOIs for investigation during the SI phase. SI sampling results from the two AOIs were compared to OSD SLs. **Table ES-2** summarizes the SI results for each AOI. Based on the results of this SI, further evaluation under CERCLA is warranted in a Remedial Investigation for AOI 1 and AOI 2.

[1] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table ES-1: Screening Levels (Soil and Groundwater)

Analyte[b]	Residential (Soil) (µg/kg)[a] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a]
PFOA	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter

a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.

b.) Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table ES-2: Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Future Action
1	Release Area A	◐	●	Proceed to RI
	Release Area B	◐	NA	
2	Release Area C	◐	●	Proceed to RI

Legend:
NA = not applicable
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum will be referred to as "relevant compounds" throughout this document and include perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS) at ARNG facilities nationwide. The ARNG performed this SI at Camp McCain in Grenada, Mississippi. Camp McCain is also referred to as the "facility" throughout this document.

The SI project elements were performed in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; United States [US] Environmental Protection Agency [USEPA], 1980), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300; USEPA, 1994), and in compliance with US Department of the Army (DA) requirements and guidance for field investigations.

1.2 SI Purpose

A PA was performed at Camp McCain (AECOM Technical Services, Inc. [AECOM], 2020) that identified two Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically. The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

[1] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

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2. Facility Background

2.1 Facility Location and Description

Camp McCain is located in Grenada, Mississippi and is approximately 13 miles north of the City of Winona (**Figure 2-1**). The facility is primarily in Grenada County; however, a small portion is located south of the county line, in Montgomery County. Approximately 8 miles to the northwest of the facility is the county seat of Grenada, and Interstate 55 is approximately 6 miles directly west of the facility. The latitude, longitude, and surface elevation at the main entrance of the facility are 33°41'29.9" N, 89°42'35.81" W, and 221 feet above mean sea level (amsl).

In the early 1940s, the War Department acquired 42,073 acres for the Army to establish a Triangular Division Camp. Once the camp was established, the name was changed from the provisional Grenada Triangular Division Camp to Camp McCain in honor of Major General Henry P. McCain from neighboring Carroll County, Mississippi. In December 1944, Camp McCain was designated an inactive facility. On 25 January 1946, the Army reported the 42,073 acres in fee surplus to the War Assets Administration. On 3 December 1946, 3,005.69 acres were withdrawn from surplus and licensed to the State of Mississippi for year-round use in support of the National Guard. In 1969, tracked vehicle training was added to Camp McCain, and in 1971 a maintenance facility was built. On 12 August 1986, an additional 4,600 adjoining acres were added to the Camp McCain property and increased the tactical training area. In 1987 and 1988, eight modern small arms ranges were constructed. All of the newly acquired land falls within the original borders of the facility, dating back to the 1940s. Through this expansion, Camp McCain has grown to its current size of approximately 13,027 acres.

2.2 Facility Environmental Setting

Camp McCain is located in the North-Central Hill Section of the Coastal Plain physiographic province. Long-term erosion and a well-developed drainage system are the two main factors in producing the slightly rolling surface landscape on the facility (Brown and Adams, 1943). Topography tends to slope to the southwest, toward the Batupan Bogue Valley. Five stream valleys cut across Camp McCain in the northeast-southwest direction, and these connect to the larger Batupan Bogue Valley along the southern boundaries. Elevations at the ground surface range from 460 feet amsl in the center of the Camp to 200 feet amsl along the southwestern portions of the Little Bogue Valley (United States Geological Survey [USGS], 1983) (**Figure 2-2**).

2.2.1 Geology

Camp McCain lies within the Mississippi embayment, a regional geologic feature whose sedimentary strata range in age from Jurassic to Quaternary and encompass a large area within the Gulf Coastal Plain physiographic region, stretching from southern Illinois in the north to Alabama and Texas in the east and west. Structurally, the embayment is a southward plunging syncline. The embayment thickens down plunge, with the deepest Jurassic strata lying approximately 18,000 feet below ground surface (bgs) in the southern part of the region. Parts of the embayment have been subjected to regional metamorphism (Cushing et al., 1964). Near the facility, outcrops generally date to the Eocene Epoch with underlying Paleocene and Upper Cretaceous strata. The thickness of the Eocene and Paleocene deposits reaches a maximum thickness of 7,000 feet in the southern part of the region, with the Paleocene strata accounting for the lower 1,000 feet. The Eocene strata present within the area are the Claiborne Group and the Wilcox Formation. These outcrops in the Camp McCain area consist, in stratigraphic order, of the Kosciusko Formation, the Zilpha Shale, the Winona Sand, and the Neshoba Sand member of the Tallahatta Formation; the Wilcox Formation underlies these strata.

The Kosciusko Formation, the Zilpha Shale, and the Winona Sand terminate southwest of the facility and the Tallahatta Formation directly underlies the facility (Thompson, 2010). The Tallahatta Formation consists of the Neshoba Sand, the Basic City Shale and the Meridian Sand (Cushing et al., 1964). The Neshoba Sand is typically a fine, micaceous quartz sand with a thickness of about 50 feet. Underlying the Neshoba Sand is the Basic City Shale, a clay formation reaching up to 150 feet thick below Camp McCain (Mississippi ARNG [MSARNG], 2003). The Basic City Shale is composed of light-colored, sparsely fossiliferous clay- and siltstone with sand lenses. The unit ranges up to 150 feet in thickness (MSARNG, 2003). The basal member of the Tallahatta Formation (and Claiborne Group) is the Meridian Sand, a characteristically cross-bedded, fine to very coarse quartz sand formation that averages 100 feet in thickness but reaches up to 500 feet thick. The Meridian Sand's contact with the underlying Wilcox Formation is determined by the presence of lignitic clay or other carbonaceous material characteristic of the Wilcox (Cushing et al., 1964).

The Wilcox Formation is undifferentiated in this section of Mississippi but does consist of two identifiable units: an upper shale and a lower sand unit. The shale unit is the differentiating marker between the Meridian-Upper Wilcox and the Middle Wilcox aquifers. These aquifers are the principal aquifers in the region.

The unconsolidated deposits throughout the Camp McCain area consist of channel and floodplain deposits in the eroded stream valleys and terrace and weathered loess deposits in the uplands. The channel and floodplain deposits are classified as loose sand, clay, and vegetal debris up to 20 feet thick. The terrace and loess deposits are described as loose sand, clay, and loam up to 15 feet thick (Brown and Adams, 1943).

During the SI, soil borings were completed at depths between 10 and 40 feet bgs. Sand with clays and silts were predominantly identified in the top 5 to 10 feet of the borings. Underlying the surficial sands were primarily clays with varying amounts of sand. Boring AOI01-02 was an exception to these general observations. From 5 to 20 feet bgs, lenses of poorly graded sand alternated with lenses of silts with clay. Thickness of the lenses ranged from 0.5 to 5.5 feet. A sample for grain size analysis was collected at boring AOI01-02 from one of the silt and clay lens from 8 to 8.5 feet bgs (sample AOI01-02-SB-06-08) and analyzed via American Society for Testing and Materials (ASTM) Method D-422. The results indicate that the soil sample was comprised primarily of silt (70.79 percent [%]) and clay (26.20%), with trace amounts of sand (3.01%). These results and facility observations are consistent with the reported depositional environment of the region. Boring logs are presented in **Appendix E**, and grain size results are presented in **Appendix F**.

2.2.2 Hydrogeology

The Mississippi embayment aquifer system is the system of water-bearing units that underlie the Mississippi embayment, comprising a hydraulically connected system of various sand and clay units that encompass an area of more than 160,000 square miles. This system serves Mississippi as well as areas of Texas, Alabama, Arkansas, Illinois, Tennessee, and Louisiana. The most widely used aquifers in the embayment are those of the Wilcox Group, namely the Meridian-Upper Wilcox and Middle Wilcox aquifers (Darden, 1986a). The Meridian Sand and the upper part of the Wilcox Group comprises the Meridian-Upper Wilcox Aquifer.

Depth to groundwater varies throughout the region, but within the boundaries of Camp McCain historically ranges from below 1 feet bgs to greater than 50 feet bgs (Brown and Adams, 1943). Groundwater levels in the southeast section of Camp McCain ranged from 2 to 9 feet bgs and were determined by shallow (under 10 feet bgs) monitoring well installation completed in the shallow floodplain deposits. The soil gathered during the shallow monitoring well installation was characterized as sand, sandy loam, and clay with low total organic carbon content (USGS, 2004).

The local and regional groundwater flow in the Meridian-Upper Wilcox aquifer is to the southwest (Darden, 1986a; US Army Corps of Engineers [USACE], 2009), and is shown in **Figure 2-3**. Groundwater data reported by Brown and Adams (1943) and in the USGS lysimeter study (2004) suggest shallow groundwater underlying Camp McCain is controlled predominately by the local topography, resulting in localized variations in the shallow groundwater gradient.

Surface infiltration is the primary manner of recharge to the groundwater aquifer system in the Camp McCain area. Recharge to the Meridian-Upper Wilcox aquifer occurs on the ground within Camp McCain. Recharge to the Middle and Lower Wilcox aquifers occurs east of Camp McCain (Darden, 1986a; Darden, 1986b). Groundwater flows from high elevations and discharges to numerous wetlands and surface water bodies at and near Camp McCain, including Crowder Creek, Epison Branch, Campbell Creek, Little Bogue, and Batupan Bogue.

Domestic and public water supply wells located downgradient of Camp McCain (i.e., west and southwest of the facility) are primarily completed in the Meridian-Upper Wilcox, Middle Wilcox, and Lower Wilcox aquifers (USGS, 1992). According to facility personnel, three wells are located at Camp McCain. Well #1 is located adjacent to and services the tank wash located northeast of the cantonment area. This 525-foot deep well draws water from the Middle Wilcox aquifer; water from Well #1 is solely used for the tank wash facility, not potable water. Well #2 was installed in 2015, according to the Mississippi Department of Environmental Quality permit application (AECOM, 2020), to a depth of 390 feet, within the Middle Wilcox aquifer, for potable water use; it is located just south of the tank washing facility. Lastly, Well #3 is a potable well located near the fuel point. The depth of Well #3 is 429 feet (Mississippi Automated Resource Information System, 2022) and is therefore likely located within the Middle Wilcox aquifer. The majority of Camp McCain now obtains its potable water entirely from on-site groundwater wells; interviewees noted that a small southeast portion of the facility is served by Hays Creek public water system. In 2017, National Guard Bureau conducted drinking water sampling at Camp McCain. Pre-treatment samples were collected from Well #2 and Well #3, and a post-treatment sample of finished drinking water was also collected and analyzed. The only analyte detected above reporting limits among samples was perfluorotetradecanoic acid, which was also detected in the field reagent blank.

Depths to water measured in April 2022 during the SI ranged from 2.61 to 34.00 feet bgs. Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate the groundwater flow direction at Camp McCain is to the southwest.

2.2.3 Hydrology

Surface water from Camp McCain drains into several watersheds. In order of greatest areal coverage, Camp McCain drains to the Crowder Creek-Little Bogue, Sykes Creek-Batupan Bogue, Redgrass Creek, Mouse Creek-Little Bogue, and Grenada Lake-Yalobusha River drainage basins. These watersheds all lie within the Yalobusha River basin.

Various sections of the facility lie within these watersheds (**Figure 2-5**). Drainage from approximately 67% of the facility, including the cantonment area, is collected into the Crowder Creek-Little Bogue watershed, drained mostly by Crowder Creek, Epison Branch, and tributaries of Campbell Creek. The Sykes Creek-Batupan Bogue watershed drains approximately 28% of the facility in the northwest. The wastewater treatment plant (WWTP) falls on the divide between these two watersheds, with the majority of its footprint located within the latter. Both watersheds eventually drain to the Batupan Bogue. Approximately 5% of the northeast section of the facility drains north into the Redgrass Creek watershed, and Redgrass Creek empties directly to Grenada Lake, a reservoir approximately 3 miles north of Camp McCain that was formed by damming of the Yalobusha River. Trace percentages of the facility drain to the Mouse Creek-Little Bogue watershed in the east and the Grenada Lake-Yalobusha River watershed in the north.

Other surface water features within the facility include 30 ponds, 116 acres of wetlands, and Hunt Lake. Hunt Lake is used for occasional training exercises, and recreational fishing is permitted in the lake. Hunt Lake is directly north of the WWTP on a tributary of the Batupan Bogue. Camp McCain does not use reclaimed water for irrigation or biosolids/biosolid derived fertilizer at the facility.

2.2.4 Climate

The climate of the area surrounding Camp McCain is characterized by generally mild temperatures year-round, but with a noticeable change of seasons. Temperatures vary from average highs of 90 degrees Fahrenheit (°F) to average lows of 30°F. The average annual temperature is 61.25°F. Average precipitation is 59.22 inches of rain (World Climate, 2022).

2.2.5 Current and Future Land Use

Camp McCain's current land use includes serving as a weekend training area for MSARNG units located in northern Mississippi and other National Guard and Reserve units from Mississippi and adjacent states. Camp McCain currently accommodates training activities at small arms ranges and non-firing tactical maneuver areas for armor, armored cavalry, infantry, mechanized infantry, artillery, engineer, medical, aviation, and other troop units. Numerous support facilities are also present within the cantonment, including maintenance shops, dining halls, barracks, paint shop, fuel point, and recycling center. Reasonably anticipated future land use is not expected to change from the current land use.

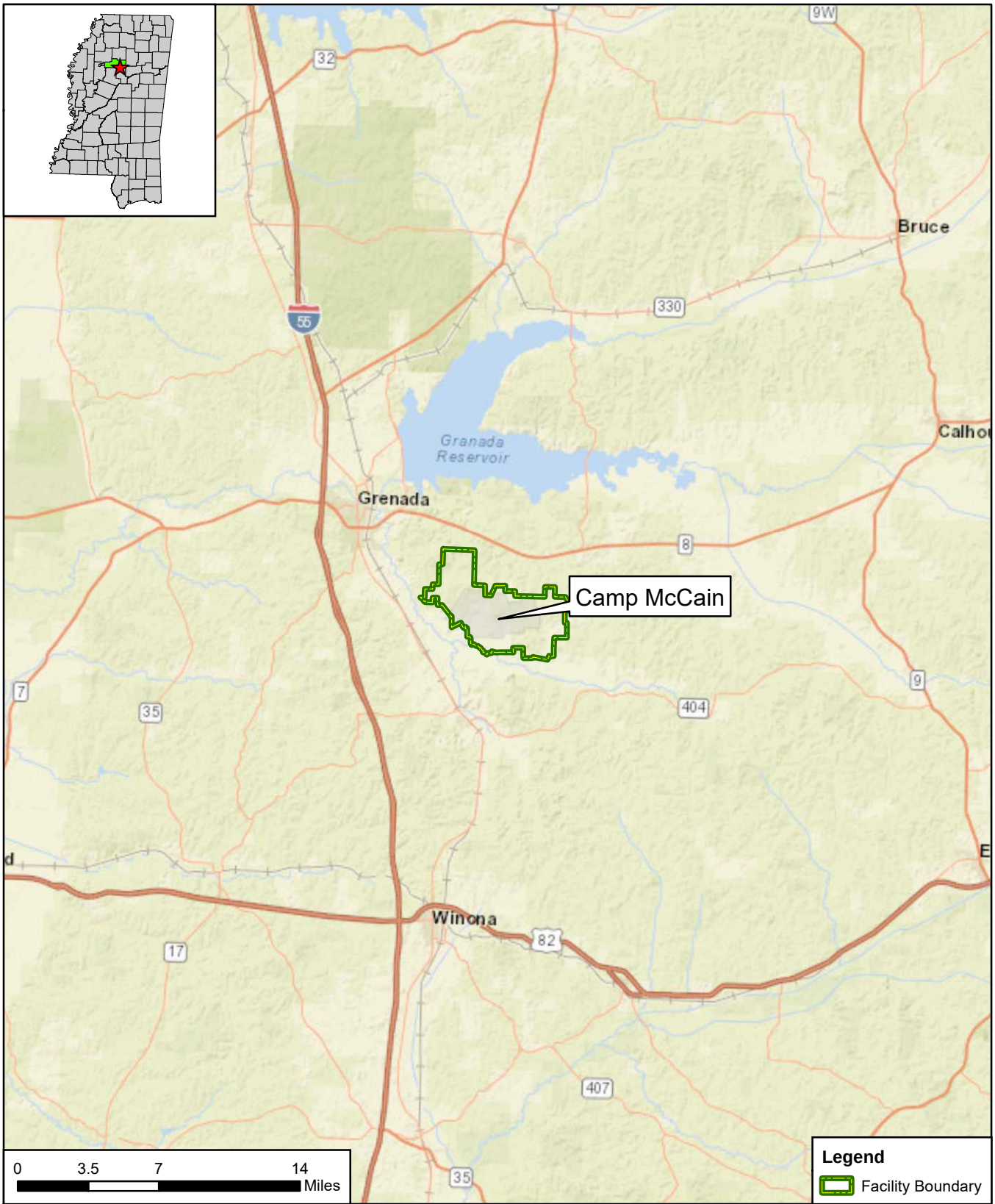
2.2.6 Sensitive Habitat and Threatened/ Endangered Species

The following birds, insects, mammals, and reptiles are federally threatened, proposed, and/ or are listed as candidate species in Grenada County, Mississippi (US Fish and Wildlife Service [USFWS], 2022).

