



Draft Final Site Inspections Report of Fire Fighting Foam Usage at Seymour Johnson Air Force Base Wayne County, North Carolina

October 2017

Submitted to:

**Air Force Civil Engineer Center
3515 General McMullen Suite 155
San Antonio, Texas 78226-2018**

Submitted by:

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under
Contract No. W912HN-15-C-0022**



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Table of Contents

	Page
Acronyms and Abbreviations	vii
1.0 INTRODUCTION.....	1
1.1 FACILITY DESCRIPTION AND HISTORY	3
2.0 AFFF AREA DESCRIPTIONS	4
2.1 FORMER FIRE TRAINING AREA 3 (AFFF AREA 1).....	4
2.2 BUILDING 4522 (AFFF AREA 2).....	5
2.3 BUILDING 4537 (AFFF AREA 3).....	5
2.4 BUILDING 4735 (AFFF AREA 4).....	6
2.5 AIRCRAFT TIRE FIRE (AFFF AREA 5)	6
2.6 KC-135 CRASH SITE (AFFF AREA 6).....	6
3.0 FIELD ACTIVITIES.....	6
3.1 FORMER FIRE TRAINING AREA 3 (AFFF AREA 1).....	8
3.1.1 <i>Sample Locations</i>	8
3.1.2 <i>Lithology</i>	8
3.1.3 <i>Groundwater Flow</i>	8
3.1.4 <i>Analytical Results</i>	8
3.1.5 <i>Conclusions</i>	9
3.2 BUILDING 4522 (AFFF AREA 2).....	12
3.2.1 <i>Sample Locations</i>	12
3.2.2 <i>Lithology</i>	12
3.2.3 <i>Groundwater Flow</i>	12
3.2.4 <i>Analytical Results</i>	12
3.2.5 <i>Conclusions</i>	13
3.3 BUILDING 4537 (AFFF AREA 3).....	16
3.3.1 <i>Sample Locations</i>	16
3.3.2 <i>Lithology</i>	16
3.3.3 <i>Groundwater Flow</i>	16
3.3.4 <i>Analytical Results</i>	16
3.3.5 <i>Conclusions</i>	17
3.4 BUILDING 4735 (AFFF AREA 4).....	19
3.4.1 <i>Sample Locations</i>	19
3.4.2 <i>Lithology</i>	19
3.4.3 <i>Groundwater Flow</i>	19
3.4.4 <i>Analytical Results</i>	19
3.4.5 <i>Conclusions</i>	21
3.5 AIRCRAFT TIRE FIRE (AFFF AREA 5)	25
3.5.1 <i>Sample Locations</i>	25
3.5.2 <i>Lithology</i>	25
3.5.3 <i>Groundwater Flow</i>	25
3.5.4 <i>Analytical Results</i>	25
3.5.5 <i>Conclusions</i>	26
3.6 KC-135 CRASH SITE (AFFF AREA 6).....	29
3.6.1 <i>Sample Locations</i>	29
3.6.2 <i>Lithology</i>	29
3.6.3 <i>Groundwater Flow</i>	29

3.6.4	<i>Analytical Results</i>	29
3.6.5	<i>Conclusions</i>	30
3.7	INVESTIGATION-DERIVED WASTE.....	33
3.7.1	<i>Waste Soil</i>	33
3.7.2	<i>Wastewater</i>	33
3.7.3	<i>Construction Waste</i>	33
4.0	GROUNDWATER PATHWAY	33
4.1	FORMER FIRE TRAINING AREA 3 (AFFF AREA 1).....	34
4.2	BUILDING 4522 (AFFF AREA 2).....	34
4.3	BUILDING 4537 (AFFF AREA 3).....	35
4.4	BUILDING 4735 (AFFF AREA 4).....	35
4.5	AIRCRAFT TIRE FIRE (AFFF AREA 5).....	35
4.6	KC-135 CRASH SITE (AFFF AREA 6).....	35
5.0	SURFACE WATER AND SEDIMENT PATHWAY	36
5.1	FORMER FIRE TRAINING AREA 3 (AFFF AREA 1).....	36
5.2	BUILDING 4522 (AFFF AREA 2).....	36
5.3	BUILDING 4537 (AFFF AREA 3).....	36
5.4	BUILDING 4735 (AFFF AREA 4).....	36
5.5	AIRCRAFT TIRE FIRE (AFFF AREA 5).....	37
5.6	KC-135 CRASH SITE (AFFF AREA 6).....	37
6.0	SOIL EXPOSURE AND AIR PATHWAYS	37
6.1	FORMER FIRE TRAINING AREA 3 (AFFF AREA 1).....	37
6.2	BUILDING 4522 (AFFF AREA 2).....	37
6.3	BUILDING 4537 (AFFF AREA 3).....	37
6.4	BUILDING 4735 (AFFF AREA 4).....	38
6.5	AIRCRAFT TIRE FIRE (AFFF AREA 5).....	38
6.6	KC-135 CRASH SITE (AFFF AREA 6).....	38
7.0	UPDATE TO CONCEPTUAL SITE MODELS	38
7.1	FORMER FIRE TRAINING AREA 3 (AFFF AREA 1).....	38
7.2	BUILDING 4522 (AFFF AREA 2).....	38
7.3	BUILDING 4537 (AFFF AREA 3).....	39
7.4	BUILDING 4735 (AFFF AREA 4).....	39
7.5	AIRCRAFT TIRE FIRE (AFFF AREA 5).....	39
7.6	KC-135 CRASH SITE (AFFF AREA 6).....	39
8.0	SUMMARY AND CONCLUSIONS	40
8.1	FORMER FIRE TRAINING AREA 3 (AFFF AREA 1).....	41
8.2	BUILDING 4522 (AFFF AREA 2).....	44
8.3	BUILDING 4537 (AFFF AREA 3).....	44
8.4	BUILDING 4735 (AFFF AREA 4).....	44
8.5	AIRCRAFT TIRE FIRE (AFFF AREA 5).....	45
8.6	KC-135 CRASH SITE (AFFF AREA 6).....	45
9.0	REFERENCES	46

List of Tables

Table 1 Screening Values 2
Table 2 Aqueous Film Forming Foam Areas and Selection Rationale for Site Inspections at Seymour Johnson Air Force Base..... 3
Table 3 AFFF Area 1 (Former Fire Training Area 3) Surface Soil Analytical Results..... 10
Table 4 AFFF Area 1 (Former Fire Training Area 3) Subsurface Soil Analytical Results 10
Table 5 AFFF Area 1 (Former Fire Training Area 3) Groundwater Analytical Results..... 11
Table 6 AFFF Area 2 (Building 4522) Surface Soil Analytical Results..... 14
Table 7 AFFF Area 2 (Building 4522) Subsurface Soil Analytical Results 14
Table 8 AFFF Area 2 (Building 4522) Groundwater Analytical Results 15
Table 9 AFFF Area 3 (Building 4537) Subsurface Soil Analytical Results 18
Table 10 AFFF Area 3 (Building 4537) Groundwater Analytical Results 18
Table 11 AFFF Area 4 (Building 4735) Surface Soil Analytical Results..... 22
Table 12 AFFF Area 4 (Building 4735) Subsurface Soil Analytical Results 22
Table 13 AFFF Area 4 (Building 4735) Groundwater Analytical Results 23
Table 14 AFFF Area 4 (Building 4735) Sediment Analytical Results 23
Table 15 AFFF Area 4 (Building 4735) Surface Water Analytical Results 24
Table 16 AFFF Area 5 (Aircraft Tire Fire) Surface Soil Analytical Results..... 27
Table 17 AFFF Area 5 (Aircraft Tire Fire) Subsurface Soil Analytical Results 27
Table 18 AFFF Area 5 (Aircraft Tire Fire) Groundwater Analytical Results 28
Table 19 AFFF Area 6 (KC-135 Crash Site) Surface Soil Analytical Results 31
Table 20 AFFF Area 6 (KC-135 Crash Site) Subsurface Soil Analytical Results..... 31
Table 21 AFFF Area 6 (KC-135 Crash Site) Groundwater Analytical Results..... 32
Table 22 Summary of Analytical Results and Screening Level Exceedances..... 42

Appendix A – Site-Specific Figures

Figure 1 Location of Seymour Johnson Air Force Base, Wayne County, North Carolina A-1
Figure 2 Seymour Johnson AFB AFFF Area Site Inspection Locations A-2
Figure 3 Former Fire Training Area 3 (AFFF Area 1) Sample Locations and Potentiometric Contours .A-3
Figure 4 Former Fire Training Area 3 (AFFF Area 1) PFBS, PFOA, and PFOS in Soil A-4
Figure 5 Former Fire Training Area 3 (AFFF Area 1) PFBS, PFOA, and PFOS in Groundwater..... A-5
Figure 6 Building 4522 (AFFF Area 2) Sample Locations and Potentiometric Contours..... A-6
Figure 7 Building 4522 (AFFF Area 2) PFBS, PFOA, and PFOS in Soil..... A-7
Figure 8 Building 4522 (AFFF Area 2) PFBS, PFOA, and PFOS in Groundwater A-8
Figure 9 Building 4537 (AFFF Area 3) Sample Locations and Potentiometric Contours..... A-9
Figure 10 Building 4537 (AFFF Area 3) PFBS, PFOA, and PFOS in Soil..... A-10
Figure 11 Building 4537 (AFFF Area 3) PFBS, PFOA, and PFOS in Groundwater A-11
Figure 12 Building 4735 (AFFF Area 4) Sample Locations and Potentiometric Contours..... A-12
Figure 13 Building 4735 (AFFF Area 4) PFBS, PFOA, and PFOS in Soil..... A-13
Figure 14 Building 4735 (AFFF Area 4) PFBS, PFOA, and PFOS in Groundwater A-14
Figure 15 Aircraft Tire Fire (AFFF Area 5) Sample Locations and Potentiometric Contours..... A-15
Figure 16 Aircraft Tire Fire (AFFF Area 5) PFBS, PFOA, and PFOS Soil and Sediment A-16
Figure 17 Aircraft Tire Fire (AFFF Area 5) PFBS, PFOA, and PFOS in Groundwater and Surface Water A-17
Figure 18 KC-135 Crash Site (AFFF Area 6) Sample Locations and Potentiometric Contours A-18
Figure 19 KC-135 Crash Site (AFFF Area 6) PFBS, PFOA, and PFOS in Soil..... A-19
Figure 20 KC-135 Crash Site (AFFF Area 6) PFBS, PFOA, and PFOS in Groundwater A-20
Figure 21 Generalized Hydrogeologic Cross Section of Seymour Johnson Air Force Base A-21

Appendix B	Regional Screening Level Calculations for PFOA and PFOS in Soil and Sediment
Appendix C	Boring Logs and Field Forms
Appendix D	Validation Report and Laboratory Data Tables
Appendix E	Physiochemical Sample Results
Appendix F	Groundwater Level Measurements

Acronyms and Abbreviations

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AFB	Air Force Base
AFFF	aqueous film forming foam
amsl	above mean sea level
ASL	Aerostar SES LLC
BRAC	Base Realignment and Closure
bgs	below ground surface
CAS	Chemical Abstracts Service
CL	clay
CSM	conceptual site model
DoD	Department of Defense
DOT	Department of Transportation
DPT	direct push technology
DRO	diesel range organics
EC	Emerging Contaminant
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
FTA	fire training area
GW	groundwater
HA	health advisory
Hi-Ex	high expansion
ID	identification
IDW	investigation-derived waste
J	estimated value
mg/kg	milligrams per kilogram
ND	not detected at the method detection limit
NL	not listed
No.	number
OWS	oil/water separator
PA	preliminary assessment
PFAS	per- and polyfluorinated alkyl substances
PFBS	perfluorobutane sulfonate
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
pH	potential of hydrogen
QAPP	quality assurance project plan
RSL	Regional Screening Level
SC	clayey sands
SI	site inspection
SJAFB	Seymour Johnson Air Force Base
SM	silty sands
SO	subsurface soil
SP	poorly graded or gravely sands
SS	surface soil
SW	surface water
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon

TPH	total petroleum hydrocarbons
U	analyte not detected
USCS	Unified Soil Classification System
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force

1.0 INTRODUCTION

Aerostar SES LLC (ASL) under contract to the United States Army Corps of Engineers (USACE) Savannah District (Contract No. W912HN-15-C-0022) conducted screening-level site inspections (SIs) for six areas at Seymour Johnson Air Force Base (SJAFOB) in Wayne County, North Carolina. The purpose of the SI is to determine the presence or absence of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in the environment at these areas. These compounds are a class of synthetic fluorinated chemicals used in industrial and consumer products, including defense-related applications. This class of compounds is also referred to as per- and polyfluorinated alkyl substances (PFAS).

In 1970, the Air Force (USAF) began using aqueous film forming foam (AFFF), firefighting agents containing PFOS and PFOA, to extinguish petroleum fires. AFFF may have entered the environment during routine fire training, equipment maintenance, storage, and use. The United States Environmental Protection Agency (EPA) continues to permit the use of PFOS-based AFFF; however, manufacturers have reformulated AFFF to eliminate PFOS. The USAF has excess inventory of PFOS-based AFFF. As of this report, the USAF is actively removing PFOS-based AFFF from its inventory and replacing it with formulations free of PFOS and containing little or no PFOA, which are less persistent and bioaccumulative in the environment.

The objectives of this study are to

- determine if a confirmed release of PFOS and PFOA has occurred at AFFF areas selected for inspection,
- determine if PFOS and PFOA are present in groundwater or surface water in the areas in concentrations exceeding the EPA lifetime health advisory (HA),
- determine if PFOA and PFOS are present in soil or sediment in the areas at concentrations exceeding the calculated screening levels, and
- identify potential receptor pathways with immediate impacts to human health (immediate impact to human health is considered consumption of drinking water with PFOS/PFOA above the HA, or PFBS above the Regional Screening Level [RSL]).

In the quality assurance project plan (QAPP) (ASL, January 2016) screening levels for soil and sediment were established in accordance with *Interim AF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations* (USAF, August 2012). However, after publication of the QAPP, the Air Force determined that more conservative screening levels were appropriate. Therefore, screening levels for PFOS and PFOA in soil and sediment were calculated using the EPA RSL Calculator (Appendix B). Screening levels for PFOS and PFOA in groundwater and surface water are based on EPA lifetime drinking water HAs for PFOS (EPA, May 2016a) and PFOA (EPA, May 2016b), a release was considered confirmed when exceedances of the following concentrations were identified:

PFOS:

- 0.07 micrograms per liter ($\mu\text{g/L}$) in groundwater/surface water (combined with PFOA value).
- 1,260^a micrograms per kilogram ($\mu\text{g/kg}$) in soil (calculated, in the absence of EPA RSL values).
- 1,260^a $\mu\text{g/kg}$ in sediment (calculated, in the absence of RSL values).

PFOA:

- 0.07 $\mu\text{g/L}$ in groundwater/surface water (combined with PFOS value).
- 1,260^a $\mu\text{g/kg}$ in soil (calculated, in the absence of RSL values).
- 1,260^a $\mu\text{g/kg}$ in sediment (calculated, in the absence of RSL values).

EPA has derived RSL values for perfluorobutane sulfonate (PFBS), for which there is a Tier 2 toxicity value (Provisional Peer Reviewed Toxicity Value) (EPA, June 2014). The requirement to screen for PFBS, which is regulated by EPA, was not recognized before the QAPP (ASL, January 2016) was finalized and was added by AFCEC during the development of the first QAPP addendum. The USAF will also consider a release to be confirmed if the following concentrations are exceeded:

PFBS:

- 400 µg/L in groundwater/surface water.
- 1,300,000 µg/kg in soil/sediment.

Notes:

^aScreening levels are calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search). The toxicity value input for the calculator is the Tier 3 value reference dose of 0.02 µg/kg per day derived by the EPA in its drinking water health advisories for both PFOS (EPA, May 2016b) and PFOA (EPA, May 2016a). To streamline reporting and discussion of PFOS, PFOA, and PFBS sampling and analysis, these compounds will hereafter be referred to, collectively, as “PFAS.” Table 1 presents the screening values for comparing the analytical results for these three PFAS compounds.

Table 1 Screening Values

Parameter	Chemical Abstracts Number	EPA Regional Screening Level Table (June 2017) ^a		Calculated RSL for Soils and Sediments ^b (µg/kg)	EPA Health Advisory for Drinking Water (Surface Water or Groundwater)(µg/L) ^c
		Residential Soil (µg/kg)	Tap Water (µg/L)		
Perfluorobutane sulfonate (PFBS)	375-73-5	1,300,000	400	NL	NL
Perfluorooctanoic acid (PFOA)	335-67-1	NL	NL	1,260	0.07*
Perfluorooctane sulfonate (PFOS)	1763-23-1	NL	NL	1,260	

^aEPA Regional Screening Levels (June 2017) (<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>)

^b Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search). The toxicity value input for the calculator is the Tier 3 value reference dose of 0.00002 mg/kg per day derived by EPA in its Drinking Water Health Advisories for both PFOS (May 2016b) and PFOA (May 2016a).

^c EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*.

*Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds should be compared with the 0.07 µg/L health advisory value. Only groundwater and surface water were sampled during the SI, but analytical results have been compared to the tap water screening levels.

µg/kg = micrograms per kilogram

µg/L = micrograms per liter

EPA = Environmental Protection Agency

NL = not listed

AFFF areas were selected for further inspection through the SI process at SJAFB during the preliminary assessment (PA) phase and documented in a PA report (CH2M Hill, September 2015). The PA evaluated 22 areas and recommended that six areas required additional evaluation through the SI process at SJAFB. The recommendation for the areas was based on the reported or suspected release of AFFF material containing PFAS compounds. The six AFFF areas selected for SI and the rationale for inclusion are listed in Table 2. Media evaluated during the SI included surface soil (0 to 6 inches in depth); subsurface soil (in the vadose zone collected immediately above the water saturated/unsaturated soil interface); groundwater (including samples from existing monitoring wells, temporary wells, and/or direct push sampling); and surface water/sediment.

**Table 2 Aqueous Film Forming Foam Areas and Selection Rationale for Site Inspections
at Seymour Johnson Air Force Base**

AFFF Area	AFFF Inspection Area	Associated Existing ERP Site	Area Selection Rationale
1	Former FTA 3	FT-07	The FTA was operational from 1956 to 1992. Soil was removed during remedial efforts at the location, but groundwater was not analyzed for PFAS. No record of AFFF use at the FTA, but the operational period includes post-1970 when the Air Force used AFFF in firefighting.
2	Building 4522	OW-C538	The building has an AFFF system that was deactivated in May 2015. Two discharges of AFFF occurred in the winters of 2000 and 2001. The AFFF discharges did not leave the inside of the hangar. However, floor drains in the hangar lead to an OWS that has had documented releases of other contaminants.
3	Building 4537	OW-C545	The building has an active AFFF system. An accidental discharge of AFFF occurred in the summer of 1998. The discharge did not leave the hangar doors and went into the floor drains. However, the floor drains lead to an OWS and AFFF holding tank system that had documented releases of other contaminants.
4	Building 4735	OW-C557	The building has an active AFFF system. Accidental discharges of AFFF occurred in the building on February 4, 2015, and March 4, 2015. The AFFF discharges entered the floor drain system and did not leave the inside of the building. However, floor drains in the hangar lead to an OWS and exterior AFFF holding pond system that had documented releases of other contaminants.
5	Aircraft Tire Fire	New Site	Approximately 20 gallons of AFFF/water mixture were discharged on the runway to extinguish a fire on an aircraft tire. PFAS may have migrated to grassy areas nearby.
6	KC-135 Crash Site	SS-22	AFFF may have been applied where fuel released in a December 1973 aircraft crash was set on fire.

AFFF = aqueous film forming foam

FTA = fire training area

PFAS = per- and polyfluorinated alkyl substances

ERP = Environmental Restoration Program

OWS = oil/water separator

SJAFB encompasses 3,216 acres in central Wayne County, approximately 4 miles southeast of Goldsboro, North Carolina. Figure 1 (Appendix A) shows the location of SJAFB.

The base is bounded on the north and northwest by Stoney Creek and on the west and southwest by the Neuse River. SJAFB also includes 47,926 acres of land outside the boundaries of the main facility. This property includes

- 13 acres at four nearby communications/navigation stations;
- 1,065 acres of easements;
- 46,606 acres of bombing range in Dare County, North Carolina, 125 miles to the northeast;
- Fort Fisher Air Force Station, a 100-acre radar surveillance station on Cape Fear in southeastern North Carolina; and
- Ground-Air Transmission Receiver (GATR) site on 142 acres of land immediately north of Fort Fisher Air Force Station.

SJAFB was activated in June 1942 after the War Department approved the establishment of a technical training school near Goldsboro, North Carolina. The primary mission of the base was to house a

headquarters technical school for the Army Air Force. In 1943, a secondary mission was added (the provisional overseas replacement training center) to prepare officers and enlisted men for overseas duty. In addition, the base became the home of the 75th Training Wing and the 326th Fighter Group. In 1944, basic training of P-47 pilots became the primary mission at SJAFB (URS, June 2004). At the end of World War II, SJAFB was designated as a central assembly station for processing and training military personnel being reassigned in the continental United States and Pacific theaters. This function was discontinued in September 1945, and the base became an Army Air Force separation center. In May 1946, SJAFB was deactivated, and in 1949, the property was deeded to the city of Goldsboro. Between 1950 and the end of 1952, Piedmont Airlines conducted commercial flights to the Seymour Johnson Air Field. During this time, the base facilities were leased to private interests for warehouse storage, temporary residence, light manufacturing, family housing, and special presentations (URS, June 2004).

In December 1952, the city of Goldsboro transferred the base to the federal government, and in April 1956, SJAFB was reactivated as a Tactical Airlift Group base. Three months later, the 83rd Fighter-Day Wing I was assigned to the base as the host unit. The 4th Fighter-Day Wing (redesignated the 4th Wing in April 1991) replaced the 83rd Wing in December 1957. In 1958, the 4241st Strategic Wing was formed and redesignated as the 68th Bombardment Wing. In June 1992, the Air Force reorganized, and SJAFB became an Air Combat Command installation. The host unit at SJAFB currently is the 4th Fighter Wing (URS, June 2004).

The climate at SJAFB is characterized as humid, subtropical with hot summers and cool winters. The average annual precipitation is approximately 50 inches. The average annual temperature in the area is approximately 64 degrees Fahrenheit. The average annual high temperature is approximately 74 degrees Fahrenheit, and the average annual low temperature is approximately 54 degrees Fahrenheit (Weather Underground, June 2017).

The topography in the Goldsboro area is generally level to gently rolling. Surface elevations in the area average 110 feet above mean sea level (amsl). Land surfaces at SJAFB slope from elevations slightly above 112 feet amsl on the northeast portion of the base to approximately 60 feet amsl along the southwest base border in the Neuse River floodplain. Local relief is primarily the result of dissection by erosional activity or stream channel development (A.T. Kearney, Inc., December 1988).

2.0 AFFF AREA DESCRIPTIONS

The following sections describe the AFFF areas inspected during the SI. Figure 2 (Appendix A) shows the relative position of the AFFF areas on SJAFB.

2.1 FORMER FIRE TRAINING AREA 3 (AFFF AREA 1)

Former Fire Training Area (FTA) 3 (also known as Environmental Restoration Program [ERP] Site FT-07) is near the northwestern base boundary at the southern terminus of Collier Avenue. FTA 3 was operational from 1956 to 1992 and consisted of a circular diked pit containing corrugated metal cylinders. During typical training exercises, approximately 500 gallons of fuel were released into the pit from a nearby underground storage tank. The drainage system beneath the pit conveyed wastewater and residual fuel to an oil/water separator (OWS) prior to discharging into the sanitary sewer system (Bay West/URS, February 2008). In 2007, Bay West, under contract with the USACE Savannah District, completed a Comprehensive Environmental Response, Compensation, and Liability Act removal action at FTA 3 (Bay West/URS, February 2008). The depth of the excavation in the area averaged 12 to 13 feet below ground surface (bgs), resulting in the removal of approximately 3,676 cubic yards of petroleum-contaminated soil that was shipped to the Sampson County Landfill for disposal. Additional remedial measures in the area included

- placing potassium permanganate at the bottom of the excavation prior to backfilling,
- operating of a biosparge system in the area from January 2008 to January 2009, and
- conducting chemical oxidation injection events in January and September 2009.

The former FTA 3 received a No Further Action Required notice from the North Carolina Department of Environmental Quality and is in the long-term monitoring program at SJAFB (Bay West/URS, February 2008).

No records were found indicating AFFF was used during fire training activities at FTA 3. However, the operational years of the FTA (1956 to 1992) include post-1970 years when the Air Force was known to have used AFFF in firefighting operations. Therefore, it is possible that AFFF was used during training operations at the former FTA, though the quantities of AFFF discharged in the area are unknown (CH2M Hill, September 2015).

2.2 BUILDING 4522 (AFFF AREA 2)

Building 4522 is a five-bay hangar across from Hangar Row, near the south end of the runway. The building contains three fire suppression systems. Bays A and B (northernmost bays) have a 2.2% high-expansion foam (Hi-Ex) system with a 55-gallon bladder tank that replaced an AFFF system in 2013. Bays C and D use a 3% AFFF system with a 900-gallon tank installed in 1986. Bay E (southernmost bay) is a paint spray booth that has a 3% AFFF system with a 900-gallon tank installed in 1986. The hangar floor drains lead to an OWS that discharges into the sanitary sewer system. Discharge from the OWS can be diverted to a foam retention pond at the northwest end of the building, which also connects to the sanitary sewer system. The AFFF system for the paint booth (Bay E) accidentally discharged in the winters of 2000 and 2001. All AFFF discharged during these two events was reportedly captured in the hangar floor drains, and none of it reached outside the hangar doors. None of the fire suppression systems in Building 4522 were operational at the time of the PA report. The AFFF systems (Bays C, D, and E) have been shut down since May 2015 because of system degradation and are expected to be replaced with Hi-Ex systems. The Hi-Ex systems (Bays A and B) have not been approved for activation (CH2M Hill, September 2015).

The area around the OWS was investigated in 2012 and was determined to have had a release to the environment due to concentrations of total petroleum hydrocarbons (TPH)-diesel range organics (DRO) in the surrounding soil found to be above regulatory criteria. PFAS were not analyzed during the investigation of the OWS. However, due to the presence of elevated levels of TPH-DRO, the integrity of the OWS system is uncertain and PFAS may have been released into the surrounding area (CH2M Hill, September 2015).

2.3 BUILDING 4537 (AFFF AREA 3)

Building 4537 is a three-bay hangar on Hangar Row near the south end of Runway 08/26. The hangar is equipped with a 3% AFFF system, including an 800-gallon tank installed in 1984. The AFFF system is not operational, and the tank is badly corroded from an apparent leak. The mechanical room has a floor drain that leads to the sanitary sewer system. The hangar has two underwing turrets and four floor drains that lead to an OWS and then to a 20,000-gallon holding tank connected to the sanitary sewer system. At the time of the PA, the system had been shut down since May 2015 and was scheduled for maintenance in January 2016. The AFFF system in Bay B (middle bay) accidentally discharged in summer 1998. All of the foam remained inside the hangar doors and was collected in the floor drains. The area around the OWS at Building 4537 was investigated in 2012 and was determined to have had a release because TPH-DRO concentrations in the surrounding soil were above regulatory criteria. PFAS were not analyzed during the 2012 investigation. However, due to the presence of TPH-DRO in the soils around the OWS,

the integrity of the OWS system is uncertain and PFAS may have been released into the area (CH2M Hill, September 2015).

2.4 BUILDING 4735 (AFFF AREA 4)

Building 4735 is a two-bay hangar near Flightline Road and the intersection of Jabara Avenue and Martin Street. The hangar has two 3% AFFF systems manufactured in 1989, that include two 800-gallon tanks. At the time of the PA, the system had been out of service since May 2015 and was scheduled to be retrofitted to a Hi-Ex system. Accidental AFFF discharges occurred from the system on February 4, 2015, and March 4, 2015. In both instances, the AFFF was contained inside the hangar and captured in the floor drains. Floor grates for the drain system are at the bay doors and lead to the sanitary sewer system, but the drains can be diverted to an AFFF holding pond north of the building. Originally, the holding pond drained to the stormwater system, but the stormwater connection was reportedly capped in 2013 and the pond now drains to the sanitary sewer system (CH2M Hill, September 2015).

The area around the OWS for Building 4735 was investigated in 2012 and was determined to have had a release to the environment because TPH-DRO concentrations in the surrounding soil were above regulatory criteria. PFAS were not analyzed during the 2012 investigation. However, due to the presence of TPH-DRO in the soils around the OWS, the integrity of the OWS system is uncertain and PFAS may have been released into the area (CH2M Hill, September 2015).

2.5 AIRCRAFT TIRE FIRE (AFFF AREA 5)

In 2004, the SJAFB Fire Department responded to an aircraft tire fire on the runway southwest of where Taxiways G and H intersect the runway. Approximately 20 gallons of AFFF/water mixture were sprayed on the fire. The AFFF and water mixture was allowed to evaporate in place on the runway. Residual AFFF may have migrated with stormwater runoff to the grassy areas beside the runway and infiltrated into the soil and groundwater in the area (CH2M Hill, September 2015).

2.6 KC-135 CRASH SITE (AFFF AREA 6)

In December 1973, a KC-135 refueling aircraft crashed and approximately 1,700 gallons of JP-4 aviation fuel was released from the aircraft near where Taxiways C and D cross the runway. A four-foot-wide, six-inch-deep trench was excavated downgradient (south) of the crash site (also known as ERP Site SS-22) to retain the fuel. The fuel retained in the trench was intentionally ignited and allowed to burn on location (EA Engineering, Science, and Technology, Inc., June 1991). No records were found during the PA indicating whether, or what quantity of, AFFF was applied at the crash site. However, AFFF is typically sprayed on crash sites, fuel releases, and fires, so it is very likely that an unknown quantity of AFFF was released in this area during the incident (CH2M Hill, September 2015).

3.0 FIELD ACTIVITIES

ASL personnel mobilized to SJAFB on Friday, February 17, 2017, to perform SI sampling activities for all six AFFF areas. A readiness review was conducted with all ASL field personnel prior to mobilizing to SJAFB. Readiness review forms are presented in Appendix C. The readiness review covered anticipated hazards, types, and proper use of equipment needed for field activities, sampling procedures, and procedures to prevent cross-contamination of samples with PFAS-containing compounds. The procedure included

- not allowing equipment containing Teflon (polytetrafluoroethylene) components to come into contact with the samples because they can be a potential source of PFAS contamination;

- not allowing sampling personnel to don Gore-Tex® clothing, Tyvek® suits, or clothes treated with stain- or rain-resistant coatings; and
- requiring site personnel to wash their hands thoroughly before coming on site after coming into contact with plastic wrappers, Post-It® notes, or Styrofoam® cups (these are also potential sources of PFAS contamination).

Field activities for the SI included collecting groundwater samples from existing monitoring wells, temporary direct push technology (DPT) wells, or a stainless-steel HydroPunch® sampler; collecting surface and subsurface soil samples from DPT soil borings; and collecting surface water and sediment samples. In accordance with the quality assurance project plan (QAPP) (ASL, January 2016) and the site-specific field sampling plan (ASL, February 2017), ASL used a targeted sampling design to collect samples in locations most likely to have detectable concentrations of the target compounds as a result of an AFFF release. Field forms generated during the sampling activities are in Appendix C. Field forms include readiness review forms, boring logs, groundwater sampling and groundwater grab sampling logs, soil and sediment sampling logs, surface water sampling logs, and field instrument calibration logs. All field activities were completed by Tuesday, February 21, 2017. Samples were submitted via overnight courier to Maxxam Analytics International Corporation of Mississauga, Ontario, Canada, under chain of custody procedures. The samples were analyzed by modified EPA Method 537 for 18 PFAS compounds, including the following three PFAS compounds, and are the only ones to have associated health-based screening levels.

Analyte	*CAS Number
• Perfluorooctane sulfonate (PFOS)	1763-23-1
• Perfluorooctanoic acid (PFOA)	335-67-1
• Perfluorobutane sulfonate (PFBS)	29420-43-3

*CAS = Chemical Abstracts Service

Third-party data validation was conducted on 100% of the analytical data for the PFAS compounds. Data validation qualifiers were applied, as needed, to the data. All the results were evaluated as usable for the decisions being made. No determinations of an AFFF release are based upon quality control-qualified data. The data validation report, laboratory data sheets, and chain of custody forms are in Appendix D.

Field activities were conducted in accordance with the QAPP (ASL, January 2016) and the SJAFB site-specific addendum to the QAPP (ASL, February 2017). Soil borings in the areas were advanced with a track-mounted DPT system. Borings logs are presented in Appendix C. Surface soil samples were collected to 6 inches bgs using a combination of stainless steel hand augers and stainless steel spoons. Subsurface soil samples were collected immediately above the water saturated/unsaturated soil interface using a DPT macro-core sampler with acetate liners. Groundwater samples were collected with peristaltic pumps through disposable polyvinyl tubing. The groundwater samples were collected from either existing groundwater monitoring wells, temporary wells installed using 3/4-inch diameter polymerizing vinyl chloride (PVC) prepacked screens in the DPT borings, or stainless steel HP-16 HydroPunch® samplers installed in the DPT borings. The temporary wells were removed at the end of the sampling event and all borings were backfilled with bentonite. Sediment samples were collected using stainless steel spoons. Surface water samples were collected directly from surface water bodies into the sample containers. For each site where borings were installed, a representative composite soil sample was collected for each depth where samples were collected for PFAS analysis. The composite soil samples were submitted to the project laboratory for analyses of soil physiochemical properties, including soil potential of hydrogen, particle size, and total organic carbon. The physiochemical analytical results are presented in Appendix E.

The coordinates, surface elevations of the soil borings, and top of casing elevations for the temporary wells were established by land survey. The land survey of sample points was conducted by B.R. Kornegay, Inc., of Goldsboro, North Carolina, on February 20, 2017. Surface water and sediment sample locations were recorded with a Trimble GeoX7 handheld global positioning system (GPS) unit. Northing and easting coordinates were recorded in North Carolina State Plane Coordinates based on the North American Datum 1983. Elevations were recorded referenced to the North American Vertical Datum 1988.

Sample locations, site-specific lithology, groundwater flow direction, analytical results, and conclusions for each AFFF area are presented in the following sections.

3.1 FORMER FIRE TRAINING AREA 3 (AFFF AREA 1)

The media of concern at Former FTA 3 are surface soil, subsurface soil, and groundwater. No surface water or sediment samples were collected for the area because there are no storm drains or ditches within the vicinity of FTA 3 and precipitation falling on the area infiltrates through the porous surface material with very little run off from the area. Therefore, it is unlikely that AFFF has migrated to surface water bodies from the area (CH2M Hill, September 2015).

3.1.1 Sample Locations

Surface and subsurface soil samples were collected from three soil borings (SEYMR01-001, SEYMR01-002, and SEYMR01-003) installed around the area excavated during the former remedial action at FTA 3. A temporary well was installed at SEYMR01-001 to 15 feet (10 feet of pre-pack screen) and a groundwater sample was collected. Groundwater samples were also collected from two existing monitoring wells (FT07-MW105 and FT07-MW106). The sample locations for AFFF Area 1 are shown on Figure 3 (Appendix A).

3.1.2 Lithology

Soil borings SEYMR01-001, SEYMR01-002, and SEYMR01-003 were all terminated at 15 feet bgs. All three borings were terminated within the Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix C.

3.1.3 Groundwater Flow

On February 19 and 20, 2017, depth to groundwater measurements were taken from existing wells FT07-MW105 and FT07-MW106, and from the temporary well installed in boring SEYMR01-0017. The groundwater elevation measurements are presented in Appendix F. Figure 3 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours indicate that the groundwater flow direction at AFFF Area 1 is to the west.

3.1.4 Analytical Results

Five surface soil samples (three primary, one field duplicate, and one composite physiochemical sample), five subsurface soil samples (three primary, one field duplicate, and one composite physiochemical sample); and four groundwater samples (three primary and one field duplicate sample) were submitted to the project laboratory for analyses from AFFF Area 1.

Surface Soil

All three target compounds were detected in one or more surface soil samples from AFFF Area 1. PFOS (estimated concentration of 1,400 µg/kg in sample SEYMR01-001-SS-001) was the only target

compound that exceeded the screening level for soil of 1,260 µg/kg. Table 3 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the surface soil samples. Figure 4 (Appendix A) shows the sample locations and the results of the target compounds in soil at AFFF Area 1.

Subsurface Soil

All three target compounds were detected in the subsurface soil samples from AFFF Area 1. None of the detected concentrations of the target compounds exceeded the screening levels for soil. Table 4 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the subsurface soil samples. Figure 4 (Appendix A) shows the sample locations and the results of the target compounds in soil at AFFF Area 1.

Groundwater

All three target compounds were detected in all four groundwater samples from AFFF Area 1. PFBS was not detected in any of the samples at a concentration exceeding the screening value (400 µg/L). All four groundwater samples had concentrations of PFOA and PFOS exceeding the individual screening value (0.07 µg/L for PFOA and PFOS) and the combined screening value for PFOA and PFOS (combined concentration of 0.07 µg/L). Table 5 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the groundwater samples. Figure 5 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 1.

Physiochemical Sample

Two composite samples for physiochemical analyses were submitted for AFFF Area 1. The surface soil sample (SEYMR01-004-SS-001) was composed of aliquots of surface soil (0 to 6 inches bgs) collected from the borings. The subsurface soil sample (SEYMR01-004-SO-009) was composed of aliquots of the subsurface soil collected from the borings immediately above the water saturated/unsaturated soil interface. This depth was between 9 to 12 feet bgs. The results of the analyses of the physiochemical sample are presented in Appendix E.

3.1.5 Conclusions

Former FTA 3 was used for fire training activities from 1956 to 1992. Although there are no records indicating that AFFF was used during fire training operations in the area, the operational timeframe of the area includes the time post-1970 when the Air Force was known to have used AFFF in fire-fighting training. Therefore, the quantity of AFFF released at the site is not known. Remedial actions have been conducted at the former FTA to address petroleum hydrocarbon contamination in soil and groundwater. Therefore, it is likely that if AFFF was used, PFAS compounds would have also been released to the environment along with the other contaminants, but analyses for PFAS was not previously conducted in this area. During the SI, samples were collected where concentrations of the target compounds would most likely be detected in the area, based on surface drainage patterns and the groundwater flow direction. The results for the analyses of the surface soil samples indicate that concentrations of the PFOS remain in the surface soil in excess of the screening criteria. However, the results of the subsurface soil samples indicate that concentrations of the target compounds do not remain in the subsurface soils in the area in excess of the screening criteria. Further, PFOA and PFOS were detected in all four groundwater samples at concentrations exceeding the individual screening levels. All four groundwater samples also had combined concentrations of PFOA and PFOS exceeding the HAs. Based on the analytical results, a release of AFFF to the surface soil and groundwater at AFFF Area 1 has been confirmed.

Table 3 AFFF Area 1 (Former Fire Training Area 3) Surface Soil Analytical Results

	Field Sample ID	SEYMR01-001-SS-001	SEYMR01-001-SS-901 (Field Duplicate)	SEYMR01-002-SS-001	SEYMR01-003-SS-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	6.6 U	2.9 J	0.56 U	0.40 J
PFOA	1,260 ^b	26 J	7.5 J	2.0	0.78 J
PFOS	1,260 ^b	1,400 J	1,000 J	180	19

Note: A bold value indicates the concentration was detected above the Method Detection Limit. A shaded value indicates the parameter met or exceeded the corresponding screening level

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

U = parameter not detected at the Method Detection Limit

Table 4 AFFF Area 1 (Former Fire Training Area 3) Subsurface Soil Analytical Results

	Field Sample ID	SEYMR01-001-SO-009	SEYMR01-001-SO-909 (Field Duplicate)	SEYMR01-002-SO-012	SEYMR01-003-SO-009
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	6.9 J	16 J	30	2.6
PFOA	1,260 ^b	58 J	130 J	120	59
PFOS	1,260 ^b	56 J	36 J	34	75

Note: A bold value indicates the concentration was detected above the Method Detection Limit.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

Table 5 AFFF Area 1 (Former Fire Training Area 3) Groundwater Analytical Results

Field Sample ID		SEYMR01-001-GW-010	SEYMR01-001-GW-910 (Field Duplicate)	SEYMR01-FT07MW105-015	SEYMR01-FT07MW106-015
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	400 ^a	14	14	6.0	11
PFOA	0.07 ^b	100	89	62	75
PFOS	0.07 ^b	100	85	35	39
PFOA + PFOS	0.07 ^b	200	174	97	114

Note: A bold value indicates the concentration was detected above the Method Detection Limit. A shaded value indicates the parameter met or exceeded the corresponding screening level.

^aEPA Regional Screening Levels for Tap Water (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bEPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter
PFOA = perfluorooctanoic acid

ID = identification
PFOS = perfluorooctane sulfonate

PFBS = perfluorobutane sulfonate

3.2 BUILDING 4522 (AFFF AREA 2)

The media of concern at Building 4522 are surface soil, subsurface soil, and groundwater. No surface water or sediment samples were collected for the area because the releases of PFAS compounds would have been below the ground surface from the OWS system. Therefore, it is unlikely that AFFF has migrated to surface water bodies from the area (CH2M Hill, September 2015).