- **Birds:** Wood stork, *Mycteria americana* (threatened)
- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Mammals**: Northern long-eared bat, *Myotis septentrionalis* (threatened); Tricolored bat, *Perimyotis subflavus* (proposed endangered)
- **Reptiles**: Alligator snapping turtle, *Macrochelys temminckii* (proposed threatened)

2.3 History of PFAS Use

Two AOIs were identified in the PA where AFFF may have been used, stored, disposed, or released historically at Camp McCain (AECOM, 2020). AFFF may have historically been released at the facility during disposal and/ or storage as early as 2005. The potential release areas were grouped into two AOIs based on preliminary data and presumed groundwater flow directions. A description of each AOI is presented in **Section 3**.



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Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	9/20/2022

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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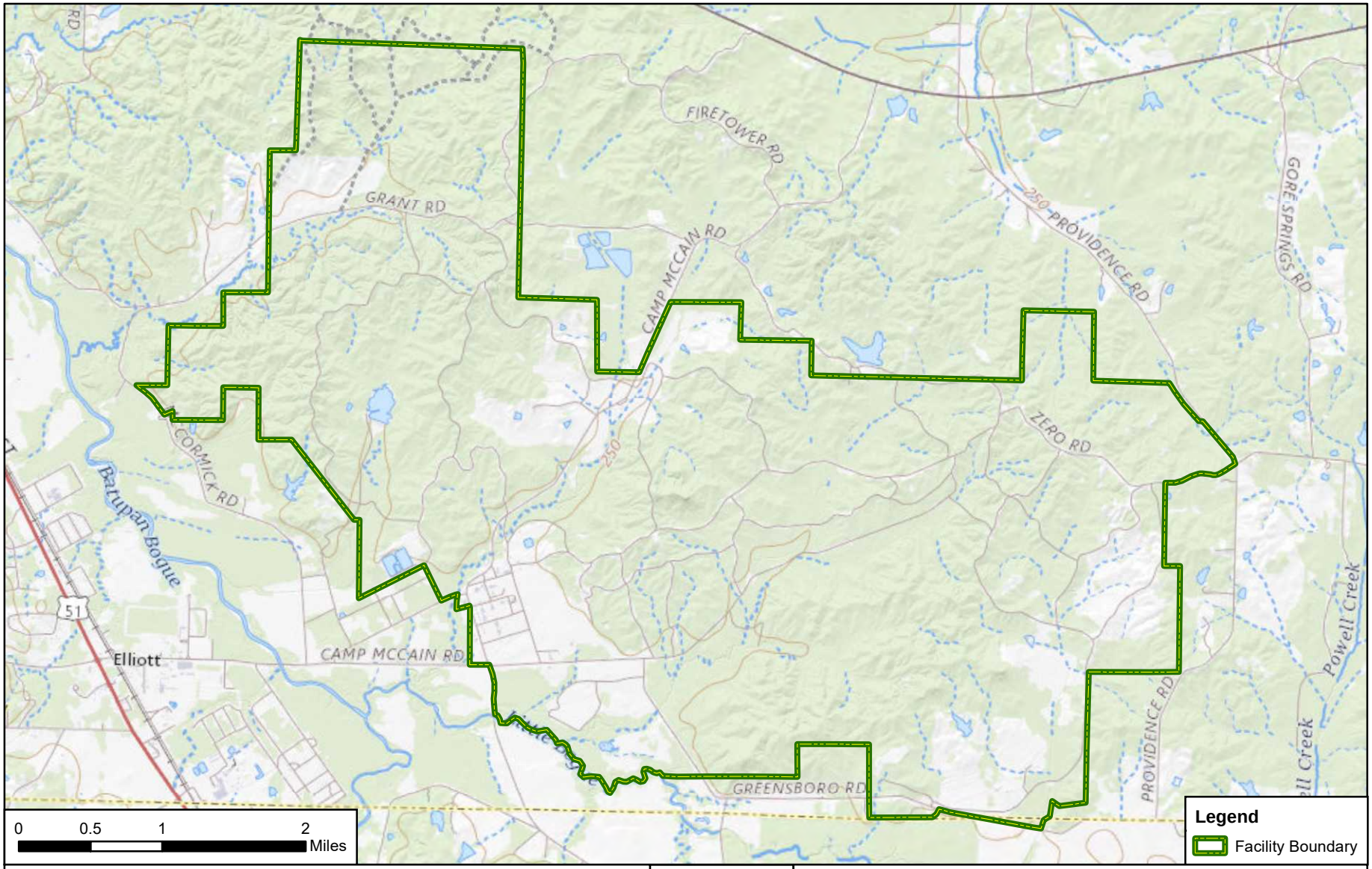

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Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset,		PM	CM	9/20/2022

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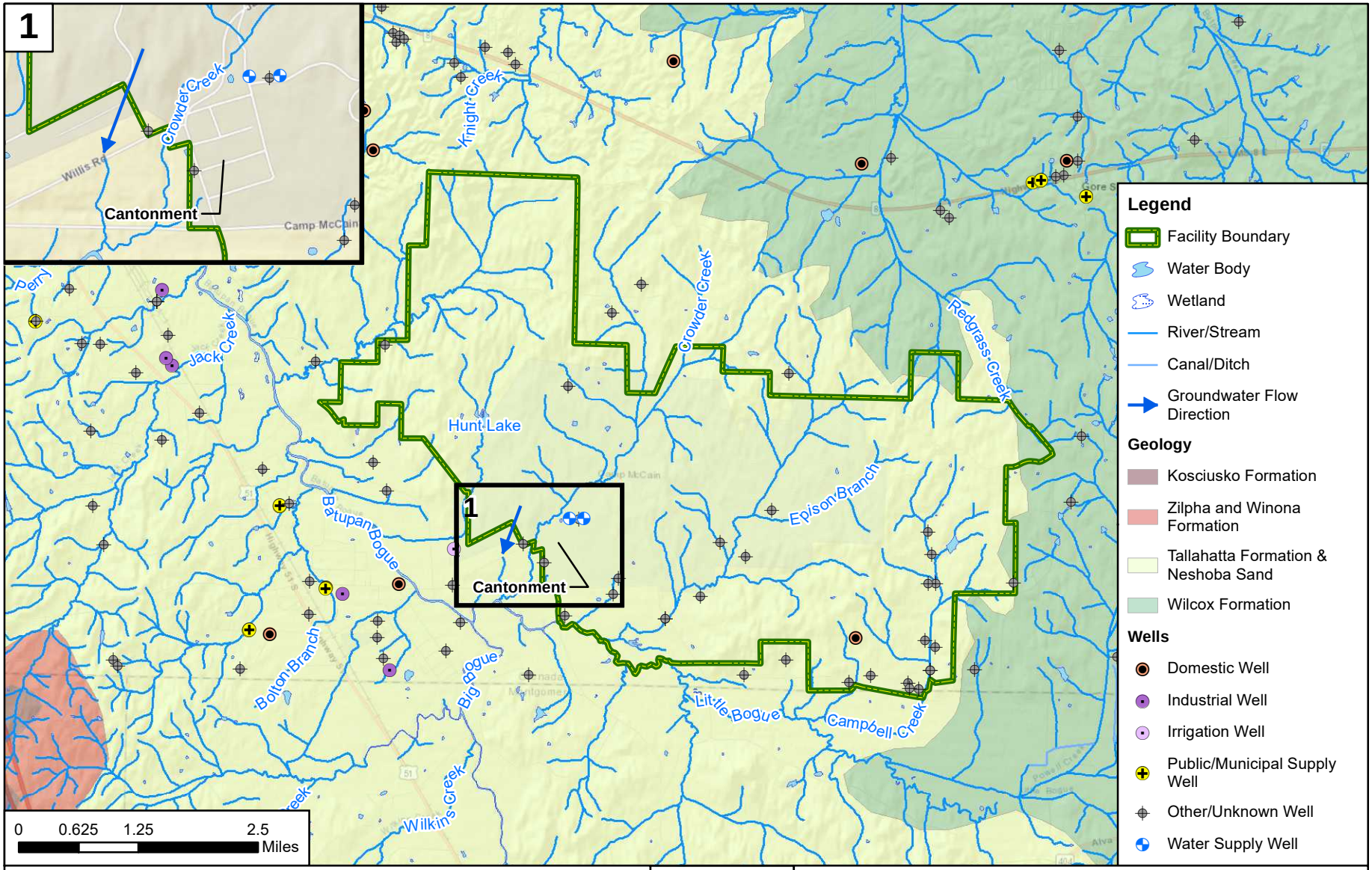
Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



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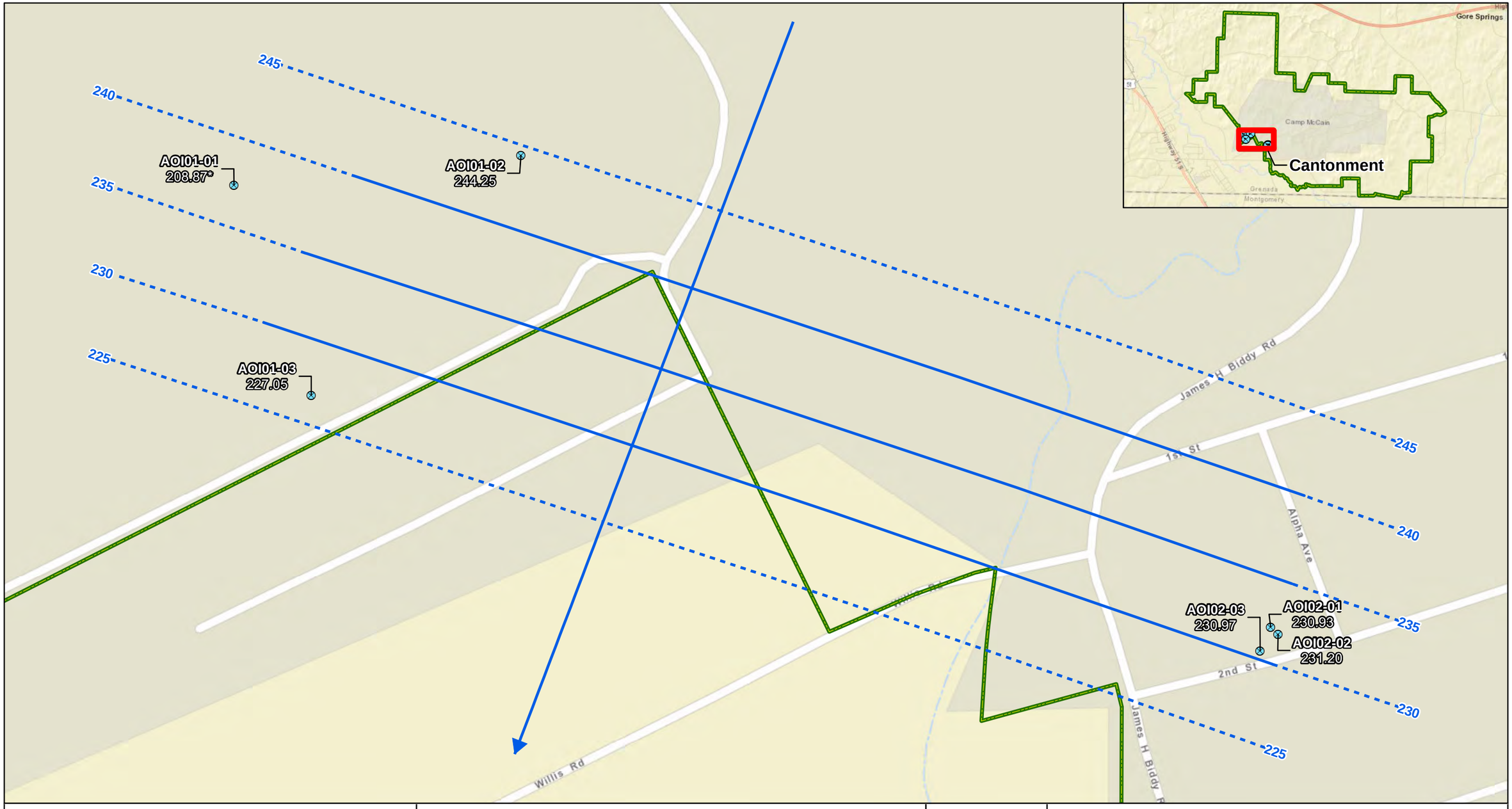
Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3



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- Soil Boring
- Facility Boundary
- Groundwater Elevation Contour
- Inferred Groudnwater Elevation Contour
- Groundwater Flow Direction

0 175 350 700 Feet

Groundwater elevations in ft NAVD88.

* Elevation from AOI01-01 not used to construct groundwater map.