3.2.1 Sample Locations

Surface and subsurface soil samples were collected from three soil borings (SEYMR02-001, SEYMR02-002, and SEYMR02-003) installed on February 19, 2017, around the perimeter of the foam retention pond where the OWS system discharges. The base requested that temporary wells not be installed in, or around the airfield; therefore, groundwater samples were collected from all three borings using a stainless steel HydroPunch® sampler set 6 to 10 feet bgs. A previously existing monitoring well (MW-6) was also planned for groundwater sampling, but could not be located. The sample locations for AFFF Area 2 are shown on Figure 6 (Appendix A).

3.2.2 Lithology

Soil borings SEYMR02-001, SEYMR02-002, and SEYMR02-003 were all terminated at 10 feet bgs. All three borings were terminated within the Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix C.

3.2.3 Groundwater Flow

During the SI, accurate depth to groundwater measurements were not available from the HydroPunch® sampler. However, based on the U.S. Geological Survey (USGS) report of the hydrogeologic framework at SJAFB (USGS, 1997), the groundwater flow direction at AFFF Area 2 is southwest towards the Neuse River.

3.2.4 Analytical Results

Five surface soil samples (three primary, one field duplicate, and one composite physiochemical sample), five subsurface soil samples (three primary, one field duplicate, and one composite physiochemical sample); and four groundwater samples (three primary and one field duplicate sample) were submitted to the project laboratory for analyses from AFFF Area 2.

Surface Soil

All three target compounds were detected in one or more surface soil samples from AFFF Area 2. None of the detected concentrations exceeded the corresponding screening levels for soil. Table 6 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the surface soil samples. Figure 7 (Appendix A) shows the sample location and results of the target analytes in the surface soil at AFFF Area 2.

Subsurface Soil

PFOS was the only target compound detected in the subsurface soil samples from AFFF Area 2 and none of the detected concentrations exceeded the screening levels for soil. Table 7 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the subsurface soil samples. Figure 7 (Appendix A) shows the sample locations and the results of the target compounds in soil at AFFF Area 2.

Groundwater

All three target compounds were detected in all four groundwater samples from AFFF Area 2. PFBS was not detected in any of the samples at a concentration exceeding the screening value (400 µg/L). All four groundwater samples had detected concentrations of PFOA and PFOS exceeding the individual screening value (0.07 µg/L for PFOA and PFOS) and the combined screening value for PFOA and PFOS (combined concentration of 0.07 µg/L). Table 8 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the groundwater samples. Figure 8 (Appendix A) shows sample locations and results of the target analytes in groundwater at AFFF Area 2.

Physiochemical Sample

Two composite samples for physiochemical analyses were submitted for AFFF Area 2. The surface soil sample (SEYMR02-004-SS-001) was composed of aliquots of surface soil (0 to 6 inches bgs) from the borings. The subsurface soil sample (SEYMR02-004-SO-004) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth was between 6 to 10 feet bgs. The results of the analyses of the physiochemical sample are presented in Appendix E.

3.2.5 Conclusions

Two releases of AFFF were reported in Building 4522. Both releases were reportedly captured in the floor drains of the building and passed into the OWS, designed to divert AFFF flows into the foam-holding pond. Previous remedial investigations of the OWS indicate that other contaminants have been released into the environment from the system and it is likely that PFAS compounds have also been released. During the SI, samples were collected in the most likely areas where concentrations of the target compounds would be detected in the area, based on surface drainage patterns and the groundwater flow direction. The results for the analyses of the surface and subsurface soil samples do not indicate concentrations of the target compounds remain in the soils in excess of the screening criteria. However, PFOS and PFOA were detected in all four groundwater samples at concentrations exceeding the individual screening levels, and all four groundwater samples had combined concentrations of PFOA and PFOS exceeding the HAs. Based on the analytical results, a release of AFFF to the groundwater at AFFF Area 2 has been confirmed.

Table 6 AFFF Area 2 (Building 4522) Surface Soil Analytical Results

Field Sample ID		SEYMR02-001-SS-001	SEYMR02-001-SS-901 (Field Duplicate)	SEYMR02-002-SS-001	SEYMR02-003-SS-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	5.2 U	6.0 U	0.22 J	0.58 U
PFOA	1,260 ^b	4.6 J	13 J	0.59 U	0.58 U
PFOS	1,260 ^b	700 J	470 J	21	2.6

Note: A bold value indicates the concentration was detected above the Method Detection Limit.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram

J= estimated value

PFOA = perfluorooctanoic acid

U = parameter not detected at the Method Detection Limit

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

Table 7 AFFF Area 2 (Building 4522) Subsurface Soil Analytical Results

Field Sample ID		SEYMR02-001-SO-005	SEYMR02-001-SO-905 (Field Duplicate)	SEYMR02-002-SO-006	SEYMR02-003-SO-009
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	0.56 U	0.60 U	0.40 U	0.58 U
PFOA	1,260 ^b	0.56 U	0.60 U	0.20 U	0.58 U
PFOS	1,260 ^b	40	42	1.4	1.8

Note: A bold value indicates the concentration was detected above the Method Detection Limit.

^aEPA Regional Screening Levels for Residential Soil (May 2016) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

ID = identification

PFOA = perfluorooctanoic acid

U = parameter not detected at the Method Detection Limit

Table 8 AFFF Area 2 (Building 4522) Groundwater Analytical Results

Field Sample ID		SEYMR02-001-GW-008	SEYMR02-001-GW-908 (Field Duplicate)	SEYMR02-002-GW-008	SEYMR02-003-GW-010
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	400 ^a	36	27	1.7	0.33
PFOA	0.07 ^b	4.4	3.5	0.56	0.17
PFOS	0.07 ^b	52	44	18	5.8
PFOA + PFOS	0.07 ^b	56.4	47.5	18.56	5.97

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening limit.

^b EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter
 PFBS = perfluorobutane sulfonate
 PFOS = perfluorooctane sulfonate

ID = identification
 PFOA = perfluorooctanoic acid

3.3 BUILDING 4537 (AFFF AREA 3)

The media of concern at Building 4537 are subsurface soil and groundwater. No surface soil samples were collected from the area because the releases of PFAS compounds would have been from the AFFF holding tank below an asphalt paved parking area. For the same reason, no surface water or sediment samples were collected for the area because the releases of PFAS compounds would have been below the asphalt-paved ground surface from the AFFF holding tank and would not have impacted surface water.

3.3.1 Sample Locations

Subsurface soil samples were collected from three DPT borings (SEYMR03-001, SEYMR03-002, and SEYMR03-003) installed on February 19, 2017 between Building 4537 and the AFFF holding tank. The base requested that temporary wells not be installed in, or around the airfield; therefore, groundwater samples were collected from all three borings using a stainless steel HydroPunch® sampler set 6 to 10 feet bgs. The sample locations for Building 4537 are shown on Figure 9 (Appendix A).

3.3.2 Lithology

Soil samples were collected from three DPT borings in AFFF Area 3. All three borings were terminated at 10 feet bgs within Quaternary sediments of the Surficial Aquifer. Detailed boring logs are in Appendix C.

3.3.3 Groundwater Flow

During the SI, accurate depth to groundwater measurements were not available from the HydroPunch® samplers. However, based on the USGS report of the hydrogeologic framework at SJAFB (USGS, 1997), the groundwater flow direction at AFFF Area 3 is southwest towards the Neuse River.

3.3.4 Analytical Results

Four subsurface soil samples (three primary samples and one composite physiochemical sample) and three groundwater samples were submitted to the project laboratory for analyses from AFFF Area 3.

Subsurface Soil

PFOS was detected in all three samples and was the only target analyte detected in the subsurface soil samples from AFFF Area 3. None of the detected concentrations for PFOS exceeded the corresponding screening level for soil. Table 9 presents the screening values and analytical results of PFBS, PFOA, and PFOS detected in the subsurface soil samples. Figure 10 (Appendix A) shows the sample locations and results of the target analytes in subsurface soil at AFFF Area 3.

Groundwater

All three target analytes were detected in the three groundwater samples from AFFF Area 3. The individual concentrations for PFOA and PFOS detected in all three samples exceeded the individual screening level (0.07 µg/L) and the combined value of the detected concentrations of PFOS and PFOA in all three groundwater samples exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L). Table 10 presents the screening values and analytical results of PFBS, PFOA, and PFOS detected in the groundwater samples. Figure 11 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 3.

Physiochemical Sample

One composite sample for physiochemical analyses was submitted for AFFF Area 3. The subsurface soil sample (SEYMR03-004-SO-004) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. The depth to water in the borings was consistently 5 feet bgs. The results of the analyses of the physiochemical sample is presented in Appendix E.

3.3.5 Conclusions

One documented release of AFFF occurred in Building 4537 that was reportedly captured by the floor drains and diverted to the OWS and AFFF holding tank system. The remedial investigation of the OWS did not investigate for PFAS, but did indicate other contaminants had been released from the system. Based on the analytical results from the SI, a subsurface release of AFFF is confirmed to groundwater at AFFF Area 3.

Table 9 AFFF Area 3 (Building 4537) Subsurface Soil Analytical Results

	Field Sample ID	SEYMR03-001-SO-004	SEYMR03-002-SO-004	SEYMR03-003-SO-004
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	0.66 U	0.57 U	0.60 U
PFOA	1,260 ^b	0.66 U	0.57 U	0.60 U
PFOS	1,260 ^b	2.8	16	3.2

Note: A bold value indicates the parameter was detected at or above the method detection limit.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram

ID = identification

U = parameter not detected at the Method Detection Limit

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

Table 10 AFFF Area 3 (Building 4537) Groundwater Analytical Results

	Field Sample ID	SEYMR03-001-GW-008	SEYMR03-002-GW-008	SEYMR03-003-GW-008
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	400 ^a	0.062	0.093	0.040
PFOA	0.07 ^b	0.079	0.075	0.11
PFOS	0.07 ^b	1.3	1.5	0.37
PFOA + PFOS	0.07 ^b	1.379	1.575	0.48

Note: A bolded value indicates parameter was detected at or above the Method Detection Limit. A shaded value indicates that the concentration met or exceeded the corresponding screening level.

^aEPA Regional Screening Levels for Tap Water (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bEPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

3.4 BUILDING 4735 (AFFF AREA 4)

The media of concern at Building 4735 are surface soil, subsurface soil, groundwater, surface water, and sediment.

3.4.1 Sample Locations

Surface soil and subsurface soil samples were collected from three DPT borings (SEYMR04-001, SEYMR04-002, and SEYMR04-003) installed on February 17, 2017, on the south and west sides of the AFFF holding pond north of Building 4735. Groundwater samples were collected from temporary wells installed in the three borings (SEYMR04-001 screened interval 10 to 15 feet bgs, SEYMR04-002 screened interval 10 to 20 feet bgs, and SEYMR04-003 screened interval 5 to 15 feet bgs). A collocated surface water and sediment sample was planned for the drainage channel on the east side of the holding pond. However, at the time of the field effort there was no water in the drainage channel, so an additional surface soil sample (SEYMR04-004-SS-001) was collected from the drainage channel in place of the sediment sample. The sample locations for Building 4735 are shown on Figure 12 (Appendix A). Following the completion of the field effort, it was determined that the surface water and sediment samples collected in AFFF Area 5 (Aircraft Tire Fire) were collected from the drainage channel that collects surface water discharges from Area 4. Further, the soil samples collected in Area 5 had no detected concentrations of PFAS compounds with a potential for impacting surface water. Therefore, the evaluation of the surface water and sediment samples from Area 5 are included in the discussion for AFFF Area 4.

3.4.2 Lithology

Soil samples were collected in three DPT borings at AFFF Area 4. Soil borings SEYMR04-001 and SEYMR04-003 were terminated at 15 feet bgs, and soil boring SEYMR04-002 was terminated at 20 feet bgs. All three borings were terminated within the Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix C.

3.4.3 Groundwater Flow

On February 18, 2017, depth to groundwater measurements were taken from the three temporary wells installed in the DPT soil borings. The groundwater elevation measurements are presented in Appendix F. Figure 12 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours indicate that the localized groundwater flow direction at AFFF Area 4 is to the southeast. However, based on the USGS report of the hydrogeologic framework at SJAFB (USGS, 1997), the overall groundwater flow direction at SJAFB is southwest toward the Neuse River.

3.4.4 Analytical Results

Six surface soil samples (four primary, a field duplicate sample, and one composite physiochemical sample); four subsurface soil samples (three primary samples and one composite physiochemical sample); and three groundwater samples were submitted to the project laboratory for analyses from AFFF Area 4.

Surface Soil

All three target analytes were detected in or more of the surface soil samples from AFFF Area 4. PFBS and PFOA were not detected at concentrations exceeding the screening levels for soil in any of the samples. The detected concentrations of PFOS in two samples (2,300 µg/kg in SEYMR04-004-SS-001 and 1,800 µg/kg in field duplicate sample SEYMR04-004-SS-901) exceeded the screening value for

PFOS of 1,260 µg/kg in soil. Table 11 presents the screening values and analytical results of PFBS, PFOA, and PFOS of the surface soil samples. Figure 13 (Appendix A) shows the sample locations and results of the target analytes in surface soil at AFFF Area 4.

Subsurface Soil

All three target analytes were detected in the subsurface soil samples from AFFF Area 4. None of the compounds were detected at concentrations exceeding the screening levels for soil. Table 12 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the subsurface soil samples. Figure 13 (Appendix A) shows the sample locations and results of the target analytes in subsurface soil at AFFF Area 4.

Groundwater

All three target analytes were in all three groundwater samples from AFFF Area 4. None of the detected concentrations of PFBS in the samples exceeded the screening value of 400 µg/L. All three samples had individual detected concentrations of PFOA and PFOS that exceeded the screening value of 0.07 µg/L. The combined value of the detected concentrations of PFOS and PFOA in all three groundwater samples also exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L). Table 13 presents the screening values and analytical results of PFBS, PFOA, and PFOS detected in the groundwater samples. Figure 14 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 4.

Sediment

The location of the sediment samples in AFFF Area 5 were actually found to be in the drainage pathway from AFFF Area 4. PFBS and PFOS were the only target analytes detected in one or more of the sediment samples. None of the detected concentrations exceeded the screening levels for soil. Table 14 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the sediment samples. Figure 16 (Appendix A) shows the sample location and results of the target analytes in the sediment samples.

Surface Water

The location of the surface water samples in AFFF Area 5 were actually found to be in the drainage pathway from AFFF Area 4. All three target analytes were detected in the two surface water samples. The concentrations of PFBS did not exceed the screening level of 400 µg/L. The concentrations of PFOA and PFOS in both samples exceeded the individual screening level of 0.07 µg/L and the combined concentration of PFOS and PFOA exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L) in both samples. Table 15 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the surface water samples. Figure 17 (Appendix A) shows the sample location and results of the target analytes in surface water.

Physiochemical Sample

Two composite samples for physiochemical analyses were submitted for AFFF Area 4. The surface soil sample (SEYMR04-005-SS-001) was composed of aliquots of the surface soil in the borings from 0 to 6 inches bgs. The subsurface soil sample (SEYMR04-005-SO-009) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth ranged from 9 feet to 14 feet bgs. The results of the analyses of the physiochemical samples are presented in Appendix E.

3.4.5 Conclusions

Two documented releases of AFFF have occurred in Building 4735 that were reportedly captured by the floor drains and diverted to the OWS and AFFF holding pond system. The remedial investigation of the OWS did not investigate for PFAS but did indicate other contaminants had been released from the system. Based on the analytical results from the SI, a release of AFFF impacting the groundwater at AFFF Area 3 is confirmed. In addition, the elevated concentrations of PFOS detected in the surface soil sample from the drainage channel leading away from the AFFF holding pond indicates that PFAS compounds are available for dissolution and may be carried to the groundwater or transported from the area in surface water runoff. Surface water samples collected at the culvert where surface water from AFFF Area 4 exits the stormwater piping system in the vicinity of Aircraft Tire Fire (AFFF Area 5) had individual concentrations of PFOA, PFOS, and the combined concentration of PFOA plus PFOS exceeding the EPA HA.

Table 11 AFFF Area 4 (Building 4735) Surface Soil Analytical Results

Field Sample ID	SEYMR04-001-SS-001	SEYMR04-002-SS-001	SEYMR04-003-SS-001	SEYMR04-004-SS-001	SEYMR04-004-SS-901 (Field Duplicate)
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	6.0 U	1.0 J	4.0 J	52 U
PFOA	1,260 ^b	4.7 J	2.9	4.9 J	26 U
PFOS	1,260 ^b	900	490	780	2,300

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded valued indicates the detected concentration met or exceeded the corresponding screening level.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

U = parameter not detected at the method detection limit

Table 12 AFFF Area 4 (Building 4735) Subsurface Soil Analytical Results

Field Sample ID	SEYMR04-001-SO-009	SEYMR04-002-SO-012	SEYMR04-003-SO-007
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	1.7	20
PFOA	1,260 ^b	2.7	1.3
PFOS	1,260 ^b	290	27

Note: A bold value indicates the parameter was detected at or above the method detection limit.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

Table 13 AFFF Area 4 (Building 4735) Groundwater Analytical Results

Field Sample ID		SEYMR04-001-GW-010	SEYMR04-002-GW-015	SEYMR04-006-GW-010
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	400 ^a	11	3.3	2.0
PFOA	0.07 ^b	12	0.59	1.2
PFOS	0.07 ^b	300	41	21
PFOA + PFOS	0.07 ^b	312	41.59	22.2

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening level.

^aEPA Regional Screening Levels for Tap Water (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bEPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

ID = identification

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

Table 14 AFFF Area 4 (Building 4735) Sediment Analytical Results

Field Sample ID		SEYMR05-004-SD-001	SEYMR05-004-SD-901 (Field Duplicate)
Parameter	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	0.30 UJ	0.78 U	0.66 J
PFOA	0.41 J	0.78 U	0.66 U
PFOS	1.5 J	2.9 J	4.2 J

Note: A bold value indicates the parameter was detected at or above the method detection limit.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.onrl.gov/cgi-bin/chemicals/csl_search).

µg/L micrograms per liter ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

U = parameter not detected

Table 15 AFFF Area 4 (Building 4735) Surface Water Analytical Results

Field Sample ID		SEYMR05-004-SW-001	SEYMR05-004-SW-901 (Field Duplicate)
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	400 ^a	0.20	0.22
PFOA	0.07 ^b	0.20	0.20
PFOS	0.07 ^b	3.1	3.0
PFOA + PFOS	0.07 ^b	3.30	3.20

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening level.

^aEPA Regional Screening Levels for Tap Water (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bEPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

ID = identification

PFOA = perfluorooctanoic acid

3.5 AIRCRAFT TIRE FIRE (AFFF AREA 5)

The media of concern at the site of the Aircraft Tire Fire are surface soil, subsurface soil, groundwater, surface water, and sediment.

3.5.1 Sample Locations

Surface soil and subsurface soil samples were collected from three DPT borings (SEYMR05-001, SEYMR05-002, and SEYMR05-003) installed in the grass bordering the runway, adjacent to the location of the aircraft tire fire. Borings SEYMR05-001 and SEYMR05-002 were installed on the south side of the runway and boring SEYMR05-003 was installed on the north side of the runway. The base requested that temporary wells not be installed in, or around the airfield, so groundwater samples were collected from all three borings using a stainless steel HydroPunch® sampler. SEYMR05-001 was screened from 6 to 10 feet bgs, SEYMR05-002 and SEYMR05-003 were screened from 11 to 15 feet bgs. The sample locations for AFFF Area 5 are shown on Figure 15 (Appendix A). Following the completion of the field effort it was determined that the surface water and sediment samples collected at the headwall of the drainage ditch southwest of the area should actually be associated with AFFF Area 4 (Building 4735) and not with AFFF Area 5. This determination was based on the fact that the drainage channel collects surface water discharges from Area 4 and not Area 5. Therefore, the evaluation of the surface water and sediment samples collected near Area 5 are included in the discussion for Area 4.

3.5.2 Lithology

Soil samples were collected in three DPT borings at AFFF Area 5. All three borings were terminated at 15 feet bgs. All three borings were drilled within Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix C.

3.5.3 Groundwater Flow

During the SI, accurate depth to groundwater measurements were not available from the HydroPunch® samplers. However, based on the USGS report of the hydrogeologic framework at SJAFB (USGS, 1997), the groundwater flow direction at AFFF Area 5 is southwest towards the Neuse River.

3.5.4 Analytical Results

Four surface soil samples (three primary samples and one composite physiochemical sample), four subsurface soil samples (three primary samples and one composite physiochemical sample), three groundwater samples, two sediment samples (one primary and one field duplicate sample), and two surface water samples (one primary and one field duplicate sample) were submitted to the project laboratory for analyses from Area 5. The data validation report and laboratory data sheets are presented in Appendix D.