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Groundwater Elevations, April 2022

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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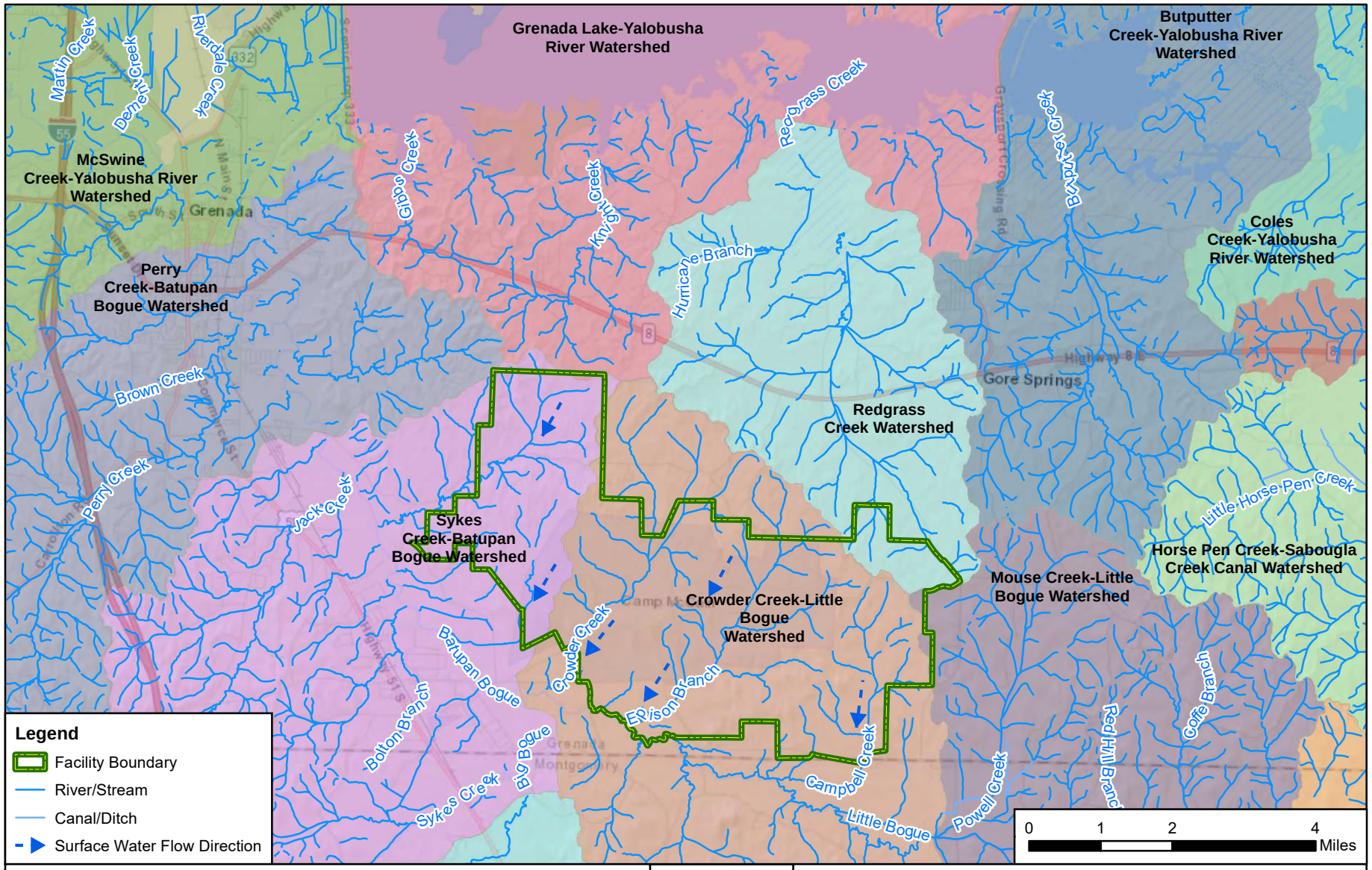

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Surface Water Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-5

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3. Summary of Areas of Interest

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, three potential release areas were identified at Camp McCain and grouped into two AOIs (AECOM, 2020). Additionally, the PA identified one potential off-site facility source, the Rockwell Grenada National Priority List (NPL) site, which is located approximately 8 miles northwest of Camp McCain. This NPL site historically had chrome plating operations, which commonly uses PFAS-containing mist suppressants. The potential release areas are shown on **Figure 3-1**.

3.1 AOI 1

AOI 1 encompasses Release Areas A and B, which are located at the Camp McCain WWTP. The WWTP was constructed in 2005 and consists of three connected stabilization lagoons, three spray-irrigation fields, and a discharge treatment facility. The lagoon system is connected in series with spray-irrigation fields and a treatment facility. The spray-irrigation fields are located to the north and east of the lagoons on hills approximately 20 to 30 feet higher in elevation than the lagoons themselves. The treatment facility collects overland flow from the irrigation fields for treatment by chlorination, dechlorination, and aeration prior to discharging to a dry drainage ditch that runs the southern length of the lagoons and connects to tributaries of the Batupan Bouge River. The WWTP system (lagoons, irrigation fields, and wastewater ponds) is unlined; however, dense clay soils are believed to restrict percolation of wastewater through soils (MSARNG, 2003). Sludge/biosolids have never been removed from the WWTP. Release Areas A and B are further discussed below.

3.1.1 Release Area A

Release Area A is the eastern lagoon. Between 2009 and 2011, approximately 3 to 5 gallons of AFFF were disposed of in the WWTP's eastern lagoon over a period of 3 to 5 months. The lagoons are approximately 8 feet deep and unlined, as noted above.

3.1.2 Release Area B

Release Area B is the dry drainage ditch. In 2010, the WWTP was forced to discharge no more than 10 gallons of post-treatment effluent to the dry drainage ditch to collect compliance samples. The dry drainage ditch is cobble-lined and approximately 300 feet in length before emptying into a grassy area south of the eastern lagoon. During the PA, interviewees reported that water flows through the ditch during heavy rainfall and travels west towards an unnamed tributary of the Batupan Bouge River. Because of the potential overlap in AFFF disposal to the eastern lagoon, Release Area B is also evaluated as part of the SI.

3.2 AOI 2 Release Area C

AOI 2 encompasses Release Area C, the current Camp McCain Fire Station (previously identified as Release Area A in the SI QAPP Addendum), which is a small two-bay building that contains one water-capable firetruck and a 1.5-gallon foam-capable Gator utility vehicle that had not been reported as being used with foam. A separate foam-capable truck was at the facility between 2007-2008 and 2009-2011; the truck was never reportedly loaded with foam. One 5-gallon container of AFFF was reportedly stored at Camp McCain prior its disposal into the eastern lagoon of the WWTP. It is assumed that the container was stored at the Camp McCain Fire Station; therefore, the fire station is considered Release Area C and identified as AOI 2.

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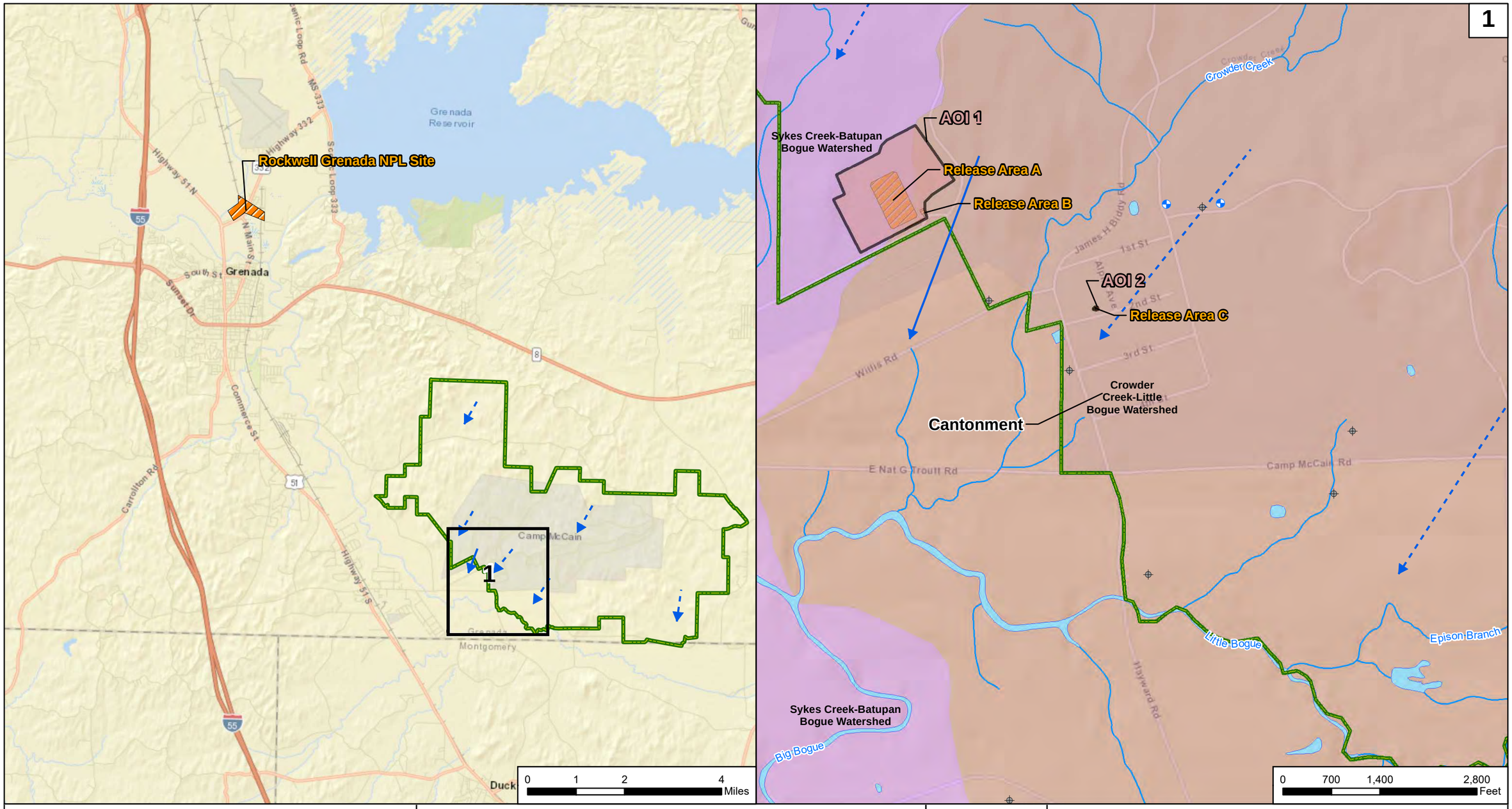

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CLIENT	ARNG			
PROJECT	Site Inspection at Camp McCain, MS			
REVISED	9/29/2022	GIS BY	MS	9/29/2022
SCALE	1:16,800	CHK BY	JH	9/29/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	9/29/2022

Legend

- Area of Interest
- Potential Release Area
- Facility Boundary
- Water Body
- River/Stream
- Surface Water Flow Direction
- Inferred Groundwater Flow Direction
- Other/Unknown Well
- Water Supply Well

N

Areas of Interest

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

As identified during the Data Quality Objective (DQO) process and outlined in the SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2022a), the objective of the SI is to identify whether there has been a release to the environment at the AOIs identified in the PA. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for presence or absence of relevant compounds at each of the sampled AOIs.

4.1 Problem Statement

ARNG will recommend an AOI for Remedial Investigation (RI) if related soil and groundwater samples have concentrations of the relevant compounds above the OSD risk-based SLs. The SLs are presented in **Section 6.1** of this report.

4.2 Information Inputs

Primary information inputs included:

- The PA for Camp McCain (AECOM, 2020);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-QAPP Addendum (AECOM, 2022a); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s).

4.4 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs within this document and decision rules as defined in the SI QAPP Addendum (AECOM, 2022a).

4.5 Data Usability Assessment

The Data Usability Assessment (DUA), which is provided in **Appendix A**, is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment determines whether project execution and the resulting data have met installation-specific DQOs. Both sampling and analytical activities are considered to assess whether the collected data are of the right type, quality, and quantity to support the decision-making (DoD, 2019a; DoD, 2019b; USEPA, 2017).

Based on the DUA, the environmental data collected during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUA and its associated data validation reports. These data are of sufficient quality to meet the objectives and requirements of the SI QAPP Addendum (AECOM, 2022a).

5. Site Inspection Activities

This section describes the environmental investigation and sampling activities that occurred as part of the SI. The SI sampling approach was based on the findings of the PA and implemented in accordance with the following approved documents:

- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP)* dated March 2018 (AECOM, 2018a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b);
- *Final Preliminary Assessment Report, Camp McCain, Grenada, MS* dated September 2020 (AECOM, 2020);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Camp McCain, Grenada, Mississippi* dated March 2022 (AECOM, 2022a); and
- *Final Site Safety and Health Plan, Camp McCain, Grenada, Mississippi* dated April 2022 (AECOM, 2022b).

The SI field activities were conducted from 19 to 25 April 2022 and consisted of utility clearance, direct push boring, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022a), except as noted in **Section 5.8**.

The following samples were collected during the SI and analyzed for a subset of 18 compounds by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.3 Table B-15 to fulfill the project DQOs:

- Twenty-two (22) soil samples from 13 boring locations;
- Six grab groundwater samples from six temporary wells;
- Seventeen (17) quality assurance (QA)/quality control (QC) samples.

Figure 5-1 provides the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**, a Nonconformance and Corrective Action Report is provided in **Appendix B3**, and land survey data are provided in **Appendix B4**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

In preparation for the SI field activities, project team members participated in Technical Project Planning (TPP) meetings, performed utility clearance, and sampled decontamination source water. Details for each of these activities are presented below.

5.1.1 Technical Project Planning

The USACE TPP Process, Engineer Manual (EM) 200-1-2 (USACE, 2016) defines four phases to project planning: 1.) defining the project phase; 2.) determining data needs; 3.) developing data collection strategies; and 4.) finalizing the data collection plan. The process encourages stakeholder involvement in the SI, beginning with defining overall project objectives, including DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 10 March 2022, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, MSARNG, USACE, Mississippi Department of Environmental Quality, and representatives familiar with the facility, the regulations, and the community. Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the SI QAPP Addendum (AECOM, 2022a).

A TPP Meeting 3 will be held in March after the Draft Final Report is submitted to the regulators. Meeting minutes for TPP 3 will be included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM's drilling subcontractor, Cascade Technical Services, LLC. placed a ticket with the Mississippi 811 utility clearance provider to notify them of intrusive work on 11 April 2022. Additionally, AECOM contracted Ground Penetrating Radar Systems, LLC. (GPRS), a private utility location service, to perform utility clearance. GPRS performed utility clearance of the proposed boring locations on 19 April 2022 with input from the AECOM field team and Camp McCain facility staff. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared using a hand auger to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and Sampling Equipment Acceptability

Two potable water sources at Camp McCain were sampled on 22 February 2022 to assess usability for decontamination of drilling equipment. Results of the sample collected at a spigot on the side of the Department of Public Works (DPW) building (CMC-DECON-02) confirmed this source to be acceptable for use in this investigation; therefore, the spigot was used throughout the field activities. Specifically, the samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15. The second sample was collected from the Firehouse spigot (CMC-DECON-01) but this water source was not used during the SI because PFOS exceeded the criteria (1/5 the SL) as stipulated in the SI QAPP Addendum (AECOM, 2022a). The results of both decontamination water samples are provided in **Appendix F**. A discussion of the results is presented in the DUA (**Appendix A**).

Materials that were used within the sampling zone were confirmed as acceptable for use in the sampling environment. The checklist of acceptable materials for use in the sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 2022a). Prior to the start of field work each day, a Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Borings were installed in grass areas where applicable, to avoid disturbing concrete or asphalt surfaces. Soil samples were collected via direct push technology (DPT), in accordance with the SI QAPP Addendum (AECOM, 2022a). A GeoProbe® 7730DT macrocore sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top 5 feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1**, and depths are provided **Table 5-1**.

At AOI 1, three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring drilled using DPT: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 2 feet above the groundwater table, and one subsurface soil sample at the mid-point between the surface and the groundwater table. At AOI 2, shallow groundwater was encountered and only two soil samples were collected from each borehole accordance with the SI QAPP Addendum (AECOM, 2022a): one surface soil sample (0 to 2 feet bgs) and one subsurface soil sample (2 to 4 feet bgs) collected above groundwater. Additionally, seven surface soil samples were collected from the top 2 feet of soil using a hand auger.