Surface Soil

PFOS was detected in only one sample and was the only target analyte detected in any of the surface soil samples from AFFF Area 5. None of the surface soil samples had detected concentrations of the target analytes exceeding the screening values. Table 14 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the surface soil samples. Figure 16 (Appendix A) shows the sample locations and results of the target analytes in surface soil at AFFF Area 5.

Subsurface Soil

None of the target analytes were detected in the subsurface soil samples from AFFF Area 5. Table 15 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the subsurface soil samples. Figure 16 (Appendix A) shows the sample locations and results of the target analytes in subsurface soil at AFFF Area 5.

Groundwater

PFBS and PFOS were the only target analytes detected in one or more of the three groundwater samples from AFFF Area 5. PFBS was detected in only one groundwater sample and the concentration did not exceed the screening level of 400 µg/L. PFOS was detected in all three samples, but the individual concentrations did not exceed the screening level of 0.07 µg/L. The combined value of the detected concentrations of PFOS and PFOA did not exceed the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L) in any of the three samples. Table 16 presents the screening values and analytical results of PFBS, PFOA, and PFOS. Figure 17 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 5.

Sediment

Sediment samples were collected at the headwall of the drainage ditch southwest of AFFF Area 5. However, following the field effort it was determined that the material in the drainage channel emanates from AFFF Area 4 (Building 4735) and not from AFFF Area 5. Therefore, the discussion of the results of the sediment samples are included in Section 3.4.4. Figure 16 (Appendix A) shows the sample location and results of the target analytes in sediment.

Surface Water

Surface water samples were collected at the headwall of the drainage ditch southwest of AFFF Area 5. However, following the field effort it was determined that the material in the drainage channel emanates from AFFF Area 4 (Building 4735) and not from AFFF Area 5. Therefore, the discussion of the results of the surface water samples are included in Section 3.4.4. Figure 17 (Appendix A) shows the sample location and results of the target analytes in surface water.

Physiochemical Sample

Two composite samples for physiochemical analyses were submitted for AFFF Area 5. The surface soil sample (SEYMR05-005-SS-001) was composed of aliquots of the surface soil in the borings from 0 to 6 inches bgs. The subsurface soil sample (SEYMR05-005-SO-009) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth ranged from 7 feet to 10 feet bgs. The results of the analyses of the physiochemical sample are presented in Appendix E.

3.5.5 Conclusions

In 2004, the fire department responded to an aircraft tire fire on the runway. Approximately 20 gallons of an AFFF and water mixture were used to extinguish the fire and the foam was allowed to evaporate on the runway. The analytical results of the surface soil, subsurface soil, sediment, and groundwater do not indicate concentrations of PFBS, PFOA, or PFOS remaining in the soils, sediments, or groundwater in AFFF Area 5 at concentrations exceeding the screening criteria. Therefore, a release of AFFF in Area 5 that has resulted in concentrations of PFAS exceeding the screening levels in any media has not been confirmed.

Table 16 AFFF Area 5 (Aircraft Tire Fire) Surface Soil Analytical Results

Field Sample ID		SEYMR05-001-SS-001	SEYMR05-002-SS-001	SEYMR05-003-SS-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	0.60 U	0.59 U	0.54 U
PFOA	1,260 ^b	0.60 U	0.59 U	0.54 U
PFOS	1,260 ^b	0.60 U	0.59 U	0.27 J

Note: A bold value indicates that the parameter was detected at or above the method detection limit.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram ID = identification J= estimated value
 PFBS = perfluorobutane sulfonate PFOA = perfluorooctanoic acid PFOS = perfluorooctane sulfonate
 U = parameter not detected at the method detection limit

Table 17 AFFF Area 5 (Aircraft Tire Fire) Subsurface Soil Analytical Results

Field Sample ID		SEYMR05-001-SO-13	SEYMR05-002-SO-013	SEYMR05-007-SO-014
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	0.66 U	0.72 U	0.84 U
PFOA	1,260 ^b	0.66 U	0.72 U	0.84 U
PFOS	1,260 ^b	0.66 U	0.72 U	0.84 U

Note: A bold value indicates that the parameter was detected at or above the method detection limit.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram ID = identification
 PFBS = perfluorobutane sulfonate PFOA = perfluorooctanoic acid PFOS = perfluorooctane sulfonate
 U = parameter not detected at the method detection limit

Table 18 AFFF Area 5 (Aircraft Tire Fire) Groundwater Analytical Results

	Field Sample ID	SEYMR05-001-GW-013	SEYMR05-002-GW-013	SEYMR05-003-GW-013
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	400 ^a	0.0070 U	0.0019 J	0.0070 U
PFOA	0.07 ^b	0.014 U	0.014 U	0.014 U
PFOS	0.07 ^b	0.0070 J	0.031	0.0058 J
PFOA + PFOS	0.07 ^b	0.0070 J	0.031	0.0058 J

Note: A bold value indicates that the parameter was detected at or above the method detection limit.

^aEPA Regional Screening Levels for Tap Water (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bEPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

U = parameter not detected at the method detection limit

3.6 KC-135 CRASH SITE (AFFF AREA 6)

The media of concern at KC-135 Crash Site are surface soil, subsurface soil, groundwater, surface water, and sediment.

3.6.1 Sample Locations

Surface soil and subsurface soil samples were collected from three DPT borings (SEYMR06-001, SEYMR06-002, and SEYMR06-003) installed on February 18, 2017, on the south side of the runway in the area where the trench reportedly used to contain fuel was located. The base requested that temporary wells not be installed in, or around the airfield, so groundwater samples were collected from all three borings using a stainless steel HydroPunch® sampler; SEYMR06-001 was screened from 11 to 15 feet bgs, SEYMR06-002 was screened from 8 to 12 feet bgs, SEYMR06-003 was screened from 6 to 10 feet bgs. Collection of a surface water and sediment sample was planned in the drainage channel south of the area. However, the channel was dry during the field effort and a surface soil sample (SEYMR06-004-SS-001) was collected from the drainage channel instead. The sample locations for the KC-135 Crash Site are shown on Figure 18 (Appendix A).

3.6.2 Lithology

Soil samples were collected in three DPT borings at AFFF Area 6. Soil boring SEYMR06-001 was terminated at 15 feet bgs, soil boring SEYMR06-002 was terminated at 12 feet bgs, and soil boring SEYMR06-003 was terminated at 10 feet bgs. All three borings were drilled within Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix C.

3.6.3 Groundwater Flow

During the SI, accurate depth to groundwater measurements were not available from the HydroPunch® samplers. However, based on the USGS report of the hydrogeologic framework at SJAFB (USGS, 1997), the groundwater flow direction at AFFF Area 6 is southwest towards the Neuse River.

3.6.4 Analytical Results

Five surface soil samples (four primary samples and one composite physiochemical sample); four subsurface soil samples (three primary samples and one composite physiochemical sample); and three groundwater samples were submitted to the project laboratory for analyses from AFFF Area 6.

Surface Soil

All three target analytes were detected in one or more of the surface soil samples. None of the detected concentrations of any of the target analytes exceeded the corresponding screening levels. Table 19 presents the screening values and the analytical results of PFBS, PFOA, and PFOS. Figure 19 (Appendix A) shows the sample locations and results of the target analytes in surface soil at AFFF Area 6.

Subsurface Soil

PFOS was the only target analyte detected in the subsurface soil samples. None of the detected concentrations of PFOS exceeded the screening level for soil. Table 20 presents the screening values and the analytical results of PFBS, PFOA, and PFOS. Figure 19 (Appendix A) shows the sample locations and results of the target analytes in subsurface soil at AFFF Area 6.

Groundwater

All three target analytes were detected in the three groundwater samples from AFFF Area 6. Table 21 presents the screening values and the analytical results of PFBS, PFOA, and PFOS. PFBS was not detected at concentrations exceeding the screening level in any of the samples. PFOA and PFOS were detected at concentrations exceeding the individual screening level (0.07 µg/L) in two of the three samples. The combined value of the detected concentrations of PFOS and PFOA in all three groundwater samples exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L). Figure 20 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 6.

Physiochemical Sample

Two composite samples for physiochemical analyses were submitted for AFFF Area 6. The surface soil sample (SEYMR06-005-SS-001) was composed of aliquots of the surface soil in the borings from 0 to 6 inches bgs. The subsurface soil sample (SEYMR06-005-SO-005) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth ranged from 5 to 8 feet bgs. The results of the analyses of the physiochemical samples are presented in Appendix E.

3.6.5 Conclusions

Fuel released following the December 1973 crash of a KC-135 aircraft was reportedly captured in a trench south of the runway and intentionally ignited on site. There are no records of whether, or what quantity of AFFF was applied at the KC-135 crash location. However, AFFF was typically sprayed on fuel fires and spills after it was introduced to the Air Force in 1970, so it is possible that it was used at this crash site. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected based on surface drainage patterns and the groundwater flow direction. The analytical results of the surface and subsurface soil samples do not indicate that PFAS compounds remain in the soils at concentrations exceeding the screening criteria. However, the analytical results of the groundwater samples show that the detected individual concentrations of PFOA and PFOS, and the combined detected concentrations of PFOA and PFOS in the groundwater exceed the screening values. Based on the analytical results from the SI, a release of AFFF is confirmed to the groundwater at AFFF Area 6.

Table 19 AFFF Area 6 (KC-135 Crash Site) Surface Soil Analytical Results

Field Sample ID	SEYMR06-001-SS-001	SEYMR06-002-SS-001	SEYMR06-003-SS-001	SEYMR06-004-SS-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	0.59 U	0.66 U	0.33 J
PFOA	1,260 ^b	0.28 J	0.66 U	0.47 J
PFOS	1,260 ^b	1.2	1.6	1.3

Note: A bold value indicates the parameter was detected at or above the method detection limit.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

U = parameter not detected at the method detection limit

Table 20 AFFF Area 6 (KC-135 Crash Site) Subsurface Soil Analytical Results

Field Sample ID	SEYMR06-001-SO-006	SEYMR06-002-SO-008	SEYMR06-003-SO-005
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	1,300,000 ^a	0.56 U	0.60 U
PFOA	1,260 ^b	0.56 U	0.60 U
PFOS	1,260 ^b	0.47 J	0.60 U

Note: A bold value indicates the parameter was detected at or above the method detection limit.

^aEPA Regional Screening Levels for Residential Soil (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bScreening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

U = parameter not detected at the method detection limit

Table 21 AFFF Area 6 (KC-135 Crash Site) Groundwater Analytical Results

Field Sample ID		SEYMR06-001-GW-018	SEYMR06-SS28MW15D-035	SEYMR06-SS28MW15S-023
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	400 ^a	0.066	0.0089 J	0.0070 J
PFOA	0.07 ^b	1.4	0.13	0.050
PFOS	0.07 ^b	0.078	0.025 J	0.072
PFOA + PFOS	0.07 ^b	1.478	0.155 J	0.122

Note: A bolded value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening limit.

^aEPA Regional Screening Levels for Tap Water (June 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>]

^bEPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

PFBS = perfluorobutane sulfonate

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFOS = perfluorooctane sulfonate

3.7 INVESTIGATION-DERIVED WASTE

All investigation-derived waste (IDW) was managed in accordance with the specific waste management guidance provided by SJAFB. IDW generated during the SI field effort consisted of soil and wastewater potentially impacted with PFAS and construction waste (such as used personal protective equipment, paper, rags, plastic sheeting, etc.). Drums of waste soil and water were staged to a secure holding area until the USAF determines the proper disposal method

3.7.1 Waste Soil

Waste soil generated during the installation of soil borings was placed in two 55-gallon, Department of Transportation (DOT)-approved steel drums for waste sampling and proper disposal. A representative sample was collected from the waste soil and submitted to the project laboratory to be analyzed for the full Toxicity Characteristic Leaching Procedure (TCLP) list (volatile organic compounds, semivolatile organic compounds, pesticides, herbicides, and metals), polychlorinated biphenyls, total petroleum hydrocarbons, flashpoint, reactivity, ignitability, corrosivity, pH, sulfide, and cyanide. The results of the analyses indicated the soils could be handled as nonhazardous.

3.7.2 Wastewater

Waste fluids generated during groundwater sampling and decontamination activities were placed in two 55-gallon, DOT-approved steel drums and staged to a secure location for waste sampling and proper disposal. A representative sample was collected from the waste fluids and submitted to the project laboratory to be analyzed for the full TCLP list. The results of the analyses indicated the soils could be handled as nonhazardous.

3.7.3 Construction Waste

Construction waste was placed in plastic garbage bags and put in dumpsters on SJAFB for disposal at an off-site Resource Conservation and Recovery Act Subtitle D industrial landfill.

4.0 GROUNDWATER PATHWAY

SJAFB is approximately 25 miles east of the boundary between the Piedmont Upland and Atlantic Coastal Plain. The geologic material underlying SJAFB is unconsolidated deposits, of Quaternary and Tertiary sediments overlying approximately 130 feet of Cretaceous marine sediments with a basement complex of pre-Cretaceous rocks. The wedge of Cretaceous sedimentary deposits dips and thickens (up to 400 feet) to the east. The sedimentary deposits rest on complexly deformed Precambrian crystalline and metamorphic basement rocks. The three geologic units that define the principal water-bearing aquifers beneath SJAFB are the surficial aquifer, the Black Creek aquifer, and the Cape Fear aquifer.

The surficial aquifer is composed of the Quaternary age undifferentiated sands, sandy clays, and clay of the Goldsboro Sand and Sunderland Formation. The thickness of the surficial aquifer at SJAFB ranges from 10 to 20 feet. Depths to groundwater are variable and can be as shallow as 1 foot bgs in the floodplain of Stoney Creek on the north side of the base. Groundwater flow in the surficial aquifer is primarily influenced by topography, so the overall direction of flow is from the higher central portion of the base, northward into Stoney Creek, westward into the Neuse River, or southward into the southern drainage ditch. The surficial aquifer is not reportedly used as a drinking water supply at the base because of low yields (less than 10 gallons per minute) (URS, June 2004).

The Cretaceous age Black Creek Formation underlying the surficial sediments represents fluvial and marine sediments in a nearshore depositional environment. The sediments consists of predominately montmorillonitic clays with interbedded glauconitic sands, and a high content of organic material (particularly lignitized wood). The Black Creek confining unit at the top of the formation is estimated to be from 8 to 20 feet thick, and generally contains less than 10% sand. The Black Creek aquifer below the confining unit, averages 90 feet thick and the productive units of the aquifer (yielding 50 to 500 gallons per minute) are found from 50 to 100 feet bgs (URS, June 2004).

The Cretaceous age Cape Fear Formation lies below the Black Creek Formation and is comprised of poorly sorted quartz sands and montmorillonitic feldspathic clays, with basal gravels grading into cross-bedded sands covered by yellow to red clay and silt. The Cape Fear confining unit at the top of the formation is up to 40 feet thick with an average composition of 18% sand. The Cape Fear aquifer beneath the confining unit is composed of interbedded sand and clay layers, average 10 to 15 feet thick and overlays igneous and metamorphic basement rocks. At SJAFB, the pre-Cretaceous basement rocks have been encountered in borings at depths of 160 to 220 feet bgs (URS, June 2004). Figure 21 (Appendix A) presents a generalized hydrogeologic column of the SJAFB area.

Drinking water for SJAFB is purchased from the City of Goldsboro municipal water supply that primarily obtains source water from the Neuse River, with the Little River as an alternate water supply as needed. However, municipal and domestic water supplies in most of Wayne County are obtained from groundwater wells. Due to scaling problems in piping and equipment from high mineral water, all drinking water supply wells at SJAFB have been abandoned, although several nonpotable irrigation wells are located on the SJAFB golf course (CH2M Hill, September 2015).

4.1 FORMER FIRE TRAINING AREA 3 (AFFF AREA 1)

The analytical results for all four groundwater samples collected in AFFF Area 1 during the SI showed individual concentrations of PFOA and PFOS, and combined concentrations of PFOA plus PFOS exceeding screening levels. Therefore, the groundwater in the area presents a potential hazard to human health, but given that the base obtains its drinking water from a municipal supply that uses surface water as the source, the groundwater pathway is not immediately dangerous to human health. Groundwater at AFFF Area 1 flows west toward Stoney Creek and the Neuse River. SJAFB has no drinking water wells and the closest reported off-base drinking water well to FTA 3, is approximately 1.5 miles to the west-northwest. The Base population within a 4-mile radius of FTA 3 is approximately 12,100 and the off-Base population within a 4-mile radius of FTA 3 is approximately 32,800 (CH2M Hill, September 2015).

4.2 BUILDING 4522 (AFFF AREA 2)

The analytical results for all four groundwater samples collected in AFFF Area 2 during the SI showed individual concentrations of PFOA and PFOS, and combined concentrations of PFOA plus PFOS exceeding screening levels. Therefore, the groundwater in the area presents a potential hazard to human health, but given that the base obtains its drinking water from a municipal supply that uses surface water as the source, the groundwater pathway is not immediately dangerous to human health. The groundwater flow in the airfield area is south-southwest toward the Neuse River. SJAFB has no drinking water wells and the closest reported off-Base drinking water well to Building 4522, is approximately 3,840 feet to the west-northwest. The base population within a 4-mile radius of Building 4522 is approximately 12,100 and the off-base population within a 4-mile radius of Building 4522 is approximately 32,750 (CH2M Hill, September 2015).

4.3 BUILDING 4537 (AFFF AREA 3)

The analytical results of the three groundwater samples collected in AFFF Area 3 during the SI indicate that the groundwater in the area contains individual concentrations of PFOA and PFOS and combined concentrations of PFOA plus PFOS exceeding screening values. This indicates that the groundwater in the area presents a potential hazard to human health, but given that the base obtains its drinking water from a municipal supply that uses surface water as the source, the groundwater pathway is not immediately dangerous to human health. The groundwater flow in the airfield area is south-southwest toward the Neuse River. SJAFB has no drinking water wells and the closest reported off-Base drinking water well, is approximately 4,690 feet to the west-northwest. The base population within a 4-mile radius of Building 4537 is approximately 12,100 and the off-base population within a 4-mile radius of Building 4537 is approximately 32,750 (CH2M Hill, September 2015).

4.4 BUILDING 4735 (AFFF AREA 4)

The analytical results of the three groundwater samples collected in AFFF Area 4 during the SI indicate that the groundwater in the area contains individual concentrations of PFOA and PFOS and combined concentrations of PFOA plus PFOS exceeding screening values. This indicates that the groundwater in the area presents a potential hazard to human health, but given that the base obtains its drinking water from a municipal supply that uses surface water as the source, the groundwater pathway is not immediately dangerous to human health. Depth to groundwater measurements in AFFF Area 4 indicate the localized groundwater flow around the AFFF holding pond is to southeast; however, overall groundwater flow in the airfield area is southwest toward the Neuse River. SJAFB has no drinking water wells and the closest reported off-Base drinking water well to Building 4735 is 1.5 miles to the west-northwest. The Base population within a 4-mile radius of Building 4537 is approximately 12,100 and the off-Base population within a 4-mile radius of Building 4537 is approximately 32,710 (CH2M Hill, September 2015).

4.5 AIRCRAFT TIRE FIRE (AFFF AREA 5)

The analytical results of the three groundwater samples collected in AFFF Area 5 during the SI indicate that the groundwater in the area does not contain individual or combined concentrations of PFOA or PFOS exceeding screening values. This indicates that the groundwater in the area does not present a potential hazard to human health.

4.6 KC-135 CRASH SITE (AFFF AREA 6)

The analytical results of the three groundwater samples collected in AFFF Area 6 during the SI indicate that the groundwater in the area contains individual concentrations of PFOA and PFOS and combined concentrations of PFOA plus PFOS exceeding screening values. This indicates that the groundwater in the area presents a potential hazard to human health, but given that the base obtains its drinking water from a municipal supply that uses surface water as the source, the groundwater pathway is not immediately dangerous to human health. The groundwater flow in the airfield area is south-southwest toward the Neuse River. SJAFB has no drinking water wells and the closest reported off-Base drinking water well is approximately 1.5 miles to the west-northwest. The Base population within a 4-mile radius of the emergency response location is approximately 12,100 and the off-Base population within a 4-mile radius of the KC-135 Crash Site is approximately 29,400 (CH2M Hill, September 2015).