The soil cores were continuously logged for lithological descriptions by an AECOM field geologist using the Unified Soil Classification System (USCS). A photoionization detector (PID) was used to screen the breathing zone during boring activities as part of personal safety requirements. Observations and measurements were recorded on boring logs (**Appendix E**) and in a non-treated field logbook (i.e., composition notebook). Depth interval, recovery thickness, PID concentrations, moisture, relative density, color (using a Munsell soil color chart), and texture (using the USCS) were recorded. The boring logs are provided in **Appendix E**.

During the SI, soil borings were completed at depths between 10 and 40 feet bgs. Sand with clays and silts were predominantly identified in the top 5 to 10 feet of the borings. Underlying the surficial sands were primarily clays with varying amounts of sand; boring AOI01-02 was an exception to these general observations. From 5 to 20 feet bgs, lenses of poorly graded sand alternated with lenses of silts with clay. Thicknesses of the lenses ranged from 0.5 to 5.5 feet. These observations are consistent with the understood depositional environment of the region.

Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15, total organic carbon (TOC) (USEPA Method 9060A), pH (USEPA Method 9045D), and grain size (ASTM Method D-422) in accordance with the SI QAPP Addendum (AECOM, 2022a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike (MS)/MS duplicates (MSDs) were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. In instances when non-dedicated sampling equipment was used, such as a hand auger for the shallow soil samples, equipment rinsate blanks were collected at a rate of 5% and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6 degrees Celsius (°C) during shipment.

DPT borings were converted to temporary wells, which were subsequently abandoned in accordance with the SI QAPP Addendum (AECOM, 2022a) and Mississippi State guidelines. Wells were abandoned either using bentonite chips for wells with a depth of less than 25 feet bgs and bentonite via tremie pipe for wells deeper than 25 feet bgs. All wells were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 Temporary Well Installation and Groundwater Grab Sampling

Temporary wells were installed using a GeoProbe® 7730DT macrocore sampling system. Once the borehole was advanced to the desired depth, a temporary well was constructed of a 5-foot section of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. New PVC pipe and screen were used to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

Groundwater samples were collected after a period of time following well installation to allow groundwater to infiltrate and recharge the temporary well screen intervals. After the recharge

period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. The temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) before each grab sample was collected. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2022a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. One field reagent blank was collected in accordance with the PQAPP (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6°C during shipment.

Following well surveying (described below in **Section 5.5**), temporary wells were abandoned as described above in **Section 5.2**.

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 22 April 2022. Groundwater elevation measurements were collected from the six new temporary monitoring wells. Water level measurements were taken from the northern side of the well casing. A groundwater flow contour map is provided in **Figure 2-4**. The groundwater level at temporary well AOI01-01 was not used to produce the contours as the groundwater level was anomalously low. The low groundwater level was likely due to the high relief (up to 30 feet) from the hills directly upgradient of the well. Groundwater elevation data are provided in **Table 5-2**.

5.5 Surveying

The northern side of each well casing was surveyed by Mississippi-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2022a). Survey data from the newly installed wells on the facility were collected on 25 April 2022 in Mississippi State Plane-West North American Datum of 1983 (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B4**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of investigation-derived waste (IDW) is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the SI QAPP Addendum (AECOM, 2022a) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Solid IDW (i.e., drill cuttings) generated during SI activities were containerized in properly labeled 55-gallon drums. The containerized IDW were left in a covered structure onsite near the DPW building, which was designated by the Camp McCain Environmental Manager and MSARNG. This IDW was not sampled and assume the characteristics of the associated soil samples collected from that source location. Based on laboratory results, containerized soil cuttings will be

managed and disposed by ARNG. ARNG will coordinate waste profiling, transportation, and disposal of the solid IDW under a separate contract.

Liquid IDW generated during SI activities (i.e., purge water and decontamination fluids) were containerized in properly labeled 55-gallon drums (see SOP 3-05). The containerized IDW will be temporarily stored onsite at a location designated by the Camp McCain Environmental Manager and MSARNG. This IDW will not be sampled and will assume the characteristics of the associated groundwater samples collected from the source locations. Based on laboratory results, containerized liquid IDW will be managed and disposed by ARNG (either by offsite disposal or onsite disposal, with treatment as appropriate) under a separate contract.

Other solids such as spent personal protective equipment, plastic sheeting, tubing, rope, unused monitoring well construction materials, and other environmental media generated during the field activities were disposed of at a licensed solid waste landfill.

5.7 Laboratory Analytical Methods

Samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 at Pace Analytical Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP certified laboratory. Soil samples were also analyzed for TOC using USEPA Method 9060A and pH by USEPA Method 9045D.

5.8 Deviations from SI QAPP Addendum

One deviation from the SI QAPP Addendum was identified during review of the field documentation. The deviation is noted below and is documented in a Nonconformance and Corrective Action Report (**Appendix B3**):

- During DPT drilling activities, a subsurface soil sample was collected from 15 to 17 feet bgs at boring AOI01-01. The approved SI QAPP Addendum states that mid-point subsurface soil samples would be collected from 13 to 15 feet bgs if total boring depth exceeded 30 feet bgs. The total boring depth of AOI01-01 was 40 feet, and the mid-point samples were inadvertently collected at depths greater than 15 feet bgs.

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Camp McCain, Mississippi

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-00-02	4/21/2022 11:45	0 - 2	x				
AOI01-01-SB-15-17	4/21/2022 12:05	15 - 17	x				
AOI01-01-SB-15-17-D	4/21/2022 12:05	15 - 17	x				Duplicate
AOI01-01-SB-33-35	4/21/2022 13:15	33 - 35	x				
AOI01-02-SB-00-02	4/21/2022 8:15	0 - 2	x				
AOI01-02-SB-06-08	4/21/2022 8:40	6 - 8	x			x	Grain size collected from 8 to 8.5 feet bgs
AOI01-02-SB-12-14	4/21/2022 8:48	12 - 14	x				
AOI01-03-SB-00-02	4/21/2022 9:50	0 - 2	x				
AOI01-03-SB-10-12	4/21/2022 10:10	10 - 12	x	x	x		
AOI01-03-SB-10-12-MS	4/21/2022 10:10	10 -12		x	x		MS/MSD
AOI01-03-SB-10-12-MSD	4/21/2022 10:10	10 - 12		x	x		MS/MSD
AOI01-03-SB-18-20	4/21/2022 10:15	18 - 20	x				
AOI01-04-SB-00-02	4/21/2022 10:30	0 - 2	x				
AOI01-05-SB-00-02	4/21/2022 10:05	0 - 2	x				
AOI01-05-SB-00-02-D	4/21/2022 10:05	0 - 2	x				Duplicate
AOI01-06-SB-00-02	4/21/2022 9:25	0 - 2	x				
AOI01-07-SB-00-02	4/21/2022 8:50	0 - 2	x				
AOI01-07-SB-00-02-MS	4/21/2022 8:50	0 - 2	x				MS/MSD
AOI01-07-SB-00-02-MSD	4/21/2022 8:50	0 - 2	x				MS/MSD
AOI01-08-SB-00-02	4/21/2022 11:10	0 - 2	x				
AOI02-01-SB-00-02	4/21/2022 7:50	0 - 2	x				
AOI02-01-SB-00-02-MS	4/21/2022 7:50	0 - 2	x				MS/MSD
AOI02-01-SB-00-02-MSD	4/21/2022 7:50	0 - 2	x				MS/MSD
AOI02-01-SB-02-04	4/21/2022 7:55	2 - 4	x				
AOI02-02-SB-00-02	4/21/2022 8:00	0 - 2	x				
AOI02-02-SB-02-04	4/21/2022 8:10	2 - 4	x				
AOI02-03-SB-00-02	4/21/2022 15:15	0 - 2	x				
AOI02-03-SB-00-02-D	4/21/2022 15:15	0 - 2	x				Duplicate
AOI02-03-SB-02-04	4/21/2022 15:20	2 - 4	x	x	x		
AOI02-03-SB-02-04-D	4/21/2022 15:20	2 - 4		x	x		Duplicate
AOI02-04-SB-00-02	4/21/2022 14:00	0 - 2	x				
AOI02-05-SB-00-02	4/21/2022 13:45	0 - 2	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Camp McCain, Mississippi

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Groundwater Samples							
AOI01-01-GW	4/21/2022 16:50	NA	x				
AOI01-02-GW	4/21/2022 16:20	NA	x				
AOI01-03-GW	4/21/2022 17:45	NA	x				
AOI02-01-GW	4/22/2022 11:15	NA	x				
AOI02-02-GW	4/22/2022 10:45	NA	x				
AOI02-02-GW-D	4/22/2022 10:45	NA	x				Duplicate
AOI02-03-GW	4/22/2022 11:00	NA	x				
AOI02-03-GW-MS	4/22/2022 11:00	NA	x				MS/MSD
AOI02-03-GW-MSD	4/22/2022 11:00	NA	x				MS/MSD
Quality Control Samples							
CMC-FRB-01	4/22/2022 8:40	NA	x				FRB
CMC-ERB-01	4/21/2022 13:45	NA	x				Off drill rig shoe
CMC-ERB-02	4/22/2022 9:15	NA	x				Off AECOM hand auger
CMC-ERB-03	4/22/2022 8:35	NA	x				Off driller hand auger
CMC-DECON-01	2/22/2022 12:30	NA	x				From Firehouse
CMC-DECON-02	2/22/2022 12:55	NA	x				From DPW building
CMC-DECON-03	4/21/2022 12:00	NA	x				From driller decon system

Notes:
ASTM = American Society for Testing and Materials
bgs = below ground surface
DPW = Department of Public Works
ERB = equipment rinsate blank
FRB = field reagent blank
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
QSM = Quality Systems Manual
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths, Temporary Well Screen Intervals, and Groundwater Elevations
Site Inspection Report, Camp McCain, Mississippi

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Depth to Water (feet btoc)	Depth to Water (feet bgs)	Groundwater Elevation (feet NAVD88)
1	AOI01-01	40	35 - 40	243.49	242.87	34.62	34.00	208.87
	AOI01-02	20	14.5 - 19.5	258.51	257.93	14.26	13.68	244.25
	AOI01-03	25	19 - 24	230.84	230.00	3.79	2.95	227.05
2	AOI02-01	10	5 - 10	235.02	234.57	4.09	3.64	230.93
	AOI02-02	10	5 - 10	235.15	234.81	3.95	3.61	231.20
	AOI02-03	10	5 - 10	234.25	233.58	3.28	2.61	230.97

Notes:
bgs = below ground surface
btoc = below top of casing
NAVD88 = North American Vertical Datum 1988

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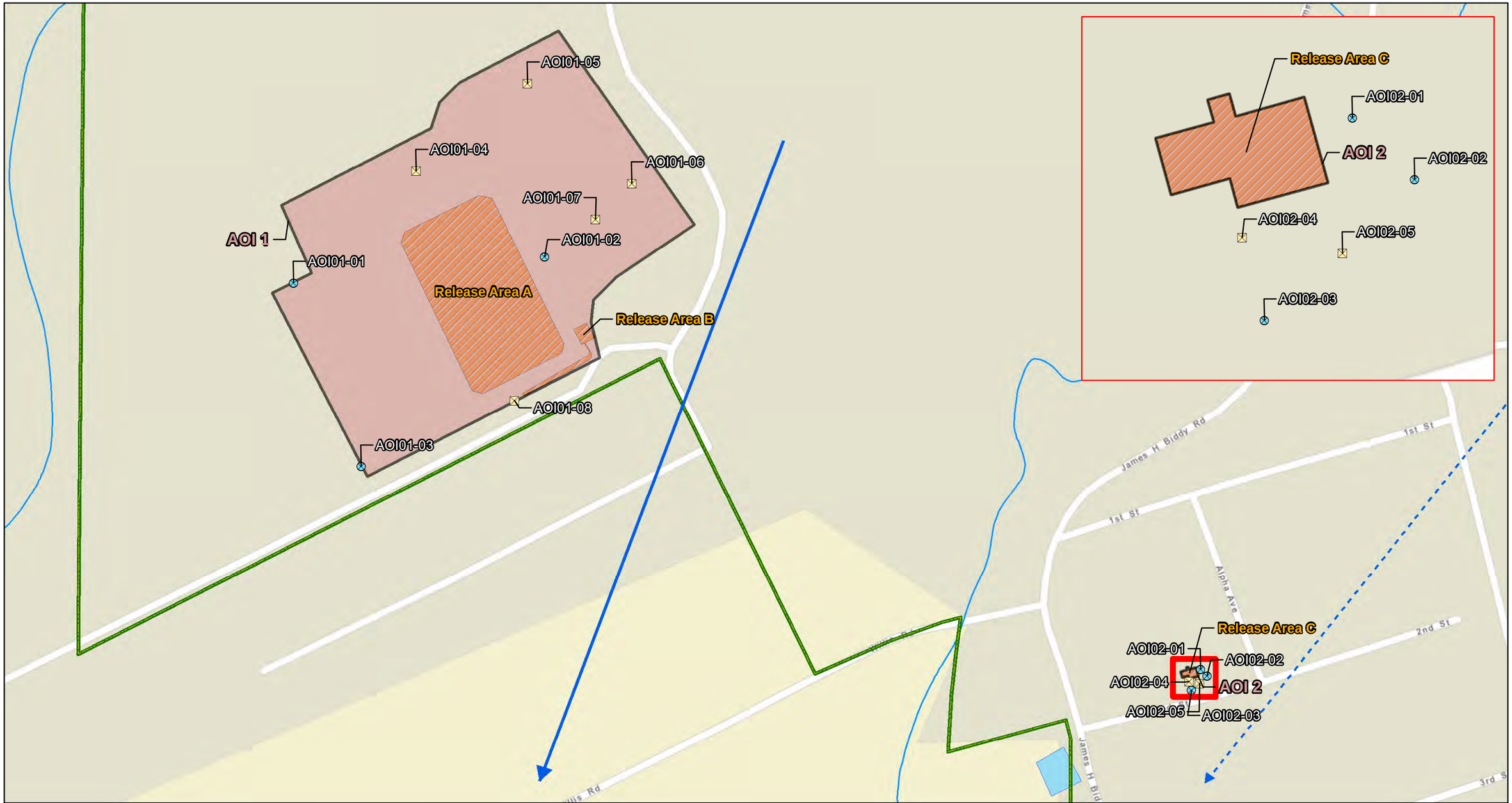

CLIENT	ARNG			
PROJECT	Site Inspection at Camp McCain, MS			
REVISED	4/5/2023	GIS BY	MS	4/5/2023
SCALE	1:4,800	CHK BY	JH	4/5/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	4/5/2023

Legend

- Soil Boring
- Surface Soil Sample
- Area of Interest
- Potential Release Area
- Facility Boundary
- Water Body
- River/Stream
- Groundwater Flow Direction

0 175 350 700 Feet

N

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Site Inspection Results

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Section 6.3** through **Section 6.4**. **Table 6-2** through **Table 6-5** present results in soil or groundwater for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the OSD dated 6 July 2022 (Assistant Secretary of Defense, 2022). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to the five compounds presented on **Table 6-1** below.

Table 6-1: Screening Levels (Soil and Groundwater)

Analyte[b]	Residential (Soil) (µg/kg)[a] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a]
PFOA	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter

a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.

b.) Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

The data in the subsequent sections are compared to the SLs presented in **Table 6-1**. The SLs for groundwater are based on direct ingestion. The SLs for soil are based on incidental ingestion and are applied to the depth intervals reasonably anticipated to be encountered by the receptors identified at the facility: the residential scenario is applied to surface soil results (0 to 2 feet bgs) and the industrial/commercial worker scenario is applied to shallow subsurface soil results (2 to 15 feet bgs). The SLs are not applied to deep subsurface soil results (>15 feet bgs) because 15 feet is the anticipated limit of construction activities.