5.0 SURFACE WATER AND SEDIMENT PATHWAY

The primary surface water features at SJAFB are the Neuse River that runs along the southwest border of the base, and its tributary, Stoney Creek that runs along the northwest border of the base. According to North Carolina water quality standards, the Neuse River and Stoney Creek in the area adjacent to SJAFB and the city of Goldsboro are both considered Class C fresh waters. This is the lowest use classification designated for fish and wildlife propagation, secondary recreation, agriculture, and other uses requiring waters of lower quality. Water quality has been classified as “fully-supporting” in this section of the Neuse River and “non-supporting” of aquatic life in Stoney Creek based on a combination of chemical analyses of the surface water and biological analyses of the species present (CH2M Hill, September 2015). Drinking water for SJAFB is purchased from the City of Goldsboro municipal water supply that primarily obtains source water from the Neuse River, with the Little River as an alternate water supply as needed.

5.1 FORMER FIRE TRAINING AREA 3 (AFFF AREA 1)

No storm drains or ditches are within the vicinity of Former FTA 3 and surface water drains to the surrounding subsurface with very little surface water run-off from the area. Therefore, no surface water or sediment samples were collected during the SI and it is unlikely that AFFF has directly impacted surface water or sediment due to releases from AFFF Area 1. However, the groundwater samples collected in the area did have concentrations of PFAS compounds exceeding screening levels. The potential migration of contaminated shallow groundwater into nearby surface water, such as Stoney Creek, is possible and could provide a potentially complete exposure pathway for surface water from AFFF Area 1; however, the intakes for the City of Goldsboro municipal water supply are upstream of the base. Therefore, the surface water pathway for AFFF Area 1 is not immediately dangerous to human health.

5.2 BUILDING 4522 (AFFF AREA 2)

The AFFF releases in this area occurred below the ground surface from the OWS and AFFF holding pond system at Building 4522 and would not have impacted surface water or sediment.

5.3 BUILDING 4537 (AFFF AREA 3)

The AFFF releases in this area occurred below the ground surface from the OWS and AFFF holding tank system at Building 4537 and would not have impacted surface water or sediment.

5.4 BUILDING 4735 (AFFF AREA 4)

The AFFF releases in this area were anticipated to have occurred below the ground surface from the OWS and AFFF holding pond system at Building 4735 and would not be expected to directly impact surface water or sediment. However, the surface soil sample collected in the drainage channel east of the AFFF holding pond showed concentrations of PFOS exceeding the screening levels, indicating there have likely been unreported releases of AFFF to the ground surface from the holding pond. The drainage channel adjacent to the holding pond transports surface water runoff to the south, passes through a culvert under the runway, and daylights at a headwall in the stormwater ditch southwest of AFFF Area 5 (Aircraft Tire Fire). Surface water samples collected at the culvert headwall in the stormwater ditch, indicate surface water had concentrations of PFAS compounds exceeding screening levels. Therefore, there is a potentially complete pathway for human exposure to surface waters from AFFF Area 4. The intakes for the City of Goldsboro municipal water supply are upstream of the base and therefore, the surface water pathway for AFFF Area 4 is not immediately dangerous to human health.

5.5 AIRCRAFT TIRE FIRE (AFFF AREA 5)

Based on the topography of the area, surface water runoff from AFFF Area 5 travels to the stormwater ditch approximately 1,000 feet to the southwest. However, the headwall where the sample was collected is the discharge point for the stormwater culvert passing under the runway that transports surface water runoff from the main base area, including AFFF Area 4 (Building 4735). The analytical results of the soil (both surface and subsurface soils) and the groundwater indicate that neither soils nor groundwater in AFFF Area 5 have concentrations of PFAS compounds exceeding screening levels. The PFAS compounds identified in the surface water samples from the stormwater drainage ditch migrated from AFFF Area 4 and are not associated with AFFF Area 5. Therefore, there is not a potentially complete pathway for human exposure from surface waters originating at AFFF Area 5.

5.6 KC-135 CRASH SITE (AFFF AREA 6)

Based on the topography in the area, surface water runoff from AFFF Area 6 travels to the drainage ditch approximately 300 feet south of the area. At the time of the SI field effort, no surface water was standing in the drainage ditch and the surface soil sample collected from the drainage ditch did not show concentrations of PFAS compounds exceeding screening levels. However, the groundwater samples collected in the area did have concentrations of PFAS compounds exceeding screening levels. The potential migration of either contaminated shallow groundwater into nearby surface water including drainage ditches or wetlands is possible and could potentially provide a complete exposure pathway to humans; however, the intakes for the City of Goldsboro municipal water supply are upstream of the base. Therefore, the surface water pathway for AFFF Area 6 is not immediately dangerous to human health.

6.0 SOIL EXPOSURE AND AIR PATHWAYS

The objective of soil sampling during the SI was to determine if soils in the individual areas had concentrations of PFAS compounds exceeding the screening levels caused by the release of AFFF.

6.1 FORMER FIRE TRAINING AREA 3 (AFFF AREA 1)

The analytical results of the environmental samples collected in AFFF Area 1 during the SI indicate that the concentrations of PFAS compounds in the subsurface soils are below soil screening values. However, the analytical results of both surface soil samples (primary and duplicate sample) collected on the south side of the excavated area of Former FTA 3 showed concentrations of PFOS exceeding the screening values.

6.2 BUILDING 4522 (AFFF AREA 2)

The analytical results of the environmental samples collected in AFFF Area 2 during the SI indicate that the concentrations of PFAS compounds are below soil screening values in both surface and subsurface soils.

6.3 BUILDING 4537 (AFFF AREA 3)

The analytical results of the environmental samples collected in AFFF Area 3 during the SI indicate that the concentrations of PFAS compounds are below soil screening values in subsurface soils.

6.4 BUILDING 4735 (AFFF AREA 4)

The analytical results of the environmental samples collected in AFFF Area 4 during the SI indicate that the concentrations of PFAS compounds are below soil screening values in subsurface soils. However, the analytical results of both surface soil samples (primary and duplicate sample) collected in the drainage ditch on the east side of the area showed concentrations of PFOS exceeding the screening values.

6.5 AIRCRAFT TIRE FIRE (AFFF AREA 5)

The analytical results of the environmental samples collected in AFFF Area 5 during the SI indicate that the concentrations of PFAS compounds are below soil screening values in both surface and subsurface soils.

6.6 KC-135 CRASH SITE (AFFF AREA 6)

The analytical results of the environmental samples collected in AFFF Area 6 during the SI indicate that the concentrations of PFAS compounds are below soil screening values in both surface and subsurface soils.

7.0 UPDATE TO CONCEPTUAL SITE MODELS

7.1 FORMER FIRE TRAINING AREA 3 (AFFF AREA 1)

The conceptual site model (CSM) for Former FTA 3 presented in Worksheet #10 of the QAPP addendum (ASL, February 2017) identified surface soil, subsurface soil, and groundwater as media of concern at the location of the former FTA. The PA identified construction workers and/or base personnel exposed to impacted surface, soil, subsurface soil, or groundwater as potential human receptors. The PA also identified the migration of impacted groundwater to surface water bodies as a potential pathway for exposure to both on-base and off-base receptors (CH2M Hill, September 2015). Based on the findings discussed in Section 3.1, surface soil was found with PFOS concentrations exceeding the screening levels. Subsurface soils had detected concentrations of PFAS compounds, but none were detected at concentrations exceeding the screening levels. Based on the findings discussed in Section 4.1, groundwater in AFFF Area 1 had concentrations of PFOA and PFOS exceeding the EPA HA screening level of 0.07 µg/L. As discussed in Section 5.1, groundwater at AFFF Area 1 flows to the west and may discharge into Stoney Creek. The discharge of groundwater containing PFAS compounds into surface water bodies could provide a potential direct human exposure pathway to off-base personnel

7.2 BUILDING 4522 (AFFF AREA 2)

The CSM in Worksheet #10 of the QAPP addendum (ASL, February 2017) for Building 4522 identified surface soil, subsurface soil, and groundwater as media of concern in the area. The PA identified construction workers and/or base personnel exposed to PFAS compounds in surface soil, subsurface soil, and groundwater as potential human receptors (CH2M Hill, September 2015). Based on the findings discussed in Section 3.2, PFAS compounds were detected in the surface and subsurface soils in AFFF Area 2, but none of the detected concentrations exceeded screening levels. Based on the findings discussed in Section 4.2, groundwater in AFFF Area 2 has concentrations of PFOA and PFOS exceeding the EPA HA screening level of 0.07 µg/L.

7.3 BUILDING 4537 (AFFF AREA 3)

The CSM in Worksheet #10 of the QAPP addendum (ASL, February 2017) for Building 4537 identified subsurface soil and groundwater as media of concern in the area. The PA identified construction workers and/or base personnel exposed to PFAS compounds in subsurface soil, or groundwater as potential human receptors (CH2M Hill, September 2015). Based on the findings discussed in Section 3.3, PFAS compounds were detected in the subsurface soils in AFFF Area 3, but none of the detected concentrations exceeded screening levels. Based on the findings discussed in Section 4.3, groundwater in AFFF Area 3 has concentrations of PFOA and PFOS exceeding the EPA HA screening level of 0.07 µg/L.

7.4 BUILDING 4735 (AFFF AREA 4)

The CSM in Worksheet #10 of the QAPP addendum (ASL, February 2017) for Building 4735 identified surface soil, subsurface soil, surface water, sediment, and groundwater as media of concern in the area. The PA identified construction workers and/or base personnel exposed to PFAS compounds in subsurface soil, or shallow groundwater as potential human receptors (CH2M Hill, September 2015). Based on the findings discussed in Section 3.4, PFAS compounds were detected in the surface and subsurface soil samples around the AFFF holding pond, but none of the detected concentrations exceeded screening levels. However, the surface soil sample collected in the drainage channel east of the area (in lieu of a sediment sample) had concentrations of PFOS exceeding the screening levels. Although there was no surface water in the drainage channel at the time of sampling, there is a potential for storm water runoff to mobilize the PFOS during storm events and transport it off-site. A surface water sample collected at the headwall of the stormwater drainage ditch where surface water from AFFF Area 4 discharges did have concentrations of PFOA and PFOS exceeding the EPA HA screening level of 0.07 µg/L. Based on the findings discussed in Section 4.4, groundwater in AFFF 4 and in surface water associated with the area had concentrations of PFOA and PFOS exceeding the EPA HA screening level of 0.07 µg/L.

7.5 AIRCRAFT TIRE FIRE (AFFF AREA 5)

The CSM in Worksheet #10 of the QAPP addendum (ASL, February 2017) for the Aircraft Tire Fire identified surface soil, subsurface soil, sediment, surface water, and groundwater as media of concern in the area. The PA identified construction workers, and/or base personnel exposed to PFAS compounds in surface soil, subsurface soil, or shallow groundwater as potential human receptors. The PA also identified the migration of impacted groundwater to surface water bodies as a potential pathway for exposure to both on-base and off-base receptors (CH2M Hill, September 2015). Based on the findings discussed in Sections 3.5 and 4.5, surface soil, subsurface soil, sediment, and groundwater did not have detections of PFAS compounds exceeding screening levels in these media at AFFF Area 5. Therefore, given that the media in Area 5 did not have concentrations of PFAS compounds exceeding the screening levels, there are no complete pathways for human exposure from AFFF Area 5.

7.6 KC-135 CRASH SITE (AFFF AREA 6)

The CSM in Worksheet #10 of the QAPP addendum (ASL, February 2017) for the KC-135 Crash Site identified surface soil, subsurface soil, surface water, sediment, and groundwater as media of concern in the area. The PA identified construction workers, and/or base personnel exposed to PFAS compounds in surface soil, subsurface soil, or shallow groundwater as potential human receptors. The PA also identified the groundwater containing PFAS compounds to surface water bodies as a potential pathway for exposure to both on-base and off-base receptors (CH2M Hill, September 2015). Based on the findings discussed in Sections 3.6, surface soil and subsurface soil had detected concentrations of PFAS compounds, but none of the concentrations exceeded the screening levels. Based on the finding discussed

in Section 4.6, groundwater in AFFF Area 6 had concentrations of PFOA and PFOS exceeding the EPA HA screening level of 0.07 µg/L. No surface water samples were collected in the drainage ditch that receives runoff from this area because it was dry at the time of sampling. However, as discussed in Section 5.6, groundwater at AFFF Area 6 flows to the southwest and may discharge into the stormwater drainage ditch approximately 1,200 feet south of the area. The stormwater drainage ditch discharges into the Neuse River that flows into Pamlico Sound. The discharge of groundwater containing PFAS compounds into surface water bodies could provide a potential direct human exposure pathway to off-base personnel.

8.0 SUMMARY AND CONCLUSIONS

The PA (CH2M Hill, September 2015) identified six AFFF areas at SJAFB requiring additional evaluation through the SI process based on the reported or suspected release of AFFF material containing PFAS compounds.

- AFFF Area 1 – Former FTA 3 (ERP Site FT-07)
- AFFF Area 2 – Building 4522 (ERP Site OW-C538)
- AFFF Area 3 – Building 4537 (ERP Site OW-C545)
- AFFF Area 4 – Building 4735 (ERP Site OW-C557)
- AFFF Area 5 – Aircraft Tire Fire (Not a previously identified ERP Site)
- AFFF Area 6 – KC-135 Crash Site (ERP Site SS-22)

Media evaluated during the SI included surface soil (0 to 6 inches in depth); subsurface soil (vadose zone in the source area); groundwater (including samples from existing monitoring wells, temporary wells, and/or direct push sampling); and surface water/sediment. The objectives of the SI were to

- determine if a confirmed release of PFOA, PFOS, or PFBS has occurred at AFFF areas selected for inspection;
- determine if PFOA, PFOS, or PFBS is present in groundwater, soil, surface water, or sediment in the area in concentrations exceeding the EPA lifetime HA; and
- identify potential receptor pathways with immediate impacts to human health (immediate impact to human health is considered consumption of drinking water with PFOS/PFOA above the HA or PFBS above the RSL).

All samples were analyzed for PFBS, PFOA, and PFOS using modified EPA Method 537. Soil and sediment PFBS analytical results were compared to published EPA RSLs (EPA, June 2017). PFOA and PFOS analytical results were compared to calculated RSLs (1,260 µg/kg for both PFOA and PFOS). Groundwater and surface water PFBS analytical results were compared to the published EPA RSL; PFOA and PFOS analytical results were compared to the EPA HA of 0.07 µg/L for the combined concentrations of PFOA and PFOS.

The maximum detected concentrations of PFBS did not exceed the screening criteria in any media at any of the six areas. Table 22 presents a summary of the maximum detected concentrations of PFBS, PFOA, and PFOS for each media at the six areas and indicates where those concentrations exceeded the corresponding screening levels. All six AFFF areas had concentrations of PFOA or PFOS in one or more media that exceeded the corresponding screening levels. However, the exceedance in surface water at AFFF Area 5 is most likely caused by other sources, such as AFFF Area 4, and not a result of the AFFF released at Area 5. No immediate impacts to human health were identified in any of the six AFFF areas at SJAFB.

8.1 FORMER FIRE TRAINING AREA 3 (AFFF AREA 1)

Fire training operations were conducted at FTA 3 from 1956 to 1992. Although there are no records of AFFF being used during these operations, the active life of the former FTA includes the time beginning in 1970 when the Air Force was known to have used AFFF in fire fighter training. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Five surface soil samples (three primary samples, a field duplicate sample, and a composite physiochemical sample), five subsurface soil samples (three primary samples, one duplicate sample, and a composite physiochemical sample), and four groundwater samples (three primary and a field duplicate sample) were submitted to the project laboratory for analyses from AFFF Area 1. The results for the analyses of the subsurface soil samples do not indicate concentrations of any of the target analytes remain in the subsurface soils in the area in excess of the screening criteria. However, PFOS was detected in one of the surface soil samples at a concentration exceeding the screening levels. Further, PFOA and PFOS were detected in all four groundwater samples at concentrations exceeding the screening criteria. Based on the analytical results, a release of AFFF has been confirmed at AFFF Area 1 to surface soil and groundwater that presents a potential hazard to human health.

Table 22 Summary of Analytical Results and Screening Level Exceedances

AFFF Area	Associated Existing ERP Site	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples / Number of Exceedances	Exceeds Screening Value
AFFF Area 1 Former FTA 3	FT-07	Surface Soil (0 to 6 inches)					
		PFBS	2.9 J	1,300,000	µg/kg	4 / 0	No
		PFOA	26 J	1,260	µg/kg	4 / 0	No
		PFOS	1,400 J	1,260	µg/kg	4 / 1	Yes
		Subsurface Soil					
		PFBS	30	1,300,000	µg/kg	4 / 0	No
		PFOA	130 J	1,260	µg/kg	4 / 0	No
		PFOS	75	1,260	µg/kg	4 / 0	No
		Groundwater					
		PFBS	14	400	µg/L	4 / 0	No
		PFOA	100	0.07	µg/L	4 / 4	Yes
PFOS	100	0.07	µg/L	4 / 4	Yes		
PFOA + PFOS	200	0.07	µg/L	4 / 4	Yes		
AFFF Area 2 Building 4522	OW-C538	Surface Soil (0 to 6 inches)					
		PFBS	22 J	1,300,000	µg/kg	4 / 0	No
		PFOA	13 J	1,260	µg/kg	4 / 0	No
		PFOS	700 J	1,260	µg/kg	4 / 0	No
		Subsurface Soil					
		PFBS	ND	1,300,000	µg/kg	4 / 0	No
		PFOA	ND	1,260	µg/kg	4 / 0	No
		PFOS	42	1,260	µg/kg	4 / 0	No
		Groundwater					
		PFBS	36	400	µg/L	4 / 0	No
		PFOA	4.4	0.07	µg/L	4 / 4	Yes
PFOS	52	0.07	µg/L	4 / 4	Yes		
PFOA + PFOS	56.4	0.07	µg/L	4 / 4	Yes		
AFFF Area 3 Building 4537	OW-C545	Subsurface Soil					
		PFBS	ND	1,300,000	µg/kg	3 / 0	No
		PFOA	ND	1,260	µg/kg	3 / 0	No
		PFOS	16	1,260	µg/kg	3 / 0	No
		Groundwater					
		PFBS	0.093	400	µg/L	3 / 0	No
		PFOA	0.11	0.07	µg/L	3 / 3	Yes
		PFOS	1.5	0.07	µg/L	3 / 3	Yes
PFOA + PFOS	1.575	0.07	µg/L	3 / 3	Yes		
AFFF Area 4 Building 4735	OW-C557	Surface Soil (0 to 6 inches)					
		PFBS	12	1,300,000	µg/kg	5 / 0	No
		PFOA	13	1,260	µg/kg	5 / 0	No
		PFOS	2,300	1,260	µg/kg	5 / 2	Yes
		Subsurface Soil					
		PFBS	20	1,300,000	µg/kg	3 / 0	No
		PFOA	2.7	1,260	µg/kg	3 / 0	No
		PFOS	290	1,260	µg/kg	3 / 0	No
		Groundwater					
		PFBS	11	400	µg/L	3 / 0	No
PFOA	12	0.07	µg/L	3 / 3	Yes		
PFOS	300	0.07	µg/L	3 / 3	Yes		

AFFF Area	Associated Existing ERP Site	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples / Number of Exceedances	Exceeds Screening Value	
		PFOA + PFOS	312	0.07	µg/L	3 / 3	Yes	
		Sediment						
		PFBS	ND	1,300,000	µg/kg	2 / 0	No	
		PFOA	ND	1,260	µg/kg	2 / 0	No	
		PFOS	4.2 J	1,260	µg/kg	2 / 0	No	
		Surface Water						
		PFBS	0.22	400	µg/L	2 / 0	No	
		PFOA	0.20	0.07	µg/L	2 / 2	Yes*	
PFOS	3.1	0.07	µg/L	2 / 2	Yes*			
		PFOA + PFOS	3.30	0.07	µg/L	2 / 2	Yes*	
AFFF Area 5 Aircraft Tire Fire	None (New Site)	Surface Soil (0 to 6 inches)						
		PFBS	ND	1,300,000	µg/kg	3 / 0	No	
		PFOA	ND	1,260	µg/kg	3 / 0	No	
		PFOS	0.27 J	1,260	µg/kg	3 / 0	No	
		Subsurface Soil						
		PFBS	ND	1,300,000	µg/kg	3 / 0	No	
		PFOA	ND	1,260	µg/kg	3 / 0	No	
		PFOS	ND	1,260	µg/kg	3 / 0	No	
		Groundwater						
		PFBS	0.0019 J	400	µg/L	3 / 0	No	
		PFOA	ND	0.07	µg/L	3 / 0	No	
		PFOS	0.031	0.07	µg/L	3 / 0	No	
		PFOA + PFOS	0.031	0.07	µg/L	3 / 0	No	
AFFF Area 6 KC-135 Crash Site	SS-22	Surface Soil (0 to 6 inches)						
		PFBS	0.33 J	1,300,000	µg/kg	4 / 0	No	
		PFOA	0.47 J	1,260	µg/kg	4 / 0	No	
		PFOS	11	1,260	µg/kg	4 / 0	No	
		Subsurface Soil						
		PFBS	ND	1,300,000	µg/kg	3 / 0	No	
		PFOA	ND	1,260	µg/kg	3 / 0	No	
		PFOS	0.47 J	1,260	µg/kg	3 / 0	No	
		Groundwater						
		PFBS	0.066	400	µg/L	3 / 0	No	
		PFOA	1.4	0.07	µg/L	3 / 2	Yes	
		PFOS	0.25 J	0.07	µg/L	3 / 2	Yes	
		PFOA + PFOS	1.478	0.07	µg/L	3 / 3	Yes	

*The exceedances in the surface water samples from AFFF Area 5 have been determined to be from AFFF Area 4 and are no longer associated with AFFF Area 5.