6.2 Soil Physicochemical Analyses

To provide basic soil parameter information, soil samples were analyzed for TOC, pH, and grain size, which are important for evaluating transport through the soil medium. **Appendix F** contains the results of the TOC, pH, and grain size sampling.

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport. According to the Interstate Technology Regulatory Council (ITRC), several important partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions and are therefore relatively mobile in groundwater (Xiao et al., 2015), but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy, 2006; Guelfo and Higgins, 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (K_{oc} values) can help in evaluating transport potential, though other geochemical factors (for example, pH and presence of polyvalent cations) may also affect PFAS sorption to solid phases (ITRC, 2018).

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1: Release Areas A and B. The soil and groundwater results are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

Figure 6-1 through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results.

Soil was sampled from surface soil (0 to 2 feet bgs) from boring locations AOI01-01 through AOI01-08. Soil was also sampled from shallow subsurface soil (between 6 and 14 feet bgs) and deep subsurface soil intervals (between 15 to 35 feet bgs) from boring locations AOI01-01 through AOI01-03.

In surface soil, PFOA, PFOS, PFHxS, PFNA, and PFBS were detected at concentrations below their SLs. PFOA was detected in two borings at a concentration of 0.099 J micrograms per kilogram (µg/kg). PFOS was detected in six borings, with concentrations ranging from 0.077 J µg/kg to 2.53 µg/kg. PFHxS was detected in five borings, with concentrations ranging from 0.261 J µg/kg to 3.72 µg/kg. PFNA was detected in one boring at a concentration of 0.034 J µg/kg. PFBS was detected in four borings, with concentrations ranging from 0.044 J µg/kg to 0.332 J µg/kg. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in the shallow or deep subsurface soil.

6.3.2 AOI 1 Groundwater Analytical Results

Figure 6-6 and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

Groundwater was sampled from temporary monitoring wells AOI01-01 through AOI01-03. Exceedances of the SLs were only observed at AOI01-02, which are described below:

- PFOA was detected above the SL of 6 nanograms per liter (ng/L), at a concentration of 9.63 ng/L.
- PFOS was detected above the SL of 4 ng/L, at a concentration of 60.6 ng/L.

- PFHxS was detected above the SL of 39 ng/L, at a concentration of 62.3 ng/L.

PFBS was detected below the SL in all three wells, at concentrations ranging from 0.858 J ng/L to 16.6 ng/L. PFNA was not detected in any of the three wells.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in soil below their SLs. PFOA, PFOS, and PFHxS were detected in groundwater at concentrations above their SLs. Based on the exceedances of the SLs in groundwater, further evaluation at AOI 1 is warranted.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2: Release Area C. The results in soil and groundwater are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.4.1 AOI 2 Soil Analytical Results

Figure 6-1 through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results.

Soil was sampled from surface soil (0 to 2 feet bgs) from boring locations AOI02-01 to AOI02-05. Additionally, shallow subsurface soil (2 to 4 feet bgs) was sampled from boring locations AOI02-01 to AOI02-03.

In surface soil, PFOA, PFOS, PFHxS, PFNA, and PFBS were detected at concentrations below their SLs. PFOA was detected in three borings, with concentrations ranging from 0.113 J µg/kg to 0.290 J µg/kg. PFOS was detected in all five borings, with concentrations ranging from 0.087 J µg/kg to 0.471 J µg/kg. PFHxS was only detected at AOI02-05, at a concentration of 0.045 J µg/kg. PFNA was detected in four borings, with concentrations ranging from 0.043 J µg/kg to 0.325 J µg/kg. PFBS was only detected at AOI02-01 at a concentration of 0.048 J µg/kg.

In shallow subsurface soil, PFOA, PFOS, PFHxS, and PFNA were detected at concentrations below their SLs, ranging from 0.036 µg/kg J to 0.252 J µg/kg. All detections occurred at boring AOI02-03. PFBS was not detected in any of the three boring locations.

6.4.2 AOI 2 Groundwater Analytical Results

Figure 6-6 and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

Groundwater was sampled from temporary monitoring wells AOI2-01 through AOI2-03. Exceedances of the SLs were only observed at AOI02-03, which are described below

- PFOA was detected above the SL of 6 ng/L, at a concentration of 56.1 ng/L.
- PFOS was detected above the SL of 4 ng/L, at a concentration of 62.6 ng/L.
- PFNA was detected above the SL of 6 ng/L, at a concentration of 10.1 ng/L. PFNA was not detected in any other temporary well.

PFHxS was detected at well AOI02-03, at a concentration of 16.7 ng/L. PFBS was detected in all three wells, at concentrations below their SLs, ranging from 1.05 J ng/L to 5.74 ng/L.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOA, PFOS, PFHxS, and PFNA were detected in soil below their SLs. PFOA, PFOS, and PFNA were detected in groundwater at concentrations above their SLs. Based on the exceedances of the SLs in groundwater, further evaluation at AOI 2 is warranted.

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Camp McCain

Area of Interest		AOI01																		AOI02	
Sample ID		AOI01-01-SB-00-02		AOI01-02-SB-00-02		AOI01-03-SB-00-02		AOI01-04-SB-00-02		AOI01-05-SB-00-02		AOI01-05-SB-00-02-D		AOI01-06-SB-00-02		AOI01-07-SB-00-02		AOI01-08-SB-00-02		AOI02-01-SB-00-02	
Sample Date		04/21/2022		04/21/2022		04/21/2022		04/21/2022		04/21/2022		04/21/2022		04/21/2022		04/21/2022		04/21/2022		04/22/2022	
Depth		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	ND	U	0.332	J	0.051	J	0.055	J	ND	U	0.074	J	0.044	J	0.048	J
PFHxS	130	ND	U	ND	U	ND	U	3.72		1.06	J	1.12		0.347	J	0.445	J	0.261	J	ND	U
PFNA	19	ND	U	ND	U	ND	U	ND	U	0.034	J	0.031	J	ND	U	ND	U	ND	U	0.043	J
PFOA	19	ND	U	ND	U	ND	U	0.099	J	0.099	J	ND	UJ	ND	U	ND	U	ND	U	ND	U
PFOS	13	0.122	J	ND	U	ND	U	0.527	J	2.53		0.921	J	0.077	J	0.981	J	0.206	J	0.087	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Limit of Detection (LOD) ranges for relevant compounds:

PFBS: 0.051-0.062 µg/kg
PFHxS: 0.101-0.123 µg/kg
PFNA: 0.051-0.062 µg/kg
PFOA: 0.202-0.247 µg/kg
PFOS: 0.202-0.247 µg/kg

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Camp McCain

	Area of Interest	AOI02									
	Sample ID	AOI02-02-SB-00-02		AOI02-03-SB-00-02		AOI02-03-SB-00-02-D		AOI02-04-SB-00-02		AOI02-05-SB-00-02	
	Sample Date	04/22/2022		04/21/2022		04/21/2022		04/21/2022		04/21/2022	
	Depth	0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)											
PFBS	1900	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	ND	U	ND	U	ND	U	ND	U	0.045	J
PFNA	19	0.050	J	0.073	J	0.063	J	ND	U	0.325	J
PFOA	19	0.113	J	0.131	J	0.137	J	ND	U	0.290	J
PFOS	13	0.147	J	0.471	J	0.405	J	0.091	J	0.386	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Limit of Detection (LOD) ranges for relevant compounds:

PFBS: 0.051-0.062 µg/kg

PFHxS: 0.101-0.123 µg/kg

PFNA: 0.051-0.062 µg/kg

PFOA: 0.202-0.247 µg/kg

PFOS: 0.202-0.247 µg/kg

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Camp McCain

	Area of Interest	AOI01						AOI02					
	Sample ID	AOI01-02-SB-06-08		AOI01-02-SB-12-14		AOI01-03-SB-10-12		AOI02-01-SB-02-04		AOI02-02-SB-02-04		AOI02-03-SB-02-04	
	Sample Date	04/21/2022		04/21/2022		04/21/2022		04/22/2022		04/22/2022		04/21/2022	
	Depth	6-8 ft		12-14 ft		10-12 ft		2-4 ft		2-4 ft		2-4 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)													
PFBS	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	1600	ND	U	ND	U	ND	U	ND	U	ND	U	0.036	J
PFNA	250	ND	U	ND	U	ND	U	ND	U	ND	U	0.040	J
PFOA	250	ND	U	ND	U	ND	U	ND	U	ND	U	0.171	J
PFOS	160	ND	U	ND	U	ND	U	ND	U	ND	U	0.252	J

Grey Fill Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Limit of Detection (LOD) ranges for relevant compounds:

PFBS: 0.051-0.059 µg/kg
PFHxS: 0.103-0.118 µg/kg
PFNA: 0.051-0.059 µg/kg
PFOA: 0.205-0.237 µg/kg
PFOS: 0.205-0.237 µg/kg

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Camp McCain

Area of Interest	AOI01							
Sample ID	AOI01-01-SB-15-17		AOI01-01-SB-15-17-D		AOI01-01-SB-33-35		AOI01-03-SB-18-20	
Sample Date	04/21/2022		04/21/2022		04/21/2022		04/21/2022	
Depth	15-17 ft		15-17 ft		33-35 ft		18-20 ft	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)								
PFBS	ND	U	ND	U	ND	U	ND	U
PFHxS	ND	U	ND	U	ND	U	ND	U
PFNA	ND	U	ND	U	ND	U	ND	U
PFOA	ND	U	ND	U	ND	U	ND	U
PFOS	ND	U	ND	U	ND	U	ND	U

Interpreted Qualifiers

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Limit of Detection (LOD) ranges for relevant compounds:

PFBS: 0.057-0.059 µg/kg

PFHxS: 0.113-0.117 µg/kg

PFNA: 0.057-0.059 µg/kg

PFOA: 0.226-0.235 µg/kg

PFOS: 0.226-0.235 µg/kg

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
µg/kg	micrograms per kilogram

Table 6-5
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Camp McCain

	Area of Interest	AOI01						AOI02							
	Sample ID	AOI01-01-GW		AOI01-02-GW		AOI01-03-GW		AOI02-01-GW		AOI02-02-GW		AOI02-02-GW-D		AOI02-03-GW	
	Sample Date	04/21/2022		04/21/2022		04/21/2022		04/21/2022		04/22/2022		04/22/2022		04/22/2022	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)															
PFBS	601	0.858	J	16.6		1.18	J	1.05	J	0.841	J	1.58	J	5.74	
PFHxS	39	ND	U	62.3		4.01		ND	U	ND	U	ND	U	16.7	
PFNA	6	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	10.1	
PFOA	6	ND	U	9.63		ND	U	1.48	J	0.970	J	1.30	J	56.1	
PFOS	4	ND	U	60.6		2.38	J	1.15	J	1.10	J	1.30	J	62.6	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022 Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Limit of Detection (LOD) ranges for relevant compounds:

PFBS: 1.92-2.05 ng/L

PFHxS: 2.88-3.07 ng/L

PFNA: 1.92-2.05 ng/L

PFOA: 1.92-2.05 ng/L

PFOS: 1.92-2.05 ng/L

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
GW	groundwater
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
USEPA	United States Environmental Protection Agency
ng/l	nanogram per liter

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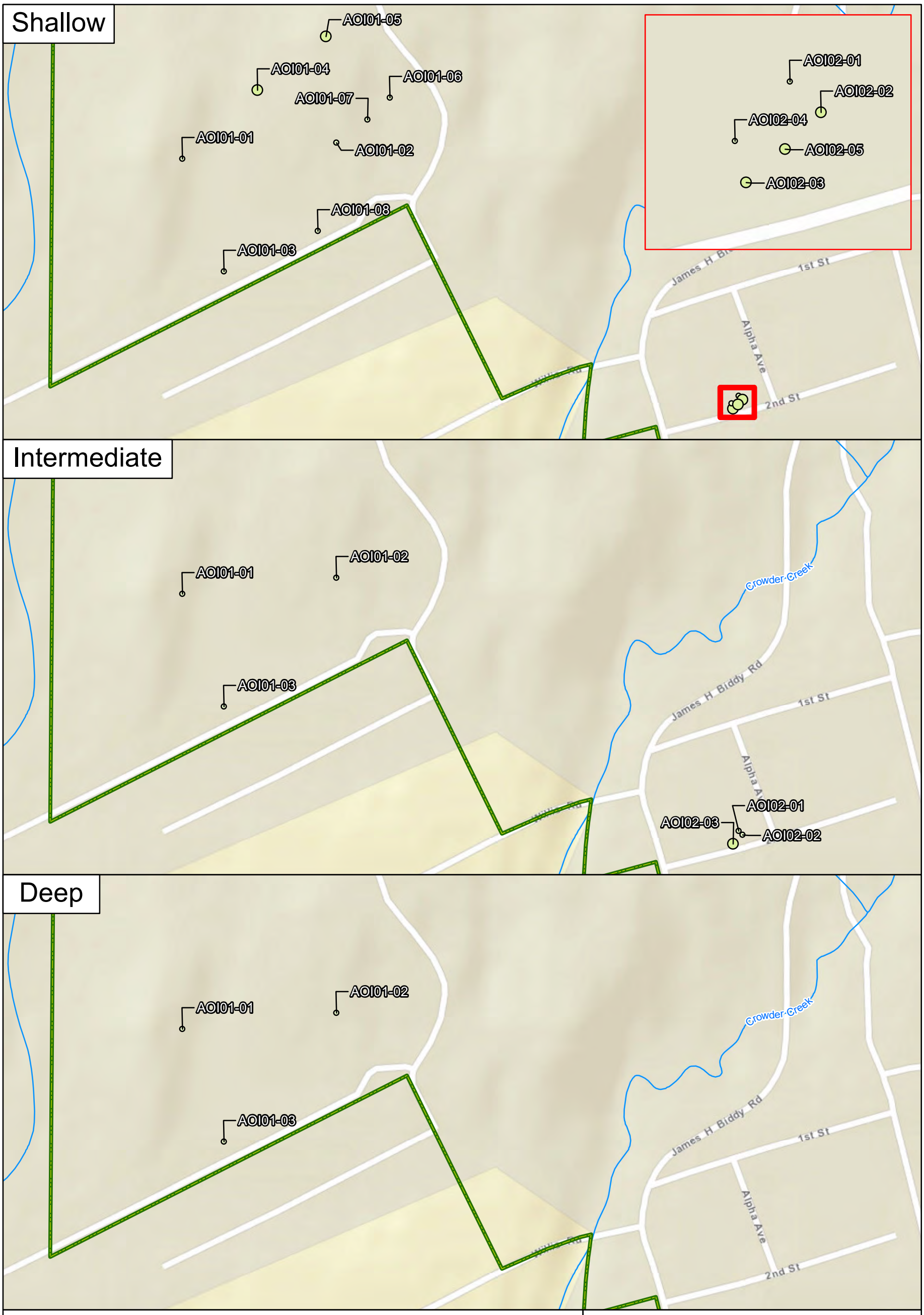


Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFOA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp McCain, MS			
REVISED	4/5/2023	GIS BY	MS	4/5/2023
SCALE	1:7,800	CHK BY	JH	4/5/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	4/5/2023

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-1

Shallow

AOI01-05
AOI01-04
AOI01-06
AOI01-07
AOI01-02
AOI01-01
AOI01-08
AOI01-03
AOI02-01
AOI02-02
AOI02-04
AOI02-05
AOI02-03
James H Biddy Rd
1st St
Alpha Ave
2nd St