Note: Bold value indicates an exceedance of the corresponding screening value.

µg/kg = micrograms per kilogram

AFFF = aqueous film forming foam

J = estimated value

ERP = Environmental Restoration Program

PFOA = perfluorooctanoic acid

µg/L = micrograms per liter

FTA = fire training area

ND = not detected at the method detection limit

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

8.2 BUILDING 4522 (AFFF AREA 2)

Building 4522 contains three fire suppression systems. Bays A and B (northernmost bays) have a Hi-Ex foam system that replaced an AFFF system in 2013. Bays C and D had an AFFF system installed in 1986. Bay E (southernmost bay) is a paint booth with an AFFF system installed in 1986. The AFFF system for Bay E accidentally discharged in 2000 and 2001, but all of the AFFF released was reportedly collected in the hangar floor drains and routed to the OWS and AFFF holding pond system. The area around the OWS was investigated in 2012, and was found to have released petroleum contaminants to the surrounding soil, but PFAS compounds were not included during the previous investigation (CH2M Hill, September 2015). During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Five surface soil samples (three primary samples, a field duplicate sample, and composite physiochemical sample), five subsurface soil samples (three primary samples, a field duplicate sample, and a composite physiochemical sample), and four groundwater samples (three primary samples and a field duplicate sample) were submitted to the project laboratory for analyses from AFFF Area 2. The results for the analyses of the surface and subsurface soil samples do not indicate concentrations of PFAS compounds remain in the soils in the area in excess of the screening criteria. However, all four groundwater samples had concentrations of PFOA and PFOS exceeding the screening criteria. Based on the analytical results, a release of AFFF has been confirmed at AFFF Area 2 to the groundwater that presents a potential hazard to human health.

8.3 BUILDING 4537 (AFFF AREA 3)

Building 4537 is a three-bay hangar on Hangar Row, near the south end of the runway. The building is equipped with an AFFF system that is not operational. The AFFF system in Bay B (middle bay) accidentally discharged in summer 1998 and all of the foam reportedly remained inside the hangar doors and collected in the floor drains leading to an OWS and AFFF holding tank system. The area around the Building 4537 OWS was investigated in 2012 and was determined to have had a release of petroleum contaminants in the surrounding soil; however, PFAS compounds were not analyzed during the 2012 investigation (CH2M Hill, September 2015). During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Four subsurface soil samples (two primary samples, a field duplicate sample, and a composite physiochemical sample) and three groundwater samples were submitted to the project laboratory for analyses from AFFF Area 3. The results for the analyses of the subsurface soil samples do not indicate that subsurface soils have been impacted at concentrations exceeding the screening levels. However, the results of the groundwater samples indicate concentrations of PFOA and PFOS remain in the groundwater at AFFF Area 3 at concentrations exceeding the screening criteria. Based on the analytical results, a release of AFFF has been confirmed to the groundwater at AFFF Area 3 that presents a potential hazard to human health.

8.4 BUILDING 4735 (AFFF AREA 4)

Building 4735 is a two-bay hangar that has two AFFF systems. Floor grates at the bay doors lead to the sanitary sewer system; however, the drains can be diverted to an OWS connected to an AFFF holding pond northeast of the building. Accidental AFFF discharges occurred inside the building on February 4 and March 4, 2015 and in both instances, the AFFF was reportedly contained inside the hangar and collected in the floor drains. The area around the Building 4735 OWS was investigated in 2012 and was determined to have had a release of petroleum contaminants to the environment; however, PFAS compounds were not analyzed during the 2012 investigation (CH2M Hill, September 2015). During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Six surface soil samples (four

primary samples, a field duplicate sample, and a composite physiochemical sample), four subsurface soil samples (three primary samples and a composite physiochemical sample), and three groundwater samples were submitted to the project laboratory for analyses from AFFF Area 4. The analytical results of the subsurface soil samples do not indicate concentrations of the target analytes remaining in the subsurface soils exceeding the screening criteria. However, the analytical results of the surface soil sample collected in the drainage channel leading from the AFFF holding pond indicates that the surface soils in this area have concentrations of PFOS exceeding the screening levels. In addition, the analytical results for the groundwater samples indicate that the groundwater at AFFF Area 4 has concentrations of PFOA and PFOS exceeding the screening levels. The analytical results for the sediment samples collected at the outfall of the stormwater drainage system (near AFFF Area 5) do not indicate concentrations of the target analytes remaining in the sediments exceeding the screening criteria. However, the results of the surface water sample collected at the headwall of the stormwater drainage ditch indicated concentrations of PFOA and PFOS exceeding the screening levels. The headwall of the stormwater drainage ditch is the point at which surface water from AFFF Area 4 discharges from the piping system carrying surface water under the runway. Based on the analytical results, a release of AFFF has been confirmed to surface soil, groundwater, and surface water at AFFF Area 4 that presents a potential hazard to human health.

8.5 AIRCRAFT TIRE FIRE (AFFF AREA 5)

In 2004, the SJAFB fire department responded to an aircraft tire fire on the runway and sprayed approximately 20 gallons of an AFFF/water mixture to extinguish the fire and the AFFF/water mixture was allowed to evaporate on the runway (CH2M Hill, September 2015). During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Four surface soil samples (three primary samples and a composite physiochemical sample), four subsurface soil samples (three primary samples and a composite physiochemical sample), and three groundwater samples were submitted to the project laboratory for analyses from AFFF Area 5. Based on the analytical results, the release of AFFF has not impacted the surface soil, subsurface soil, or groundwater at AFFF Area 5 to an extent that presents a potential hazard to human health.

8.6 KC-135 CRASH SITE (AFFF AREA 6)

In December 1973, a KC-135 refueling aircraft crashed near the west end of the runway, just south of the tarmac. Approximately 1,700 gallons of JP-4 aviation fuel were spilled and retained in a 4-foot-wide, 6-inch-deep trench that was excavated downgradient of the crash site. The spilled fuel was subsequently burned on location. It is unknown whether AFFF was used at the crash location. However, AFFF is typically sprayed on crash sites, fuel releases, and fires so it is very likely that an unknown quantity of AFFF was released in this area during the incident (CH2M Hill, September 2015). During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Five surface soil samples (four primary samples and one composite physiochemical sample), four subsurface soil samples (three primary sample and one composite physiochemical sample), and three groundwater samples were submitted to the project laboratory for analyses from AFFF Area 6. The analytical results for the surface and subsurface soil samples do not indicate concentrations of the target analytes remaining in the soils exceeding the screening criteria. However, the analytical results of the groundwater samples show that the groundwater at AFFF Area 6 contains concentrations of PFOA and PFOS exceeding the screening levels. Based on the analytical results, a release of AFFF has been confirmed to the groundwater at AFFF Area 6 that presents a potential hazard to human health.

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Appendix A
AFFF Area-Specific Figures

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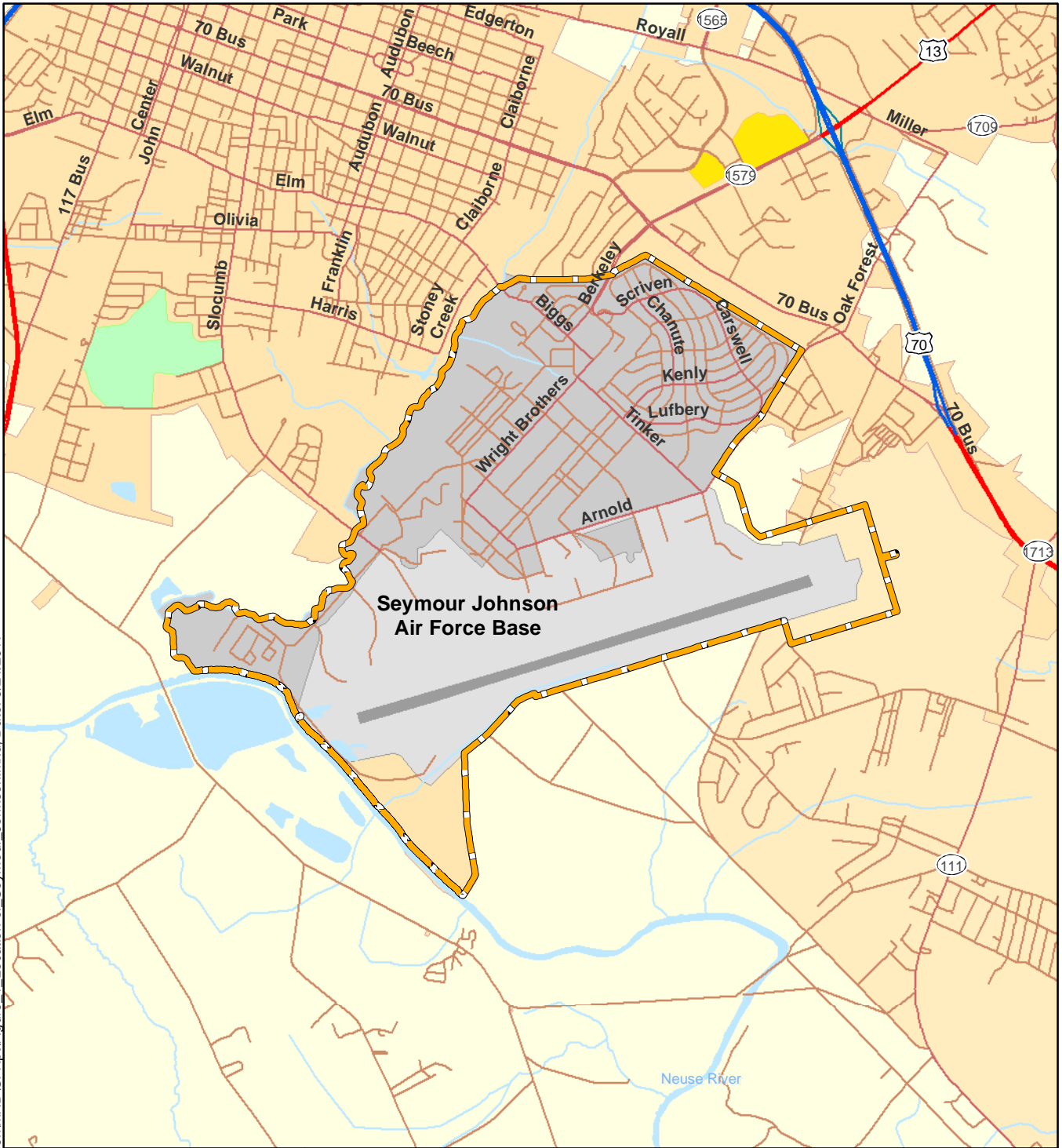



Figure 1
Location of Seymour Johnson Air Force Base
Wayne County, North Carolina

Legend
 Installation Boundary

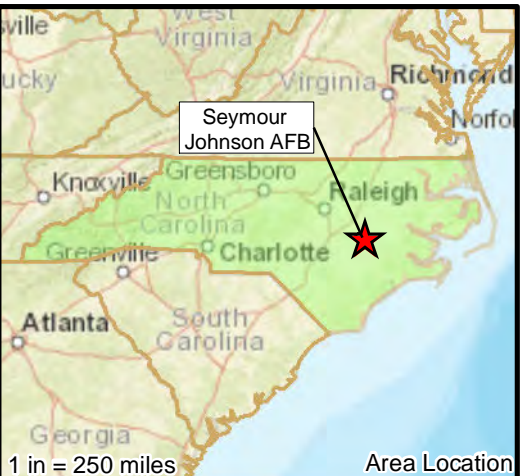
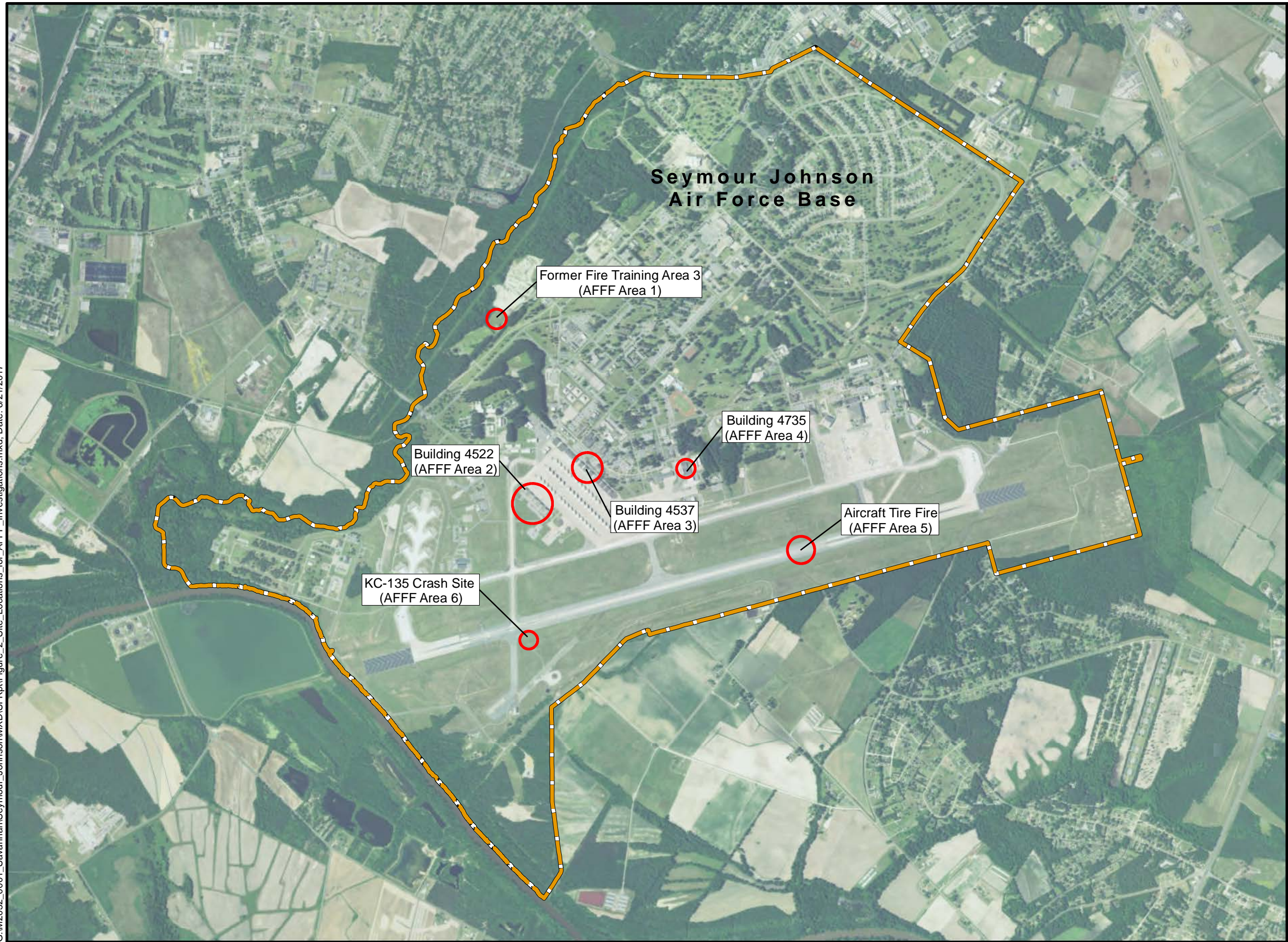
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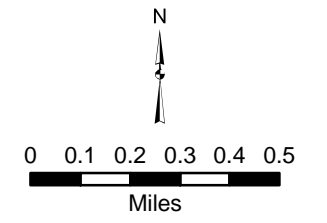


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Legend

- AFFF Inspection Area
- Installation Boundary

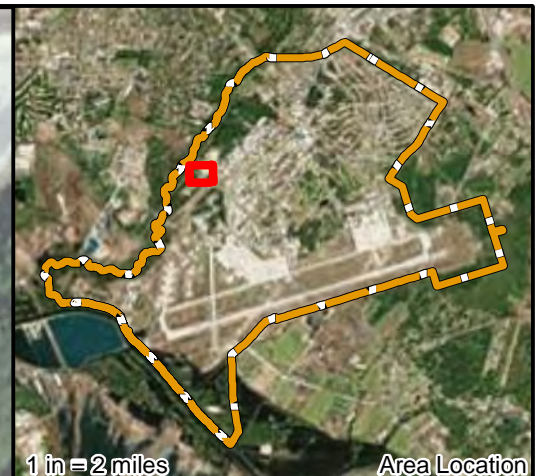
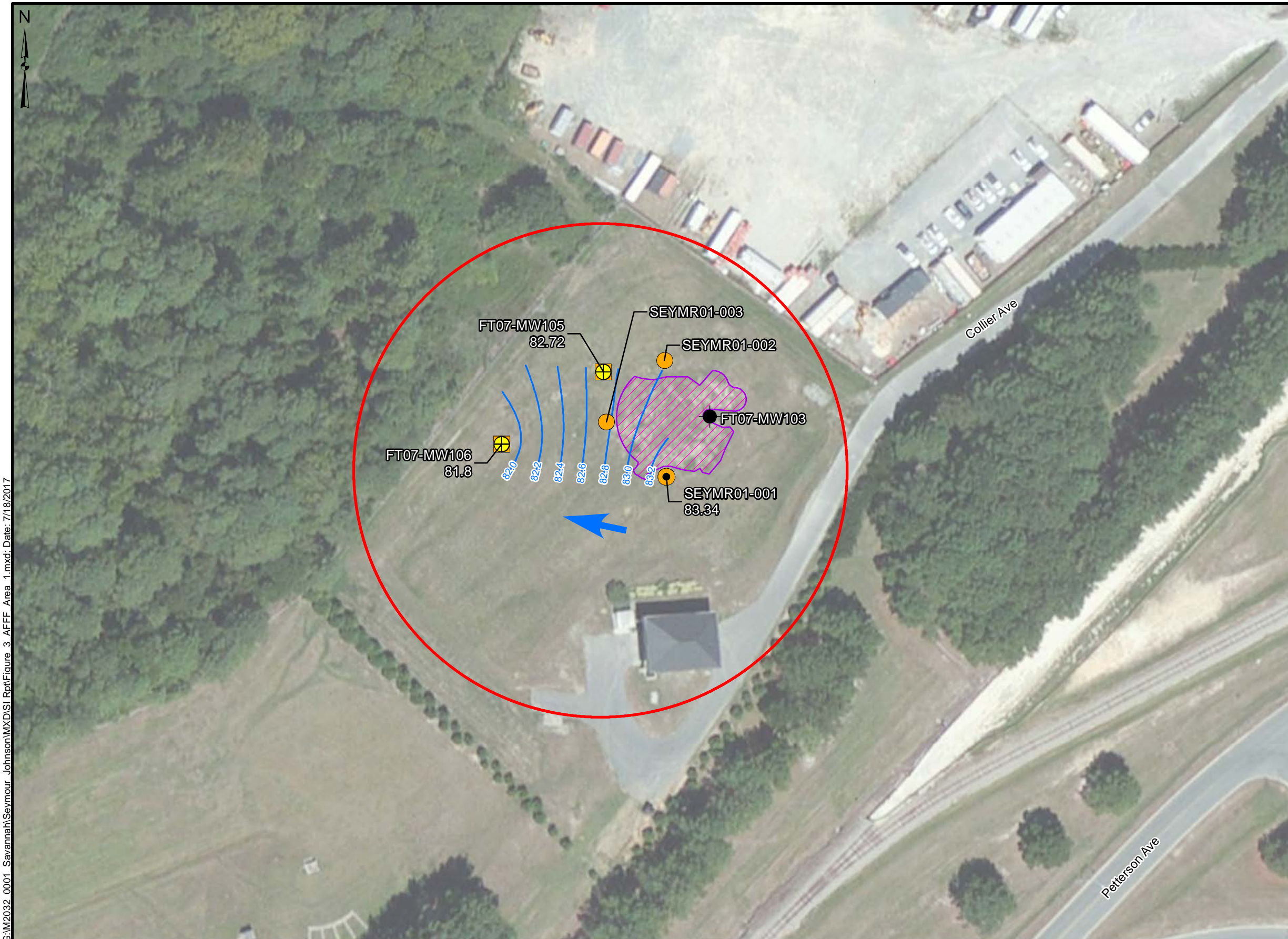


Seymour Johnson Air Force Base
North Carolina

Figure 2
Seymour Johnson AFB AFFF Area
Site Inspection Locations



Drawn: tmorse | Date: 6/21/2017
Service Layer Credits: Esri ArcGIS Online Aerial Photography



Legend

- DPT Boring Location for Collecting Surface Soil, Subsurface Soil, and Groundwater Samples
- DPT Boring Location for Collecting Surface and Subsurface Soil Samples
- Existing Groundwater Monitoring Well
- Abandoned Well
- AFFF Inspection Area
- Excavation Boundary
- Installation Boundary
- Groundwater Flow Direction
- Groundwater Elevation Contour

FT07-MW105
82.72 = Groundwater Elevation (ft) measured between February 19 and February 20, 2017.