Intermediate

AOI01-01
AOI01-02
AOI01-03
Crowder Creek
James H Biddy Rd
1st St
Alpha Ave
AOI02-01
AOI02-03
AOI02-02

Deep

AOI01-02
AOI01-01
AOI01-03
Crowder Creek
James H Biddy Rd
1st St
Alpha Ave
2nd St

Legend

- Facility Boundary
- River/Stream

PFOS Results (µg/Kg)

- ND
- >ND - 13
- >13 - 160
- >160 - 1,600
- >1,600

N

0 325 650 1,300 Feet

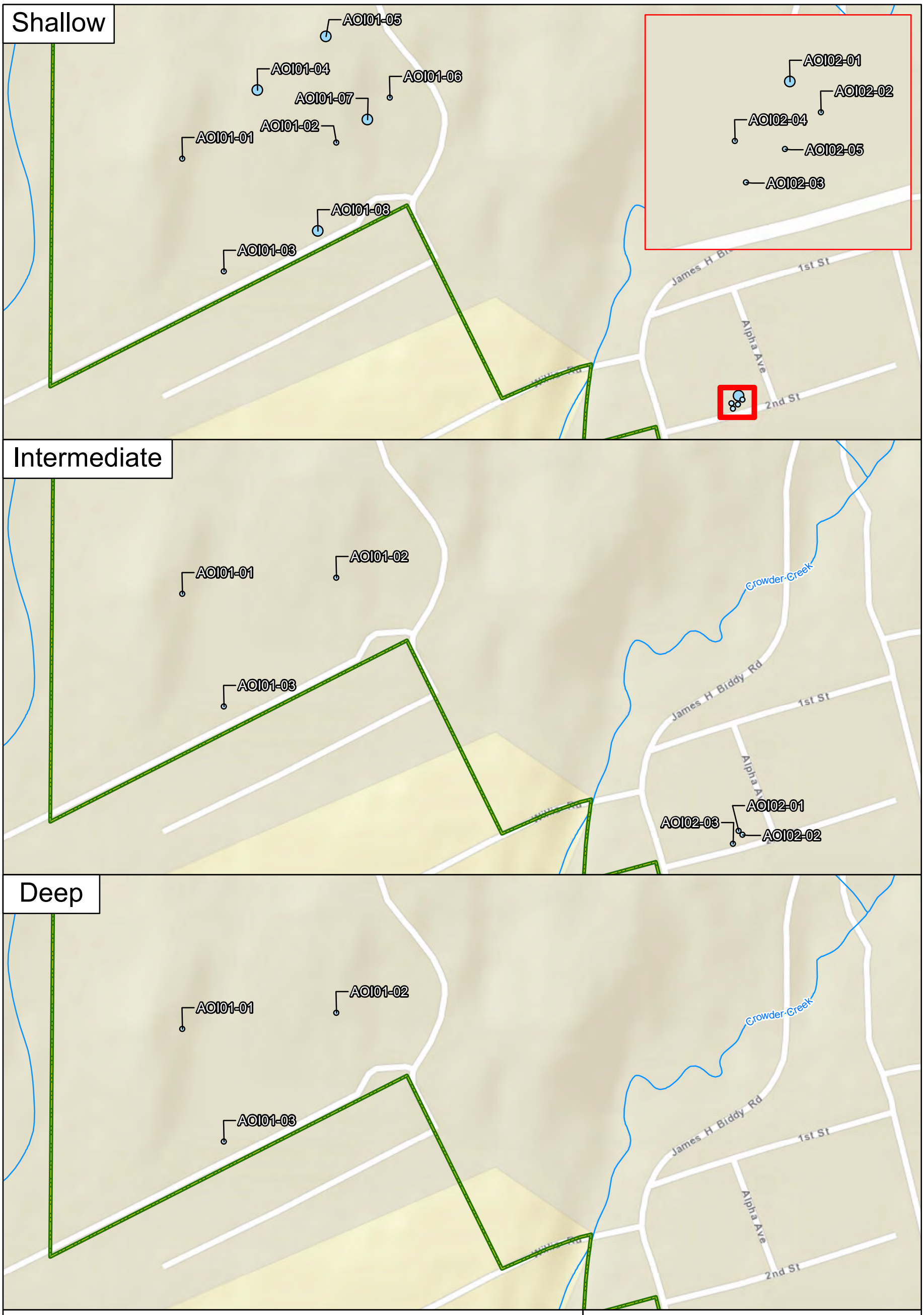
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFOS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp McCain, MS			
REVISED	4/5/2023	GIS BY	MS	4/5/2023
SCALE	1:7,800	CHK BY	JH	4/5/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	4/5/2023

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-2



Legend

- Facility Boundary
- River/Stream

PFBS Results (µg/Kg)

- ND
- >ND - 10
- >10 - 1,900
- >1,900 - 25,000
- >25,000

N

0 325 650 1,300 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFBS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp McCain, MS			
REVISED	4/5/2023	GIS BY	MS	4/5/2023
SCALE	1:7,800	CHK BY	JH	4/5/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	4/5/2023

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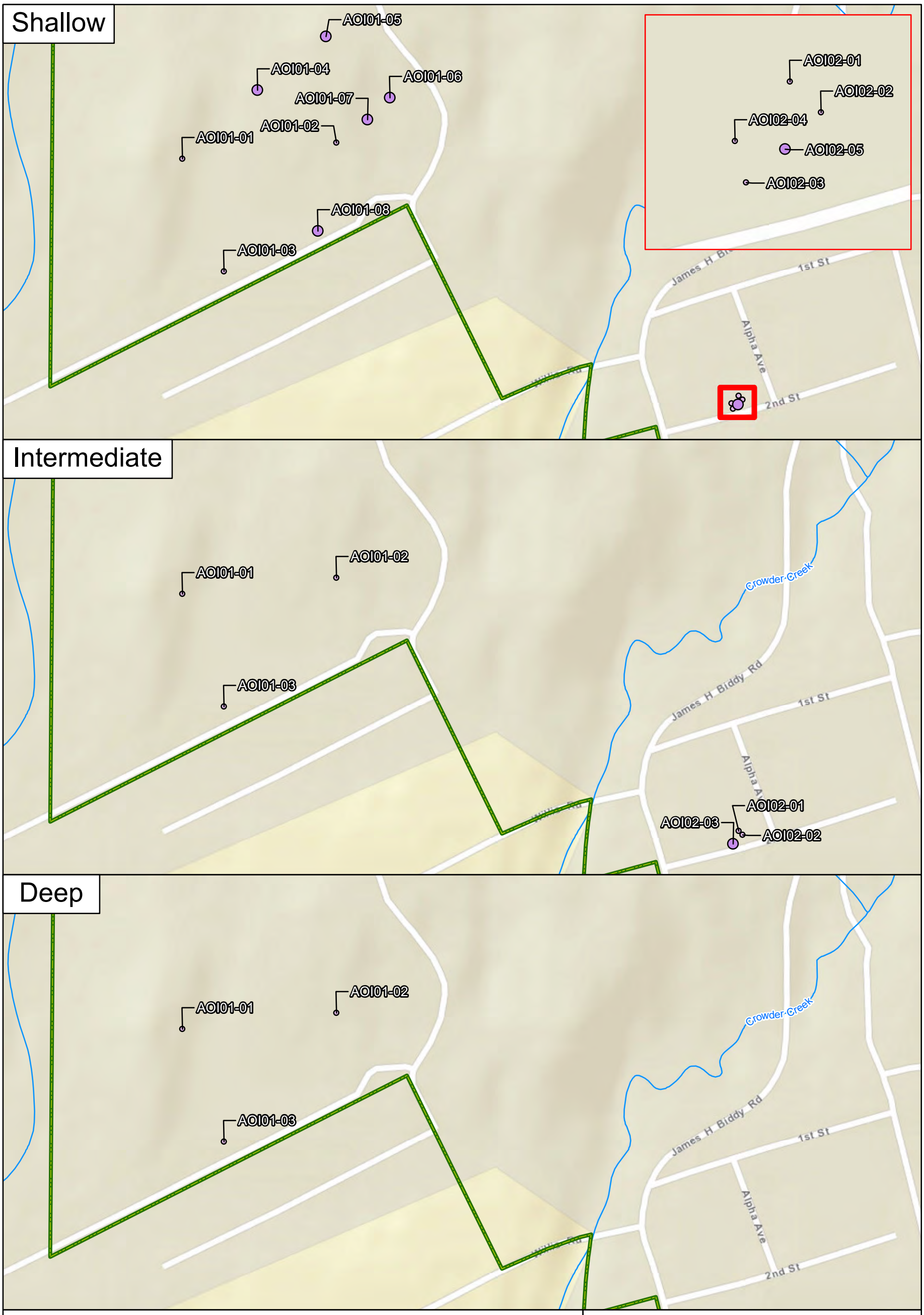
Figure 6-3



Legend

- Facility Boundary
- River/Stream

PFHxS Results (µg/Kg)

- ND
- >ND - 10
- >10 - 130
- >130 - 1,600
- >1,600

N

0 325 650 1,300 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFHxS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp McCain, MS			
REVISED	4/5/2023	GIS BY	MS	4/5/2023
SCALE	1:7,800	CHK BY	JH	4/5/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	4/5/2023

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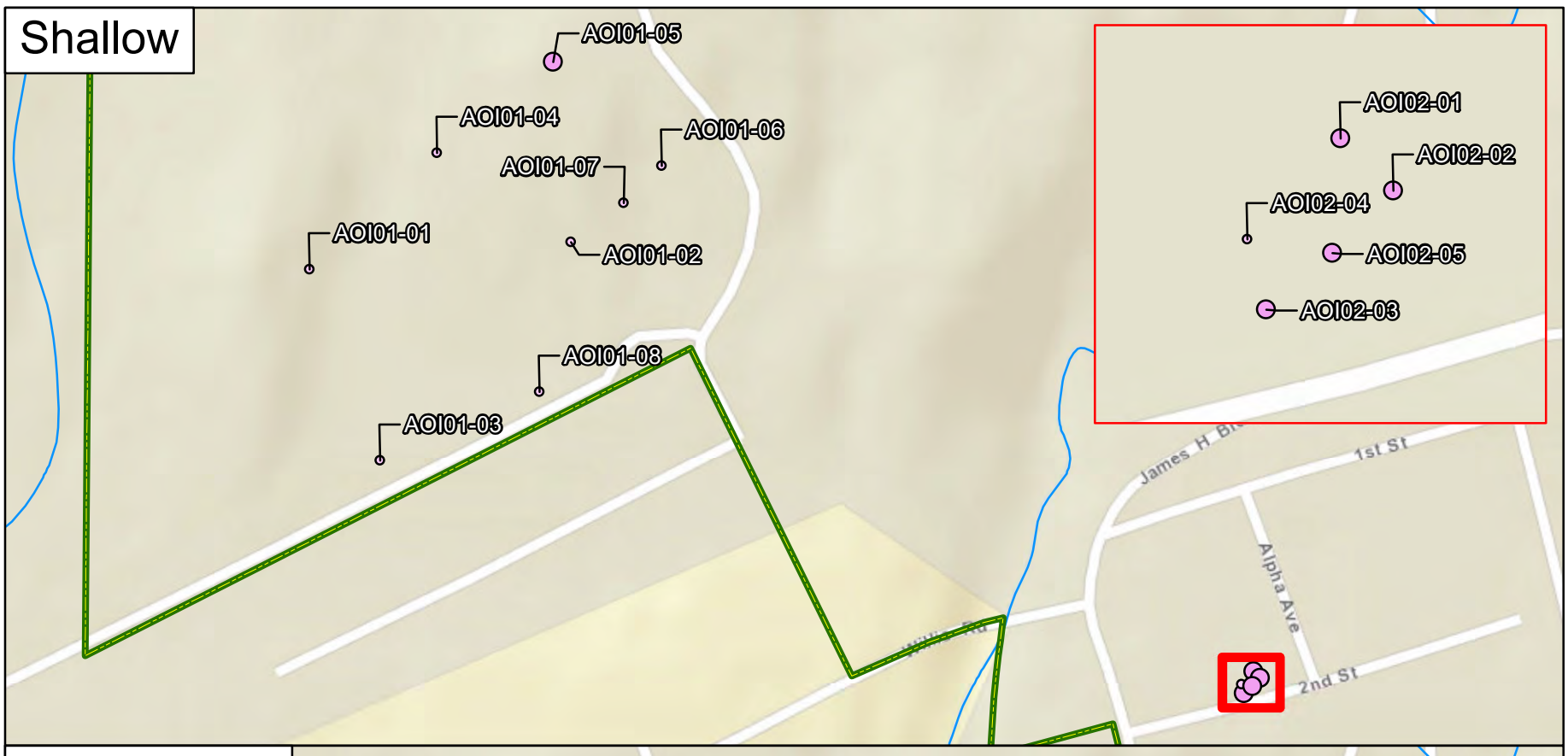
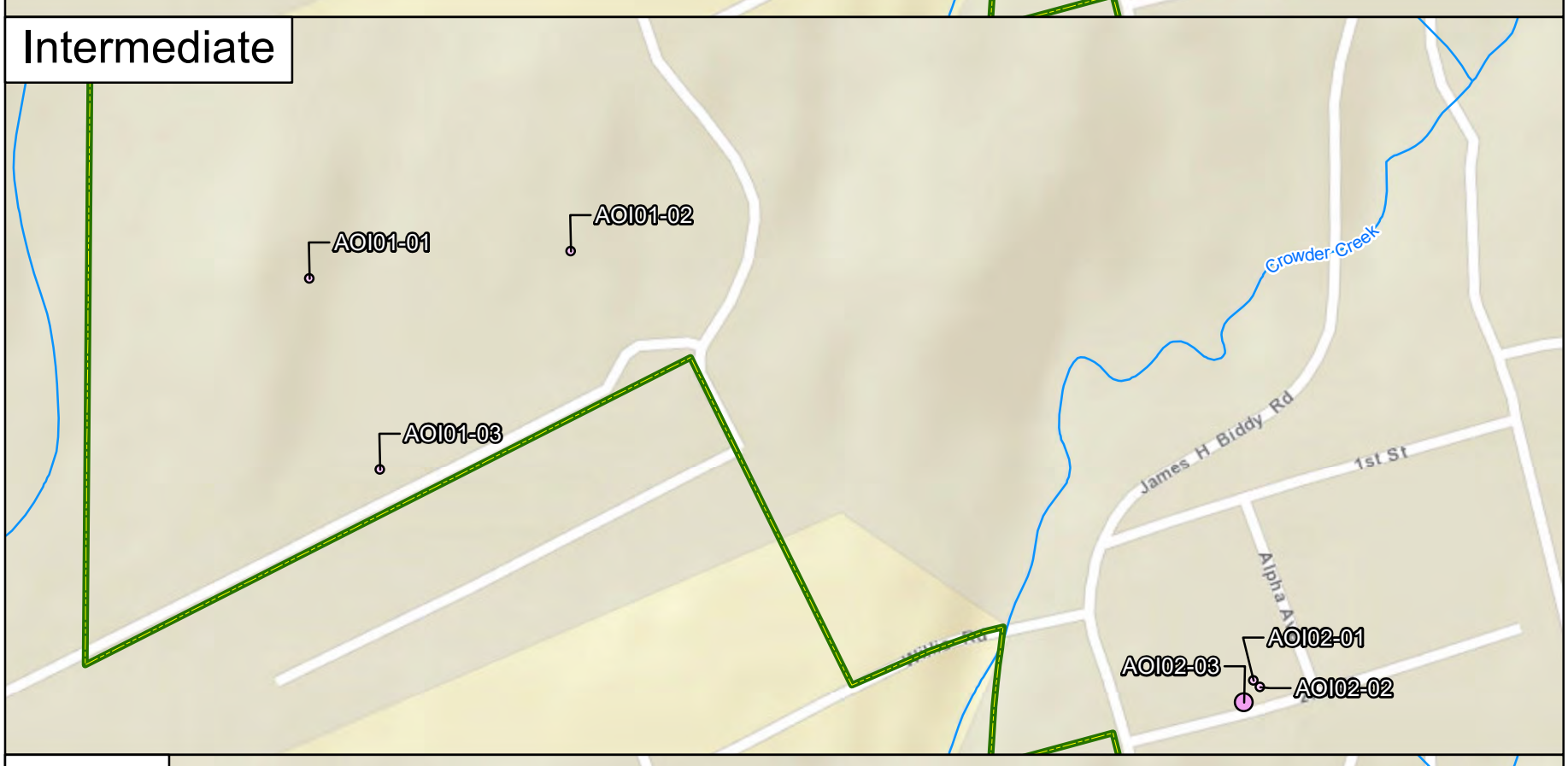
Figure 6-4