0 40 80
Feet

Seymour Johnson Air Force Base
North Carolina

Figure 3
Former Fire Training Area 3
(AFFF Area 1) Sample Locations and
Potentiometric Contours



Drawn: tmorse Date: 7/18/2017
Service Layer Credits: Esri ArcGIS Online Aerial Photography

G:\M2032_0001_Savannah\Seymour_Johnson\MXD\SI_Rpt\Figure_3_AFFF_Area_1.mxd; Date: 7/18/2017

SEYMR01-002-SO-012	
Analyte	Result (µg/kg)
PFBS	30
PFOA	120
PFOS	34

SEYMR01-002-SS-001	
Analyte	Result (µg/kg)
PFBS	0.56 U
PFOA	2.0
PFOS	180

SEYMR01-003-SO-009	
Analyte	Result (µg/kg)
PFBS	2.6
PFOA	59
PFOS	75

SEYMR01-003-SS-001	
Analyte	Result (µg/kg)
PFBS	0.40 J
PFOA	0.78 J
PFOS	19

SEYMR01-001-SO-009	
Analyte	Result (µg/kg)
PFBS	6.9 J
PFOA	58 J
PFOS	56 J

SEYMR01-001-SS-001	
Analyte	Result (µg/kg)
PFBS	6.6 U
PFOA	26 J
PFOS	1,400 J

SEYMR01-001-SO-909 (dup)	
Analyte	Result (µg/kg)
PFBS	16 J
PFOA	130 J
PFOS	36 J

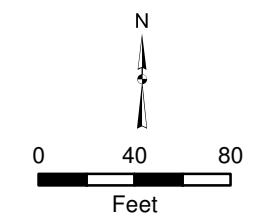
SEYMR01-001-SS-901 (dup)	
Analyte	Result (µg/kg)
PFBS	2.9 J
PFOA	7.5 J
PFOS	1,000 J

Soil Screening Levels:
 PFBS - 1,300,000 µg/kg PFOS - 1,260 µg/kg PFOA - 1,260 µg/kg

Notes:
Bold value indicates analyte detected at concentration indicated.
 = as shown, value exceeds screening level
 J = The reported concentration is an estimated value.
 U = The analyte was not detected above the reported value.
 SO = subsurface soil SS = surface soil
 dup = duplicate sample



- Legend**
- DPT Boring Location for Collecting Surface Soil, Subsurface Soil, and Groundwater Samples
 - DPT Boring Location for Collecting Surface and Subsurface Soil Samples
 - Existing Groundwater Monitoring Well
 - Abandoned Well
 - AFFF Inspection Area
 - Excavation Boundary
 - Installation Boundary
 - Groundwater Flow Direction



Seymour Johnson Air Force Base
North Carolina

Figure 4
Former Fire Training Area 3
(AFFF Area 1) PFBS, PFOA,
and PFOS in Soil

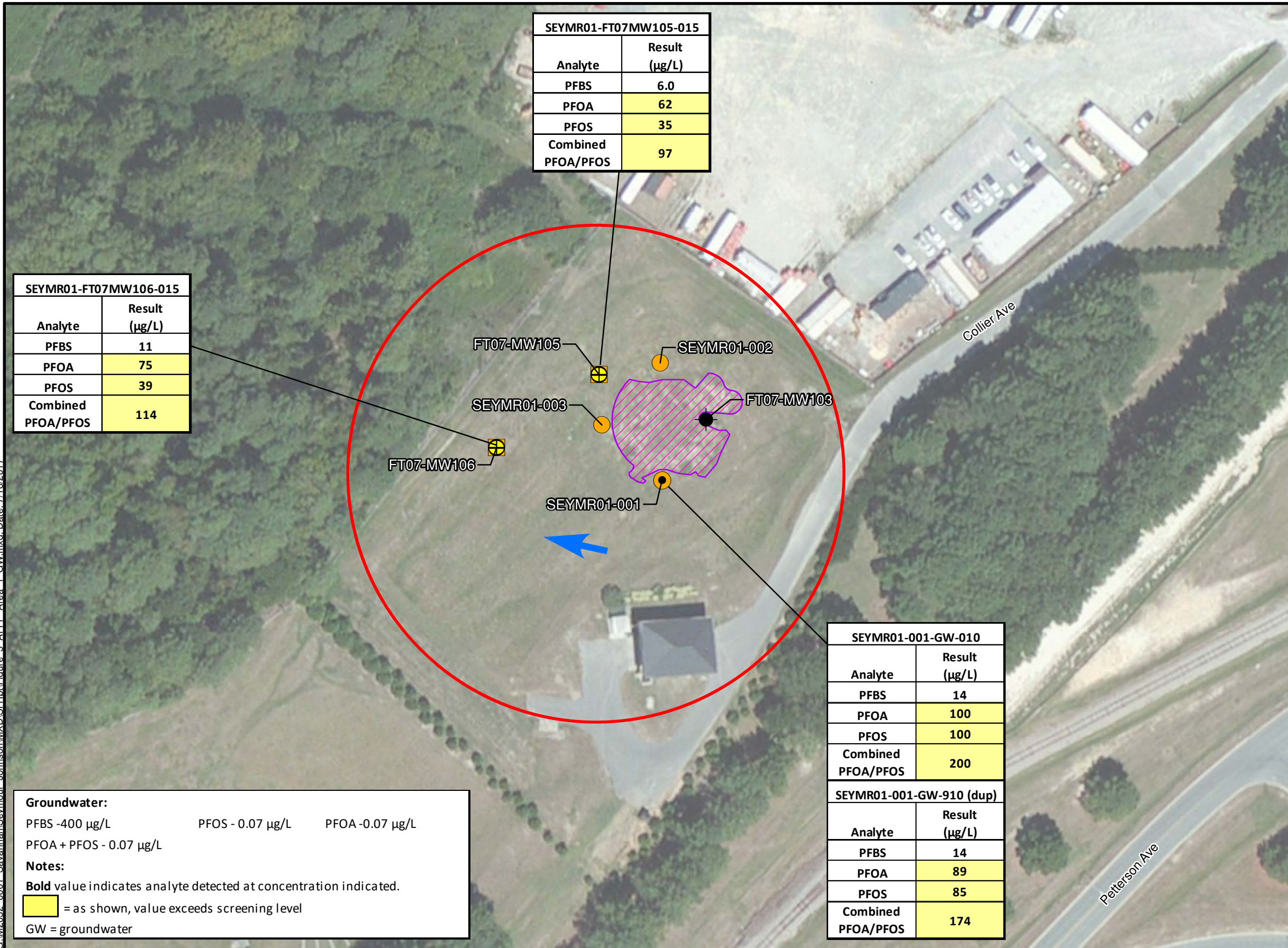


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Service Layer Credits: Esri ArcGIS Online Aerial Photography

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SEYMR01-FT07MW105-015	
Analyte	Result (µg/L)
PFBS	6.0
PFOA	62
PFOS	35
Combined PFOA/PFOS	97

SEYMR01-FT07MW106-015	
Analyte	Result (µg/L)
PFBS	11
PFOA	75
PFOS	39
Combined PFOA/PFOS	114

SEYMR01-001-GW-010	
Analyte	Result (µg/L)
PFBS	14
PFOA	100
PFOS	100
Combined PFOA/PFOS	200

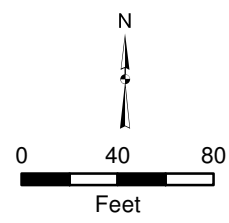
SEYMR01-001-GW-910 (dup)	
Analyte	Result (µg/L)
PFBS	14
PFOA	89
PFOS	85
Combined PFOA/PFOS	174

Groundwater:
 PFBS -400 µg/L PFOS - 0.07 µg/L PFOA -0.07 µg/L
 PFOA + PFOS - 0.07 µg/L

Notes:
Bold value indicates analyte detected at concentration indicated.
 [Yellow highlight] = as shown, value exceeds screening level
 GW = groundwater



- Legend**
- DPT Boring Location for Collecting Surface Soil, Subsurface Soil, and Groundwater Samples
 - DPT Boring Location for Collecting Surface and Subsurface Soil Samples
 - Existing Groundwater Monitoring Well
 - Abandoned Well
 - AFFF Inspection Area
 - Excavation Boundary
 - Installation Boundary
 - Groundwater Flow Direction



Seymour Johnson Air Force Base
North Carolina

Figure 5
Former Fire Training Area 3 (AFFF Area 1) PFBS, PFOA, and PFOS in Groundwater



Drawn: tmore Date: 7/18/2017

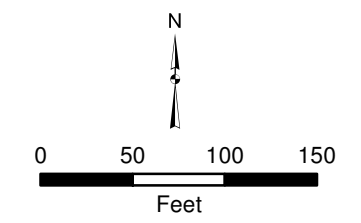
Service Layer Credits: Esri ArcGIS Online Aerial Photography



Legend

- DPT Boring Location for Collecting Surface Soil, Subsurface Soil, and Groundwater Samples
- Abandoned Well
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction per USGS 1997 Report

Note: U.S. Geological Survey (USGS), 1997. Hydrogeologic Framework and Ground-Water Resources at Seymour Johnson Air Force Base, North Carolina.

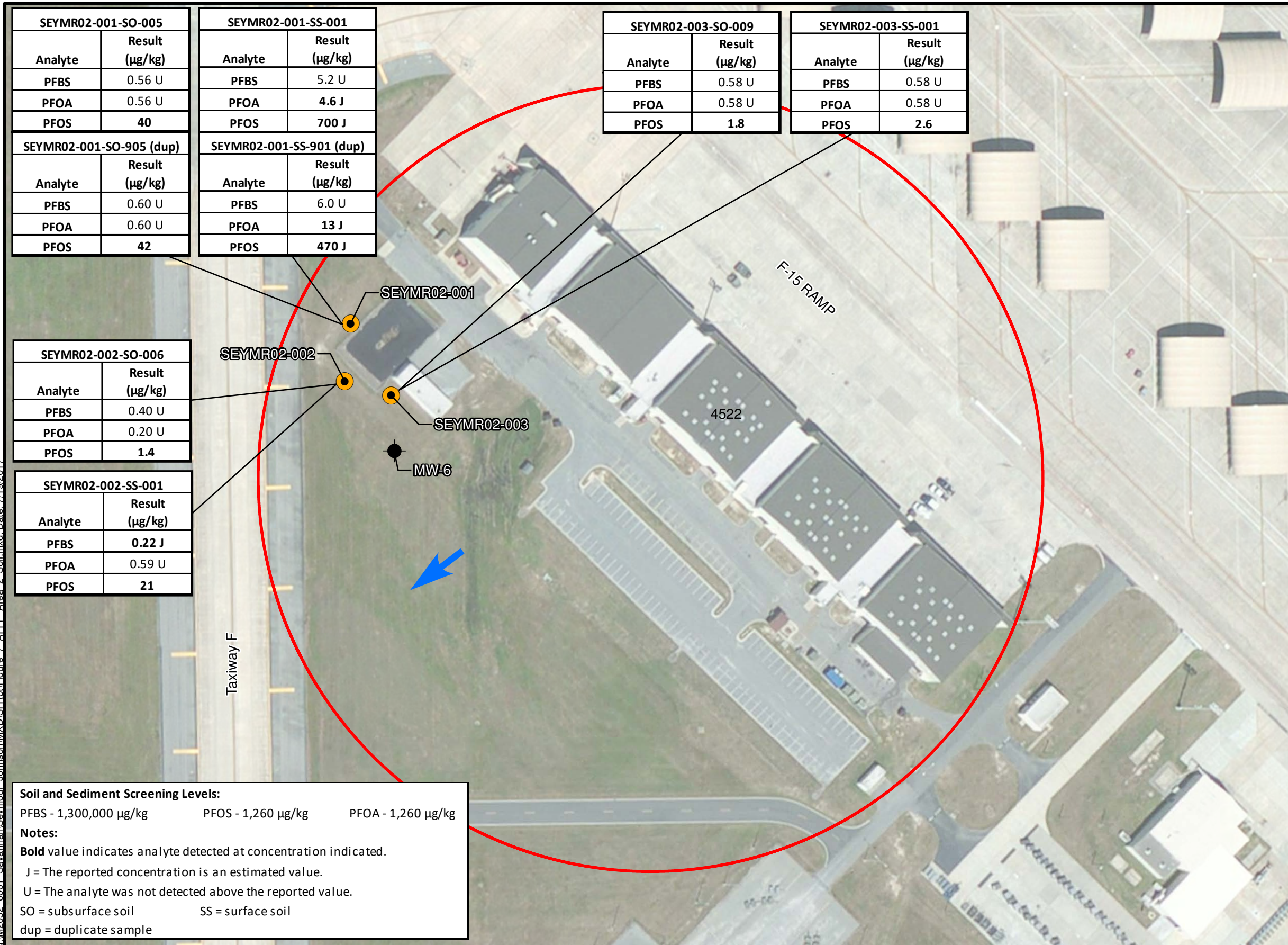


Seymour Johnson Air Force Base
North Carolina

Figure 6
Building 4522 (AFFF Area 2)
Sample Locations and
Potentiometric Contours



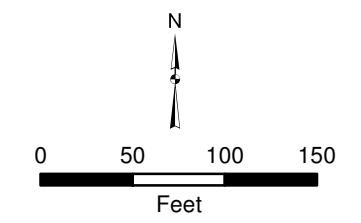
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Service Layer Credits: Esri ArcGIS Online Aerial Photography



Legend

- DPT Boring Location for Collecting Surface Soil, Subsurface Soil, and Groundwater Samples
- Abandoned Well
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction per USGS 1997 Report

Note: U.S. Geological Survey (USGS), 1997. Hydrogeologic Framework and Ground-Water Resources at Seymour Johnson Air Force Base, North Carolina.



Seymour Johnson Air Force Base
North Carolina

Figure 7
Building 4522
(AFFF Area 2) PFBS, PFOA,
and PFOS in Soil



Drawn: tmorse Date: 7/19/2017
Service Layer Credits: Esri ArcGIS Online Aerial Photography

Soil and Sediment Screening Levels:
 PFBS - 1,300,000 µg/kg PFOS - 1,260 µg/kg PFOA - 1,260 µg/kg

Notes:
Bold value indicates analyte detected at concentration indicated.
 J = The reported concentration is an estimated value.
 U = The analyte was not detected above the reported value.
 SO = subsurface soil SS = surface soil
 dup = duplicate sample

SEYMR02-001-SO-005	
Analyte	Result (µg/kg)
PFBS	0.56 U
PFOA	0.56 U
PFOS	40

SEYMR02-001-SS-001	
Analyte	Result (µg/kg)
PFBS	5.2 U
PFOA	4.6 J
PFOS	700 J

SEYMR02-003-SO-009	
Analyte	Result (µg/kg)
PFBS	0.58 U
PFOA	0.58 U
PFOS	1.8

SEYMR02-003-SS-001	
Analyte	Result (µg/kg)
PFBS	0.58 U
PFOA	0.58 U
PFOS	2.6

SEYMR02-002-SO-006	
Analyte	Result (µg/kg)
PFBS	0.40 U
PFOA	0.20 U
PFOS	1.4

SEYMR02-002-SS-001	
Analyte	Result (µg/kg)
PFBS	0.22 J
PFOA	0.59 U
PFOS	21

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SEYMR02-001-GW-008	
Analyte	Result (µg/L)
PFBS	36
PFOA	4.4
PFOS	52
Combined PFOA/PFOS	56.4

SEYMR02-001-GW-908 (dup)	
Analyte	Result (µg/L)
PFBS	27
PFOA	3.5
PFOS	44
Combined PFOA/PFOS	47.5

SEYMR02-002-GW-008	
Analyte	Result (µg/L)
PFBS	1.7
PFOA	0.56
PFOS	18
Combined PFOA/PFOS	18.56

SEYMR02-003-GW-010	
Analyte	Result (µg/L)
PFBS	0.33
PFOA	0.17
PFOS	5.8
Combined PFOA/PFOS	5.97

Groundwater Screening Levels:

PFBS - 400 µg/L PFOS - 0.07 µg/L PFOA - 0.07 µg/L

PFOA + PFOS - 0.07 µg/L

Notes:

Bold value indicates analyte detected at concentration indicated.

= as shown, value exceeds screening level

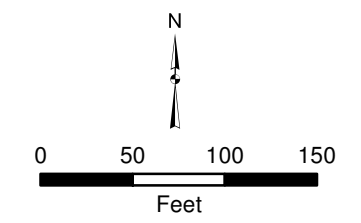
GW = groundwater



Legend

- DPT Boring Location for Collecting Surface Soil, Subsurface Soil, and Groundwater Samples
- Abandoned Well
- AFFF Inspection Area
- Installation Boundary
- ← Groundwater Flow Direction per USGS 1997 Report

Note: U.S. Geological Survey (USGS), 1997. Hydrogeologic Framework and Ground-Water Resources at Seymour Johnson Air Force Base, North Carolina.



Seymour Johnson Air Force Base
North Carolina

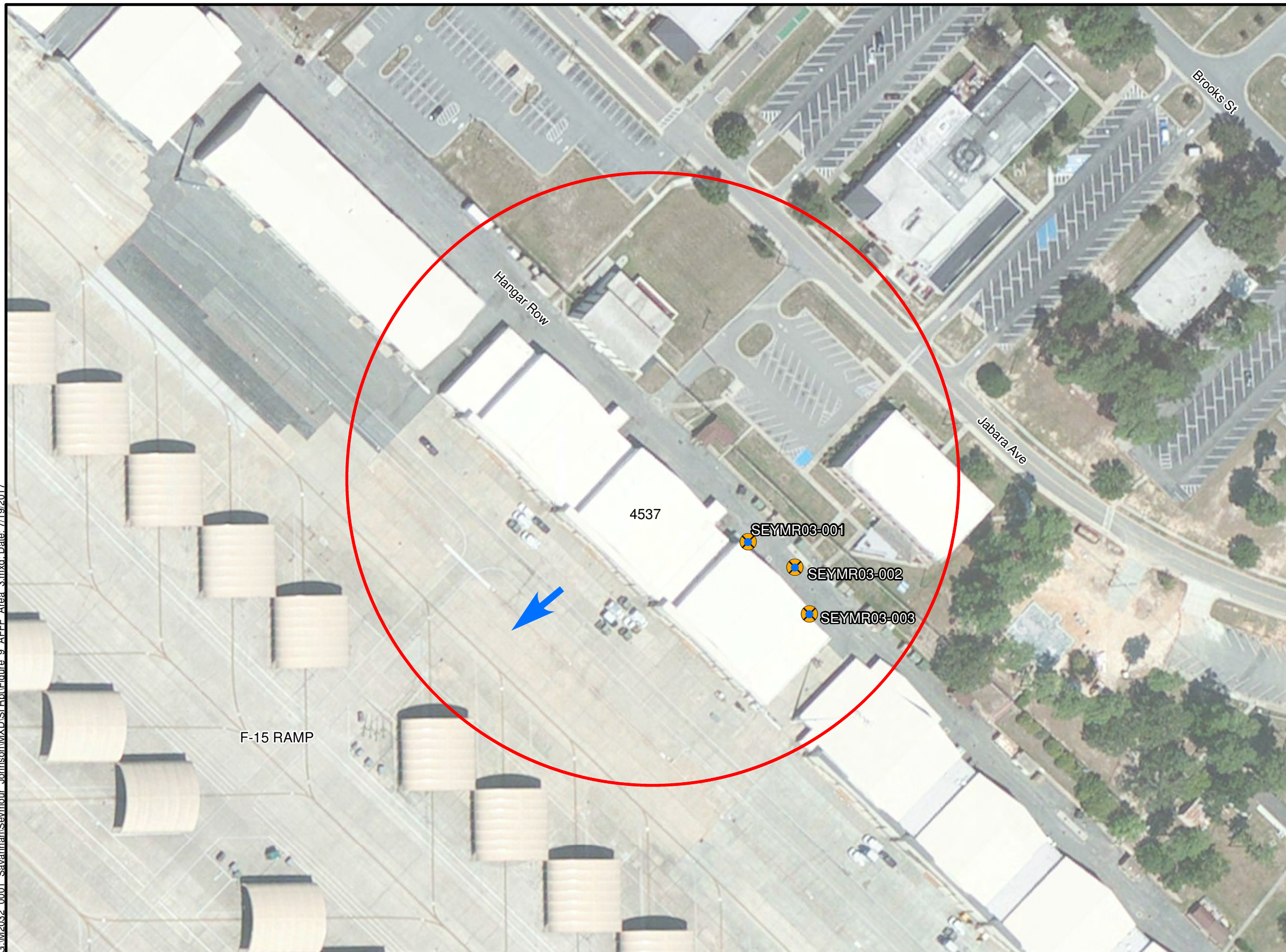
Figure 8
Building 4522
(AFFF Area 2) PFBS, PFOA,
and PFOS in Groundwater



Drawn: tmorse Date: 7/19/2017

Service Layer Credits: Esri ArcGIS Online Aerial Photography

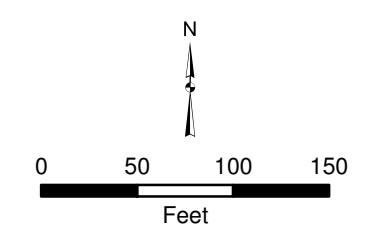
G:\M2032_0001_Savannah\Sevmour_Johnson\MXD\SI Rpt\Figure 9_AFFF Area_3.mxd - Date: 7/19/2017



Legend

- DPT Boring Location for Collecting Subsurface Soil and Groundwater Samples
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction per USGS 1997 Report

Note: U.S. Geological Survey (USGS), 1997. Hydrogeologic Framework and Ground-Water Resources at Seymour Johnson Air Force Base, North Carolina.