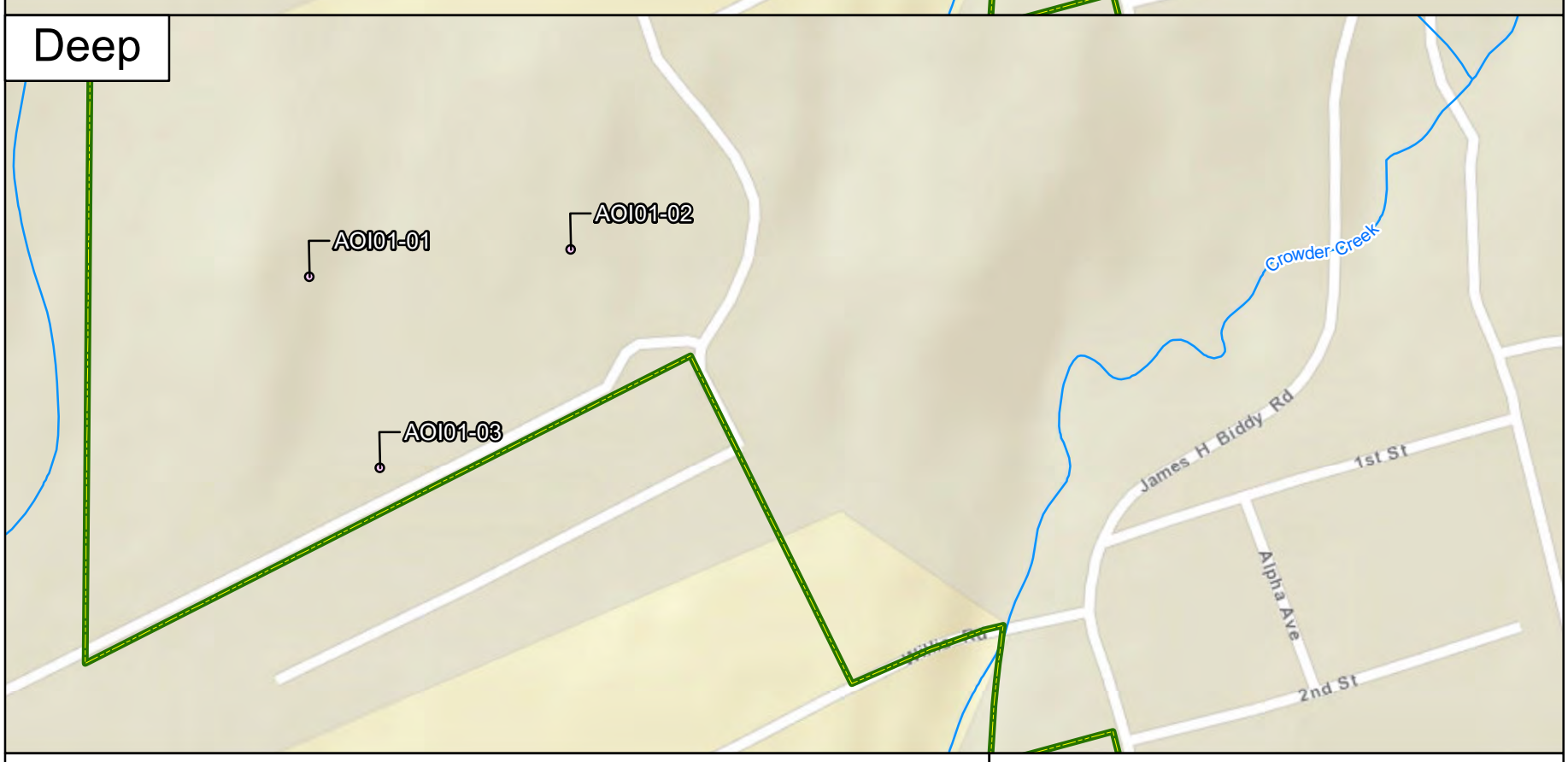
Shallow



Intermediate



Deep



Legend

- Facility Boundary
- River/Stream

PFNA Results (µg/Kg)

- ND
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

N

0 325 650 1,300 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFNA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp McCain, MS			
REVISED	4/5/2023	GIS BY	MS	4/5/2023
SCALE	1:7,800	CHK BY	JH	4/5/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	4/5/2023

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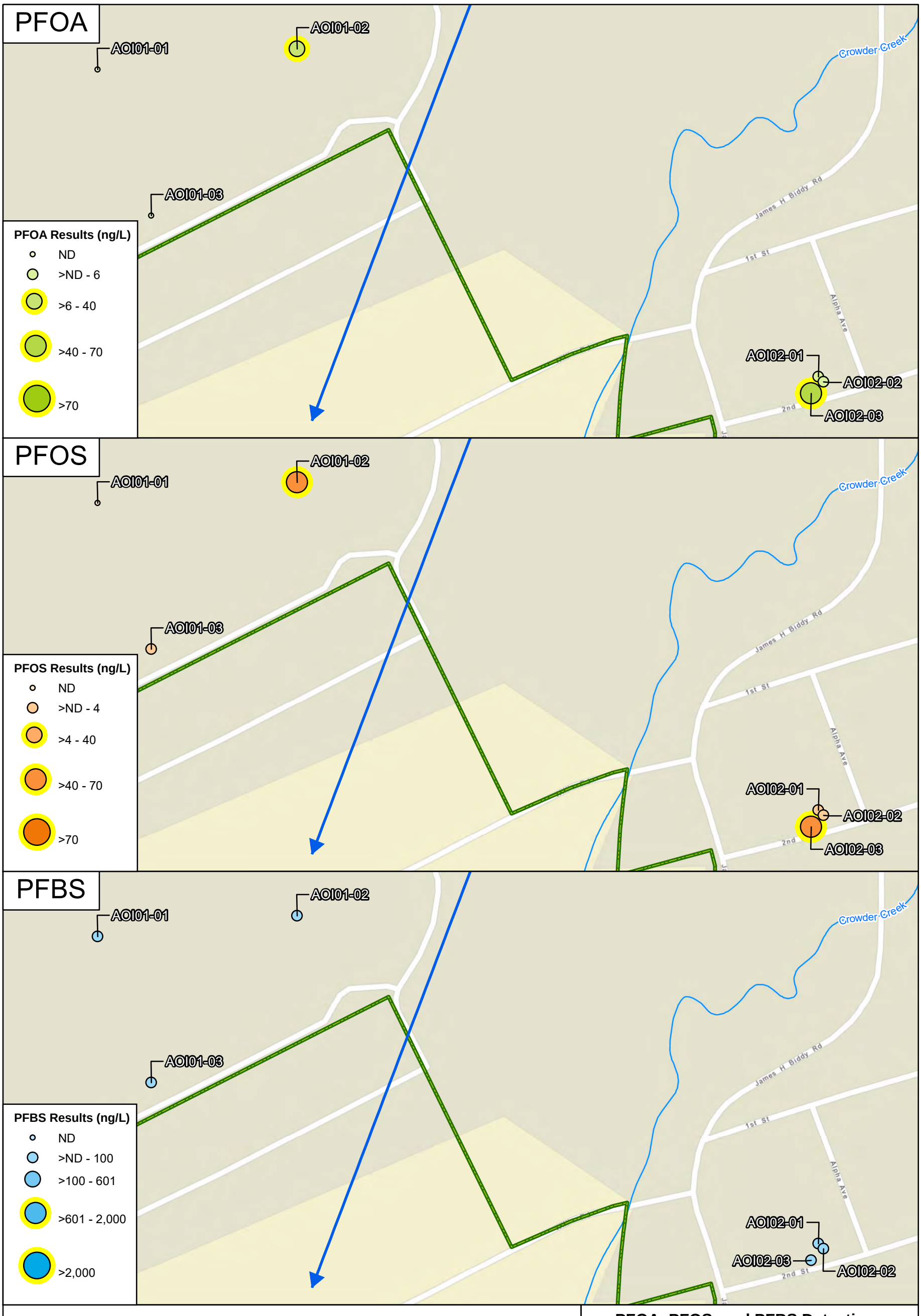
Figure 6-5



Legend

- Facility Boundary
- River/Stream
- Groundwater Flow Direction

N

0 250 500 1,000 Feet

Exceedances of the OSD SL are depicted with a yellow halo.

PFOA, PFOS, and PFBS Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Inspection at Camp McCain, MS			
REVISED	4/5/2023	GIS BY	MS	4/5/2023
SCALE	1:6,000	CHK BY	JH	4/5/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	4/5/2023

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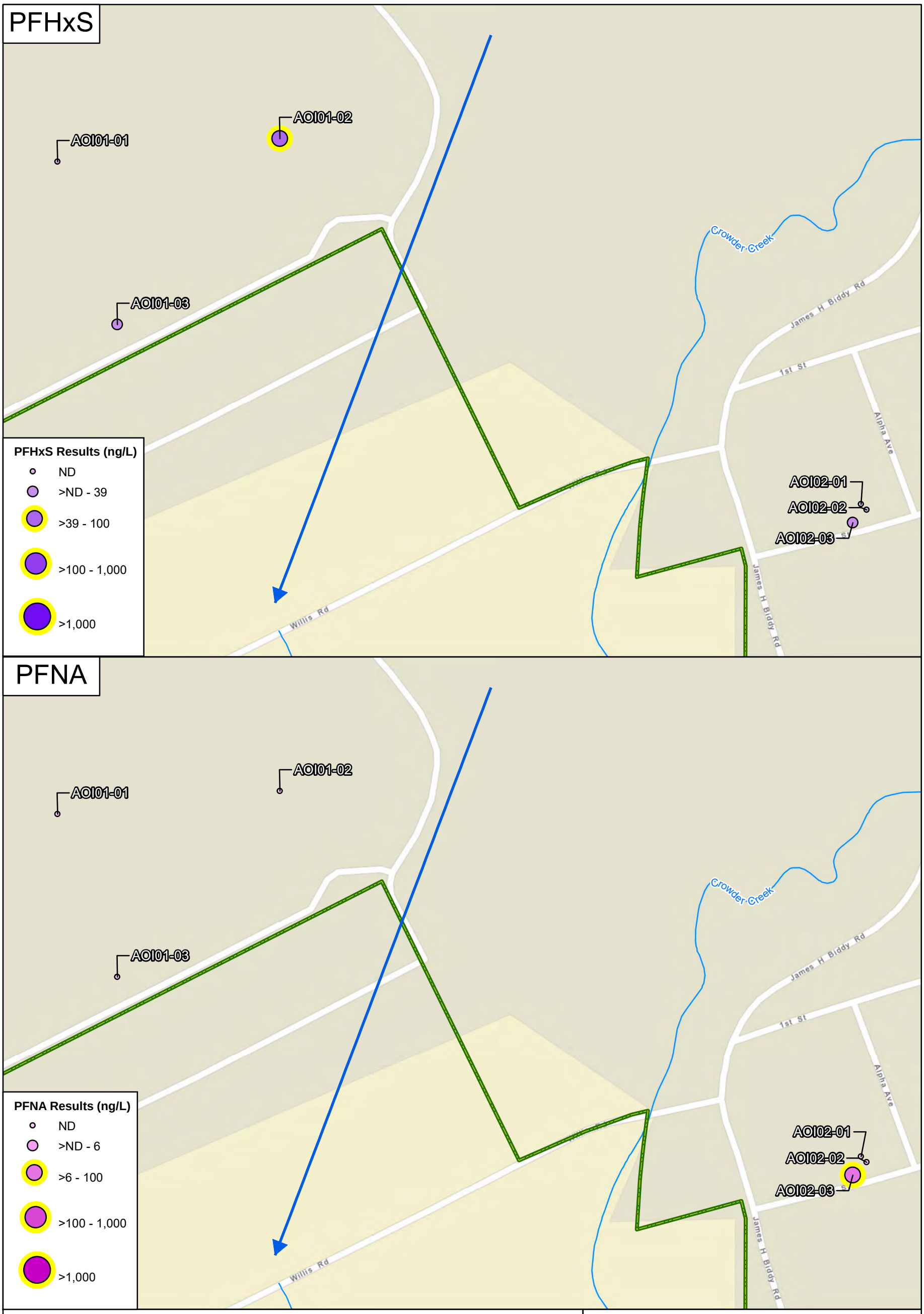
Figure 6-6



Exceedances of the OSD SL are depicted with a yellow halo.

PFHxS and PFNA Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Inspection at Camp McCain, MS			
REVISED	4/5/2023	GIS BY	MS	4/5/2023
SCALE	1:5,400	CHK BY	JH	4/5/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	4/5/2023

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Figure 6-7

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-2**. Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to RI or interim action is determined based upon exceedances of the SLs for the relevant compounds and whether the release is more than likely attributable to the DoD. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

1. Contaminant source;
2. Environmental fate and transport;
3. Exposure point;
4. Exposure route; and
5. Potentially exposed populations.

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with an incomplete pathway generally warrant no further action. However, the pathway is considered potentially complete if the relevant compounds are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of relevant compounds above the SLs. Areas with an identified potentially complete pathway that have detections of the relevant compounds above the SLs may warrant further investigation. Although the CSMs indicate whether potentially complete exposure pathways may exist, the recommendation for future study in an RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

In general, the potential routes of exposure to the relevant compounds are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2001). Receptors at the facility include site workers (e.g., facility staff and visiting soldiers), construction workers, trespassers, residents outside the facility boundary, and recreational users outside of the facility boundary. No construction was observed during SI field activities.

7.1 Soil Exposure Pathway

The SI results in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 1 and AOI 2 based on the aforementioned criteria.

7.1.1 AOI 1

AOI 1 consists of Release Areas A and B. At Release Area A, approximately 3 to 5 gallons of AFFF were disposed of between 2009 and 2011. Release Area B is the dry drainage ditch where 10 gallons of post-treatment effluent were released.

PFOA, PFOS, PFHxS, PFNA, and PFBS were detected below their SLs in the surface soil at AOI 1. Site workers, future construction workers, and trespassers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathways for these receptors are potentially complete. No constituents were detected in the shallow subsurface soil at AOI 1. Therefore, the subsurface soil exposure pathways for receptors are considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

AOI 2 consists of Release Area C, the current Camp McCain fire station, which currently houses a 1.5-gallon foam-capable Gator utility vehicle. Between approximate 2007 and 2011, a foam-capable truck was also housed at Release Area C, but the truck was reportedly never used. Lastly, a 5-gallon container of AFFF may have been stored at this location prior to disposal at Release Area A.