Seymour Johnson Air Force Base
North Carolina

Figure 9
Building 4537
(AFFF Area 3) Sample Locations and
Potentiometric Contours



Drawn: tmorse Date: 7/19/2017

Service Layer Credits: Esri ArcGIS Online Aerial Photography

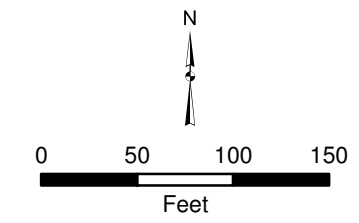
G:\M2032_0001_Savannah\Sevmour_Johnson\MXD\SI Rpt\Figure_10_AFFF_Area_3_Soil.mxd; Date: 7/19/2017



Legend

- DPT Boring Location for Collecting Subsurface Soil and Groundwater Samples
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction per USGS 1997 Report

Note: U.S. Geological Survey (USGS), 1997. Hydrogeologic Framework and Ground-Water Resources at Seymour Johnson Air Force Base, North Carolina.



SEYMR03-002-SO-004	
Analyte	Result (µg/kg)
PFBS	0.57 U
PFOA	0.57 U
PFOS	16

SEYMR03-003-SO-004	
Analyte	Result (µg/kg)
PFBS	0.60 U
PFOA	0.60 U
PFOS	3.2

SEYMR03-001-SO-004	
Analyte	Result (µg/kg)
PFBS	0.66 U
PFOA	0.66 U
PFOS	2.8

Soil Screening Levels:
 PFBS - 1,300,000 µg/kg PFOS - 1,260 µg/kg PFOA - 1,260 µg/kg

Notes:
Bold value indicates analyte detected at concentration indicated.
 U = The analyte was not detected above the reported value.
 SO = subsurface soil

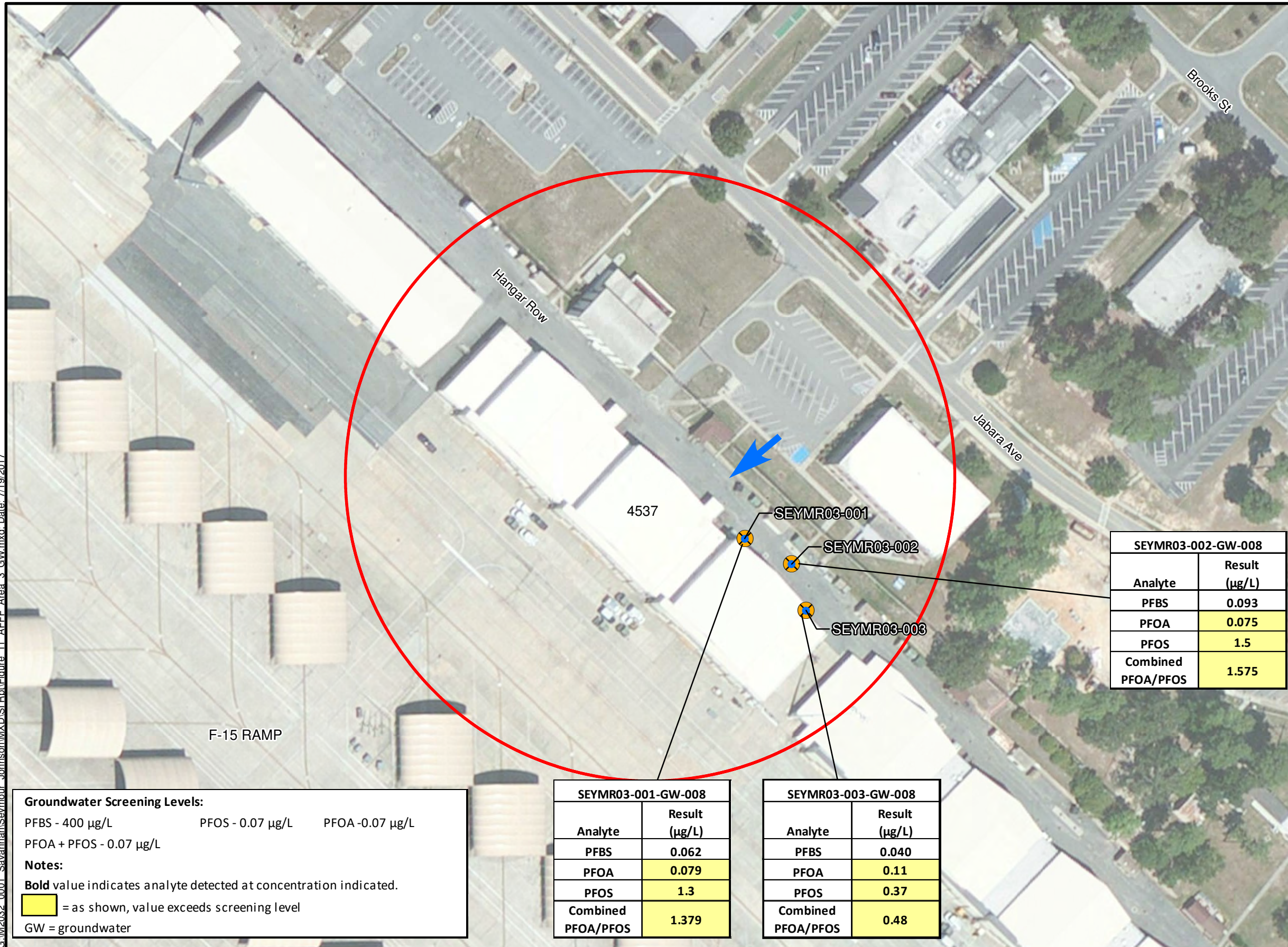
Seymour Johnson Air Force Base
North Carolina

Figure 10
Building 4537
(AFFF Area 3) PFBS, PFOA,
and PFOS in Soil



Drawn: tmorse Date: 7/19/2017
 Service Layer Credits: Esri ArcGIS Online Aerial Photography

G:\M2032_0001_Savannah\Sevmour_Johnson\MXD\SI Rpt\Figure_11_AFFF_Area_3_GW.mxd; Date: 7/19/2017



Legend

- DPT Boring Location for Collecting Subsurface Soil and Groundwater Samples
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction per USGS 1997 Report

Note: U.S. Geological Survey (USGS), 1997. Hydrogeologic Framework and Ground-Water Resources at Seymour Johnson Air Force Base, North Carolina.

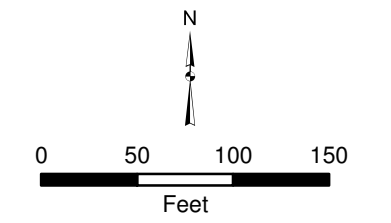
SEYMR03-002-GW-008	
Analyte	Result (µg/L)
PFBS	0.093
PFOA	0.075
PFOS	1.5
Combined PFOA/PFOS	1.575

SEYMR03-001-GW-008	
Analyte	Result (µg/L)
PFBS	0.062
PFOA	0.079
PFOS	1.3
Combined PFOA/PFOS	1.379

SEYMR03-003-GW-008	
Analyte	Result (µg/L)
PFBS	0.040
PFOA	0.11
PFOS	0.37
Combined PFOA/PFOS	0.48

Groundwater Screening Levels:
 PFBS - 400 µg/L PFOS - 0.07 µg/L PFOA - 0.07 µg/L
 PFOA + PFOS - 0.07 µg/L

Notes:
Bold value indicates analyte detected at concentration indicated.
 = as shown, value exceeds screening level
 GW = groundwater



Seymour Johnson Air Force Base
North Carolina

Figure 11
Building 4537
(AFFF Area 3) PFBS, PFOA,
and PFOS in Groundwater

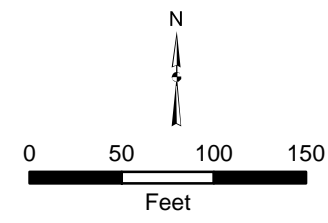


Drawn: tmorse Date: 7/19/2017
 Service Layer Credits: Esri ArcGIS Online Aerial Photography

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- Legend**
- DPT Boring Location for Collecting Surface Soil, Subsurface Soil, and Groundwater Samples
 - Location for Collecting Surface Soil Sample
 - AFFF Inspection Area
 - Installation Boundary
 - Groundwater Elevation Contour
 - Groundwater Flow Direction
- SEYMR04-001
85.54 = Groundwater Elevation (ft) measured on February 9, 2017.



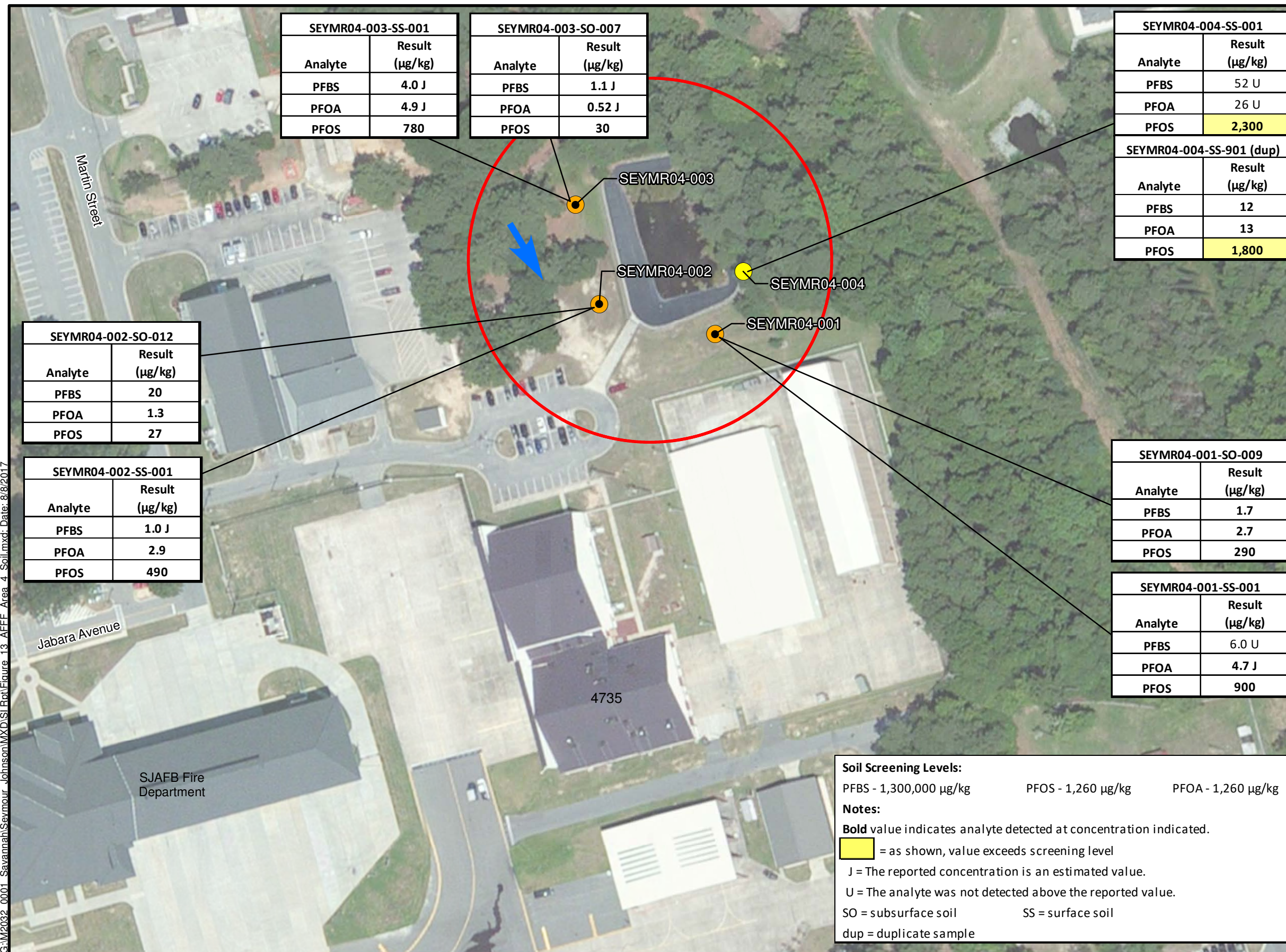
Seymour Johnson Air Force Base
North Carolina

Figure 12
Building 4735
(AFFF Area 4) Sample Locations and
Potentiometric Contours

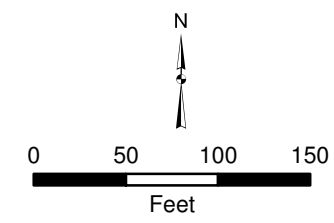


Drawn: tmorse Date: 8/8/2017
Service Layer Credits: Esri ArcGIS Online Aerial Photography

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- Legend**
- DPT Boring Location for Collecting Surface Soil, Subsurface Soil, and Groundwater Samples
 - Location for Collecting Surface Soil Sample
 - AFFF Inspection Area
 - Installation Boundary
 - Groundwater Flow Direction



Soil Screening Levels:
 PFBS - 1,300,000 µg/kg PFOS - 1,260 µg/kg PFOA - 1,260 µg/kg

Notes:
Bold value indicates analyte detected at concentration indicated.
 = as shown, value exceeds screening level
 J = The reported concentration is an estimated value.
 U = The analyte was not detected above the reported value.
 SO = subsurface soil SS = surface soil
 dup = duplicate sample

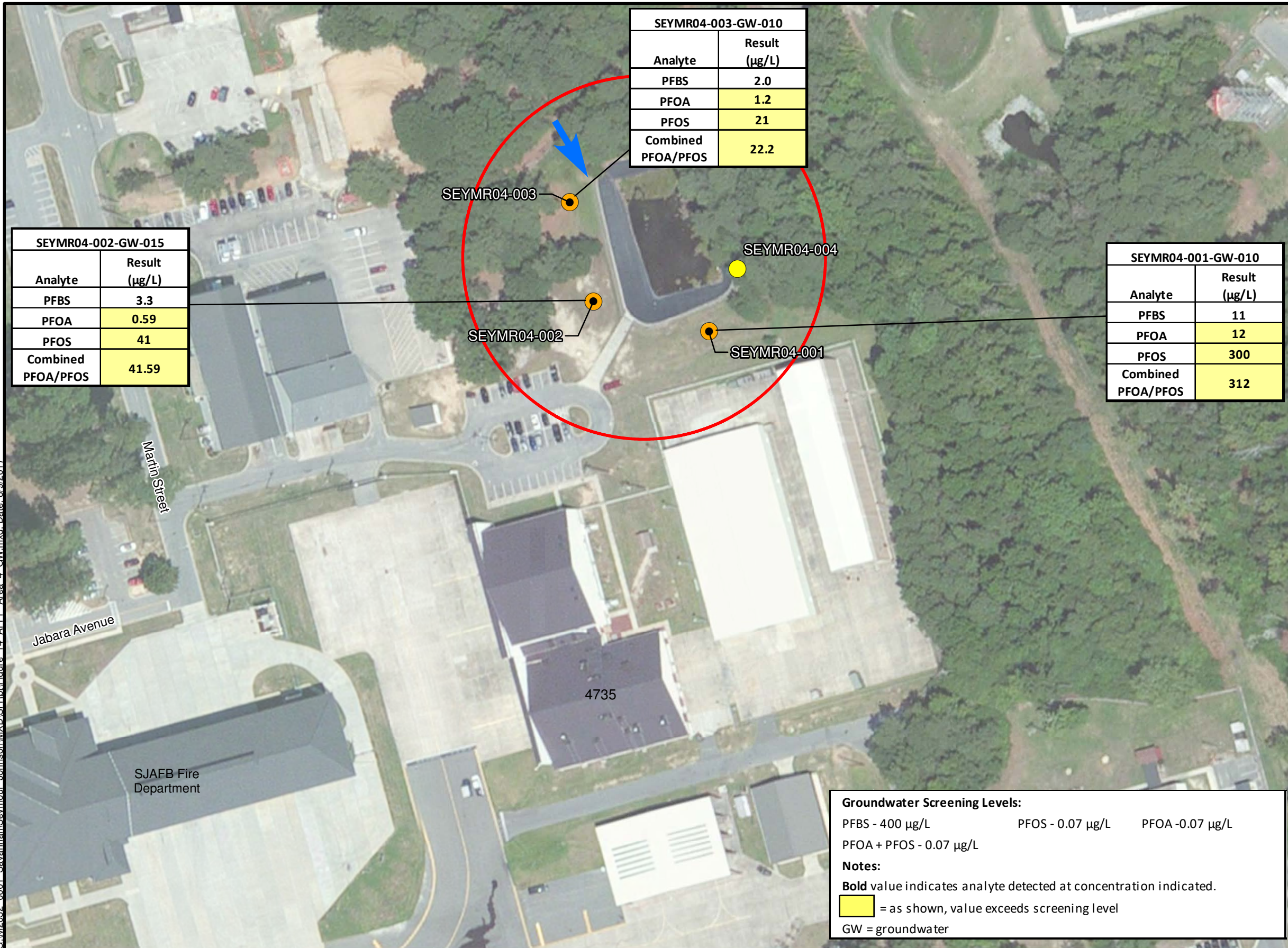
Seymour Johnson Air Force Base
North Carolina

Figure 13
Building 4735
(AFFF Area 4) PFBS, PFOA,
and PFOS in Soil



Drawn: tmorse Date: 8/8/2017
 Service Layer Credits: Esri ArcGIS Online Aerial Photography

G:\M2032_0001_Savannah\Sevmour_Johnson\MXD\SI Rpt\Figure 14_AFFF_Area_4_GW.mxd; Date: 8/9/2017



SEYMR04-003-GW-010	
Analyte	Result (µg/L)
PFBS	2.0
PFOA	1.2
PFOS	21
Combined PFOA/PFOS	22.2

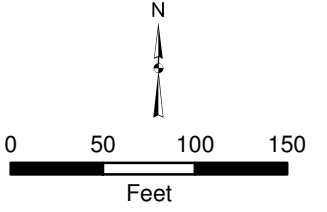
SEYMR04-002-GW-015	
Analyte	Result (µg/L)
PFBS	3.3
PFOA	0.59
PFOS	41
Combined PFOA/PFOS	41.59

SEYMR04-001-GW-010	
Analyte	Result (µg/L)
PFBS	11
PFOA	12
PFOS	300
Combined PFOA/PFOS	312



Legend

- DPT Boring Location for Collecting Surface Soil, Subsurface Soil, and Groundwater Samples
- Location for Collecting Surface Soil Sample
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction



Seymour Johnson Air Force Base
North Carolina

Figure 14
Building 4735
(AFFF Area 4) PFBS, PFOA, and
PFOS in Groundwater



Drawn: tmorse Date: 8/9/2017

Service Layer Credits: Esri ArcGIS Online Aerial Photography

Groundwater Screening Levels:
 PFBS - 400 µg/L PFOS - 0.07 µg/L PFOA - 0.07 µg/L
 PFOA + PFOS - 0.07 µg/L

Notes:
Bold value indicates analyte detected at concentration indicated.
 = as shown, value exceeds screening level
 GW = groundwater