PFOA, PFOS, PFHxS, PFNA, and PFBS were detected below their respective SLs in the surface soil at AOI 2. Site workers, future construction workers, and trespassers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathways for these receptors are potentially complete. PFOA, PFOS, PFHxS, and PFNA were detected below their respective SLs in subsurface soil at AOI 2. Future construction workers could contact constituents in subsurface soil via incidental ingestion, and therefore, the subsurface soil exposure pathway for construction workers is potentially complete. The subsurface soil exposure pathways are incomplete for site worker, offsite resident, trespassers, and recreational users. The CSM for AOI 2 is presented on **Figure 7-2**.

7.2 Groundwater Exposure Pathway

The SI results in groundwater were used to determine whether a potentially complete pathway exists between the source and potential receptors based on the aforementioned criteria.

7.2.1 AOI 1

PFOA, PFOS, and PFHxS were detected above their SLs in groundwater collected at AOI 1. Domestic and public water supply wells screened within the Meridian-Upper Wilcox aquifer are located downgradient of Camp McCain. Therefore, the exposure pathway for offsite residents via ingestion of groundwater is considered potentially complete. Depths to water measured at AOI 1 in April 2022 during the SI ranged from 2.95 to 34.00 feet bgs. Therefore, the ingestion exposure pathway for future construction workers is considered complete. Additionally, during wet periods, the water level may rise to depths shallower than 2 feet bgs. Therefore, the incidental ingestion pathway for future site workers is considered potentially complete when the groundwater is shallower than 2 feet bgs. The potable facility wells are screened in the Middle Wilcox aquifer and, consequently, the exposure pathway for ingestion of groundwater for site workers via these supply wells is considered incomplete. The incidental exposure pathway to recreational users is incomplete because recreators are not expected to encounter groundwater at the facility or in downgradient potable wells. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

PFOA, PFOS, and PFNA were detected in groundwater at concentrations above their SLs at AOI 2. Due to the presence of offsite potable wells that are screened within the Meridian-Upper Wilcox aquifer and located downgradient of Camp McCain, the exposure pathway for offsite residents via ingestion of groundwater is considered potentially complete. Depths to water measured in April 2022 during the SI ranged from 2.61 to 3.64 feet bgs. Therefore, the ingestion exposure pathway for future construction workers is considered potentially complete. Additionally, during

wet periods, the water level may rise to depths shallower than 2 feet bgs. Therefore, the incidental ingestion pathway for future site workers is considered potentially complete when the groundwater is shallower than 2 feet bgs. The exposure pathway for ingestion of groundwater for site workers via the potable facility supply wells is considered incomplete. The incidental exposure pathway to recreational users is incomplete because recreators are not expected to encounter groundwater at the facility or in downgradient potable wells. The CSM for AOI 2 is presented on **Figure 7-2**.

7.3 Surface Water and Sediment Exposure Pathway

The SI results in soil and groundwater, in combination with knowledge of the fate and transport properties of PFAS, were used to determine whether a potentially complete pathway exists between the source and potential receptors.

7.3.1 AOI 1

PFAS are water soluble and can migrate readily from soil to surface water via leaching and run-off. Drainage from AOI 1 leads to an unnamed tributary of Batupan Bogue. Additionally, shallow groundwater may discharge to the nearby surface water bodies and drainage features. PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in soil and groundwater at AOI 1; therefore, it is possible that these compounds may have migrated from soil and groundwater to the downgradient surface water bodies. Although surface water and sediment were not sampled at the WWTP lagoons, AFFF was directly released to the eastern lagoon between 2009 and 2011. Therefore, the surface water and sediment ingestion exposure pathway for site workers, future construction workers, or trespassers is considered potentially complete. Also, due to potential recreational use of the Batupan Bogue and nearby surface water bodies, the surface water and sediment ingestion exposure pathway for off-facility recreational users is also considered potentially complete. The residential exposure pathway for surface water is considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.3.2 AOI 2

PFOA, PFOS, PFHxS, PFNA, and PFBS were detected in soil and groundwater at AOI 2. It is possible these compounds may have migrated via runoff, leaching, and groundwater discharge to nearby surface water bodies, such as Crowder Creek, which flows to the Little Bogue. Consequently, the surface water and sediment ingestion exposure pathway for site workers, construction workers, or trespassers is considered potentially complete. Also, due to potential recreational use of nearby surface water bodies, the surface water and sediment ingestion exposure pathway for off-facility recreational users is also considered potentially complete. The residential exposure pathway for surface water is considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

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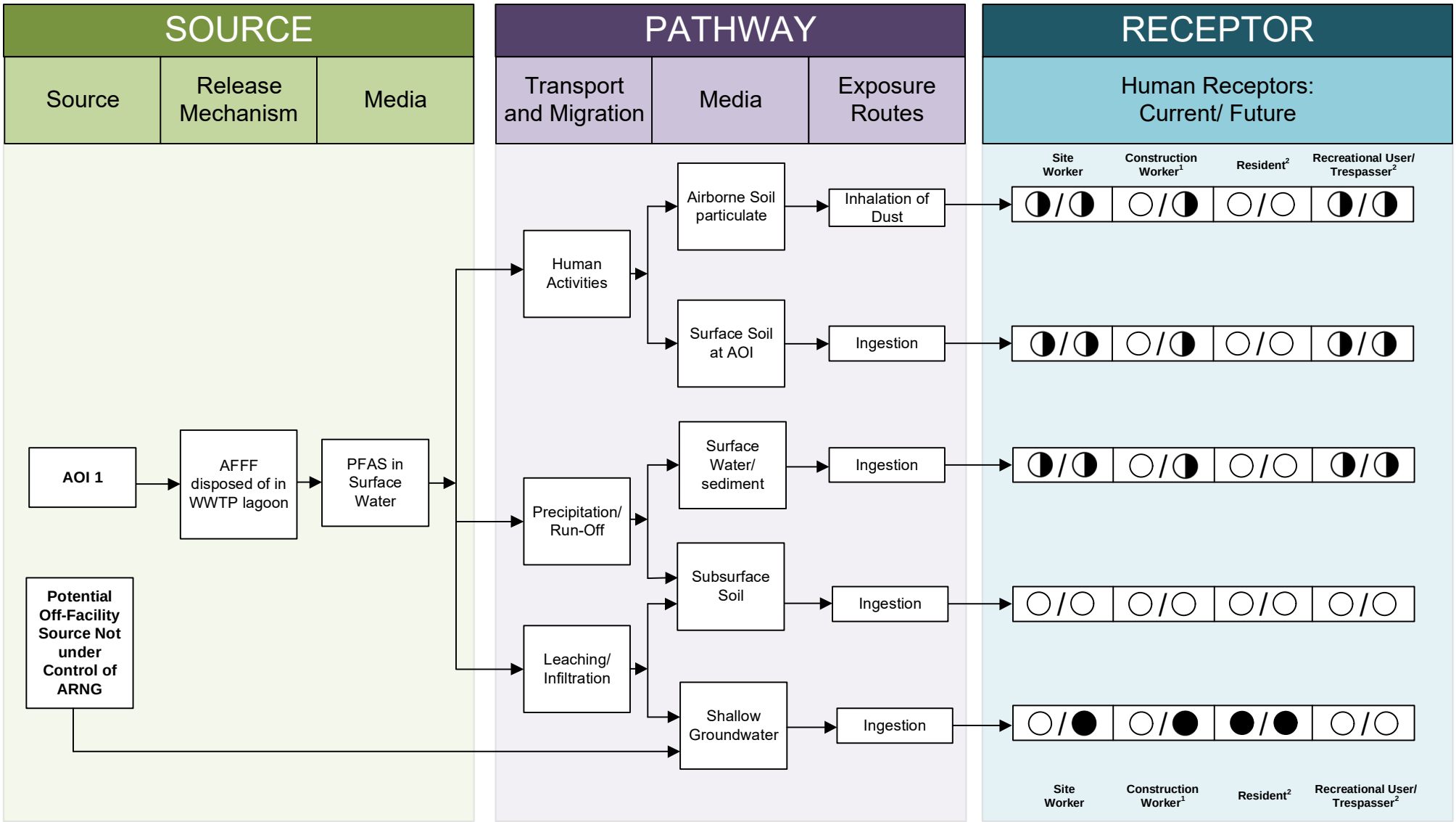


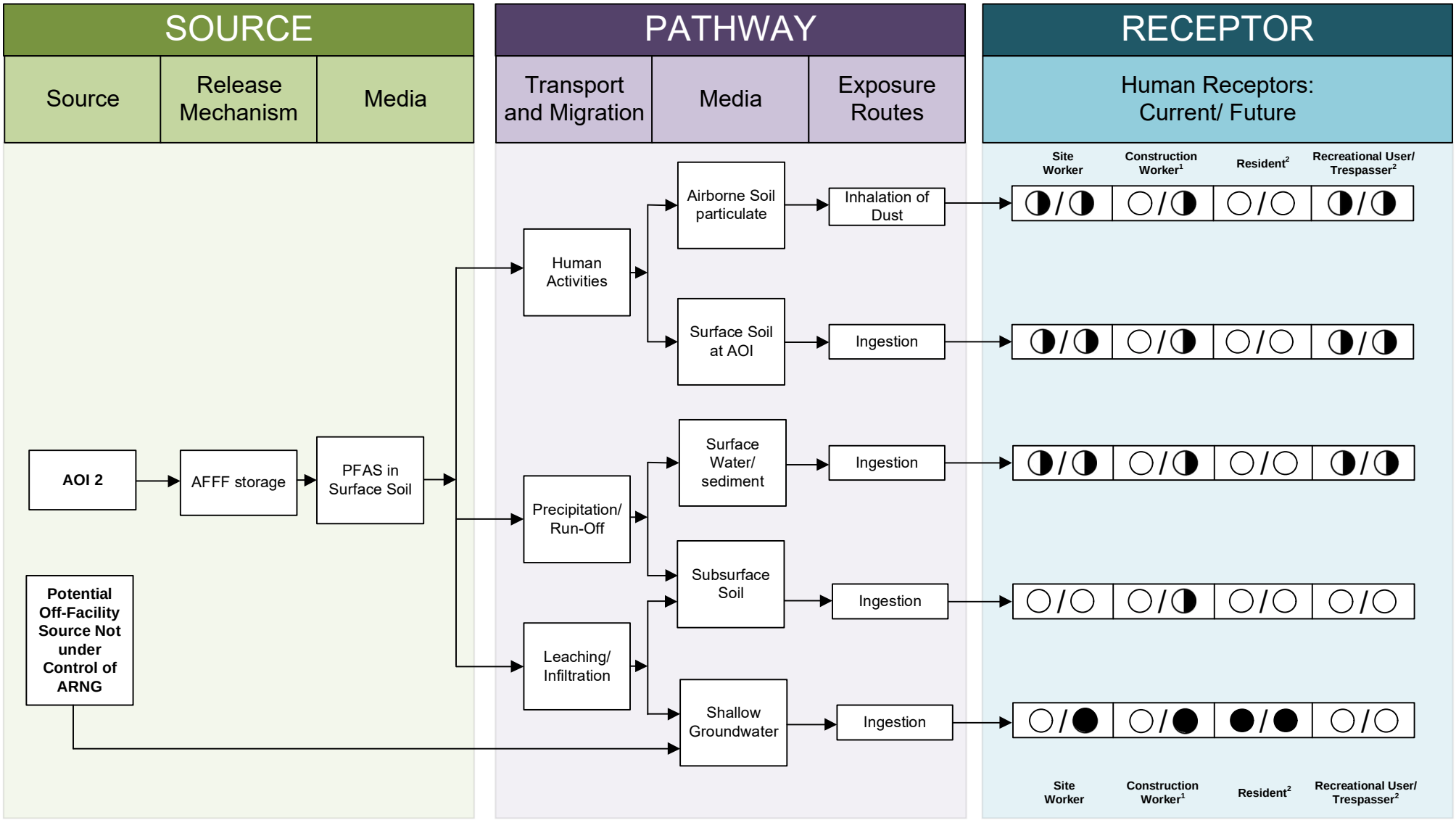
LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

Notes:

1. No construction activities were observed during SI field activities.
2. The resident and recreator receptors refer to an off-site receptor.

Figure 7-1
Conceptual Site Model
AOI 1 Release Areas A and B



LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

Notes:

1. No construction activities were observed during SI field activities.
2. The resident and recreator receptors refer to an off-site receptor.

Figure 7-2
Conceptual Site Model
AOI 2 Release Area C

8. Summary and Outcome

This section summarizes SI activities and findings. The most significant findings are summarized in this section and are reproduced directly or abstracted from information contained in this report. The outcome provides general and comparative interpretations of the findings relative to the SLs.

8.1 SI Activities

The SI field activities were conducted from 19 to 25 April 2022 and consisted of utility clearance, direct push boring, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022a), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2022a), samples were collected and analyzed for a subset of 18 compounds by LC/MS/MS compliant with QSM 5.3 Table B-15 as follows.

- Twenty-two (22) soil samples from 13 boring locations;
- Six grab groundwater samples from six temporary wells;
- Seventeen (17) QA/QC samples.

An SI is conducted when the PA determines an AOI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at AOIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. Additionally, the CSMs were refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure at the AOIs, which are described in **Section 7**.

8.2 Outcome

Based on the results of this SI, further evaluation under CERCLA is warranted in an RI for AOI 1 and AOI 2. Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to drinking water receptors from AOI 1 and AOI 2 from sources on the facility resulting from historical DoD activities. Sample analytical concentrations collected during the SI were compared to the project SLs in soil and groundwater, as described in **Table 6-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1:
    - The detected concentrations of PFOA, PFOS, PFHxS, PFNA and PFBS in soil at AOI 1 were below their SLs.
    - PFOA, PFOS, and PFHxS in groundwater exceeded their SLs at temporary well AOI01-02. PFOA exceeded the SL of 6 ng/L, with a concentration of 9.63 ng/L. PFOS exceeded the SL of 4 ng/L, with a concentration of 60.6 ng/L. PFHxS exceeded the SL of 39 ng/L, with a concentration of 62.3 ng/L. Based on the results of the SI, further evaluation of AOI 1 is warranted in an RI.
- At AOI 2:
    - The detected concentrations of PFOA, PFOS, PFHxS, PFNA, and PFBS in soil at AOI 2 were below their SLs.

- PFOA, PFOS, and PFNA in groundwater exceeded their SLs at temporary well AOI02-03. PFOA exceeded the SL of 6 ng/L, with a concentration of 56.1 ng/L. PFOS exceeded the SL of 4 ng/L, with a concentration of 62.6 ng/L. PFNA exceeded the SL of 6 ng/L with a concentration of 10.1 ng/L. Based on the results of the SI, further evaluation of AOI 2 is warranted in an RI.

As discussed in **Section 5.8**, the midpoint soil sample at boring AOI01-01 was collected from 15 to 17 feet bgs instead of 13 to 15 feet bgs, as described in the SI QAPP Addendum (AECOM, 2022a). Therefore, no shallow subsurface soil was collected at this boring location to compare against the industrial/commercial soil SLs.

Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table 8-1 summarizes the SI results for soil and groundwater used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI.

Table 8-1: Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Future Action
1	Release Area A	◐	●	Proceed to RI
	Release Area B	◐	NA	
2	Release Area C	◐	●	Proceed to RI

Legend:
NA = not applicable
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

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